JSC Safety and Health Handbook

JSC Safety and Health Handbook (JPR 1700.1, Revision I, July 2002)

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Change list for JPR 1700.1, "JSC for Safety and Health Handbook"
(Baseline – Revision G)

Change . .	***Date . . .***	***Chapters affected . . .***	***Description of change . . .***
Change 1 to Rev G	11/14/97	106 203 505	Adds process for reporting international mishaps Removes requirement for bicycle helmets Updates lifting requirements
Editorial	7/10/98	Preface	Revises JSC Safety Policy per ESC direction
Change 2 to Rev G	8/6/98	114	Updates safety committee structure Changes time to serve on committees and allows for volunteer members
Revision H	2/3/99	Entire Document	Includes upgrades from comparing JPG 1700.1 with NASA requirements Includes upgrades from comparing JPG 1700.1 with 29 CFR 1960 requirements Includes upgrades from comparing JPG 1700.1 with VPP and PEP requirements Includes other changes suggested by various JSC organizations
Change 1 to Rev H (Editorial Included in hard copies)	3/99	100 101 108 309	Update URL to on- line version and paragraph 5 Include JSC Safety Policy and rearrange chapter Update cross references Clarify "enough time" to "3 - 5 days before TRR"
Editorial	7/2000	Subject Index	Changed "Job Safety Analysis" to "Job Hazard Analysis" to be consistent with Chapter 111.
Revision I	7/2002	Entire document	Reorganizes program requirements around VPP elements. New Lockout/Tagout and Chemical alarm chapters. Updates to other chapters.
Change 1 to Rev I	11/7/02	3.6 5.1 5.2 6.8 7.3 Glossary 2.7, 6.8, 6.10, 8.1, 9.3, and Attachment 3.6A – Appendix 3B	Changes to medical exam requirements. Clarifies storage requirements. Clarifies requirements for space heaters New safe work practices and design requirements. Added responsibility for radiation equipment. Changed Oxygen Enriched Atmosphere definition. Clarifies emergency number for the Sonny Carter Training Facility.
Change 2 to Rev I	5/11/04	5.7 Part 12	Changes to accommodate new Part 12 Adds new Asbestos Control Requirements. This is a revision of the Asbestos Control Manual

Change 3 to Rev I	6/2/05	Document number	Changed number to JPR 1700.1
			New chapter on Weather Safety
		5.9	Updates emergency eyewash & shower reqmts
		6.1	Updates emergency eyewash & shower reqmts
		6.5	Updates emergency eyewash & shower reqmts
		6.8	New chapter on breathing gases
		6.13	Adds inspection program for forklifts & slings, eliminates duplicate requirements
		8.5 & Appendix 5B	Adds inspection program for power tools
		8.6	Adds inspection program for ladders
		8.7	Updates several hazardous material requirements
		9.1	Updates several hazardous material requirements
		9.2	Updates emergency eyewash & shower reqmts
		10.1	Clarifies applicability to JSC field sites
		12.1 and Part 12	Removes advisory language and updates organizational titles & document numbers in several other chapters

Change 4 to Rev I	9/25/06	2.4	Adds reference to NASA Facility System Safety Guidebook.
		2.7	Updates mishap investigation products to reference NASA mishap reporting and investigation requirements.
		5.2	Adds requirement not to wear jewelry during maintenance or troubleshooting on any electrical or mechanical system.
		6.1	Revises processes for handling and disposing of batteries.
		6.4	Revises food safety requirements.
		6.11	Adds a requirement to test oxygen and oxygen enriched gas systems with oxygen or oxygen-enriched gas before introducing a human into the loop.
		6.13	Adds requirement to allow the Safety and Test Operations Division to waive cleanliness requirements.
		10.1	Adds construction safety requirements as a result of a mishap investigation and updates requirements for construction barriers.
		10.3	Adds provisions for a less-rigorous Use Readiness Review.
		11.2	Adds requirements for construction contracts as a result of a mishap investigation.
		Glossary	Updates the definition of “oxygen enriched” consistent with the changes to Chapter 6.11.
		Several	Updates title of the Occupational Health Branch
Change 5 to Rev I	1/12/07	8.2 Appendix 8B	Temporary change via JSC Announcement to update Lockout/Tagout requirements pending a complete revision of JPR 1700.1. Also deletes Attachment 8.2A and revises Attachment 8.2B of Appendix 8B.

Part 1
Management leadership and employee involvement

1. Description of Part 1

Part 1 begins with Chapter 1.0, "JSC's Safety and Health Program." Chapter 1.0 provides an overview of and basic requirements for JSC's safety and health program. It also includes general information about who must follow this Handbook, and how to use it. The following chapters describe the requirements and processes for each sub-element under Major Element 1, Management Leadership and Employee Involvement.

2. Description of Major Element 1

Part 1 (Chapters 1.1 – 1.10) describes Major Element 1 of the JSC safety and health program, "Management Leadership and Employee Involvement." JSC must demonstrate management leadership from all levels of management. Management systems for comprehensive planning must address protecting worker safety and health. Employees must be meaningfully involved in JSC's safety and health program.

Element 1 includes the following sub-elements:

1.1 Management Commitment

1.2 VPP Commitment

1.3 Planning

1.4 Written Safety and Health Program

1.5 Top Management Leadership

1.6 Authority and Resources

1.7 Line Accountability

1.8 Contract Worker Coverage

1.9 Employee Involvement

1.10 Safety and Health Program Evaluation

The requirements, processes, and responsibilities for Major Element 1 are defined in the chapters for the sub-elements.

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Chapter 1.0
JSC's safety and health program

1. JSC safety and health policy

The following is JSC's safety and health policy:

a. All mishaps can be prevented.

b. You must remove or control hazards at work.

c. Management will help you maintain a safe workplace.

d. Training employees to work safely is essential.

e. Your continued employment depends on working safely and watching out for others.

f. Working safely will result in the best possible performance.

2. JSC's safety and health program

JSC's safety and health program must meet or exceed NASA, federal, and OSHA Voluntary Protection Program (VPP) requirements. JSC is a VPP Star site and must continue to improve its program beyond minimum requirements. JSC's program is organized around the following 4 major elements:

a. Management Leadership and Employee Involvement (Part 1 of JPR 1700.1)

b. Worksite Analysis (Part 2 of JPR 1700.1)

c. Hazard Prevention and Control (Part 3 of JPR 1700.1)

d. Safety and Health Training (Part 4 of JPR 1700.1)

Each major element is divided into sub-elements as described in each chapter or Parts 1 – 4. Parts 5 – 11 of JPR 1700.1 provide requirements for working safely and healthfully.

Basic requirements and rights

3. Basic requirements of JSC's safety and health program

The following requirements are basic to JSC's safety and health program:

a. Management leadership and employee involvement from all line organizations is critical to the success of JSC's program. Without your commitment and participation, JSC's safety and health program cannot function to provide a safe and healthy workplace and reach our goal of 0 injuries. Safety and health is an integral part of each manager's responsibilities and of each employee's job.

b. JSC will continually strive to meet its goal of 0 injuries. To remain in VPP, we must maintain 3-year average rates for injuries and illnesses that are below the most recent national average for JSC's Standard Industrial Classification Code. The Bureau of Labor

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Statistics publishes these averages. Note: when the Bureau of Labor Statistics changes to the North American Industry Classification System (NAICS), JSC will compare its rates to the rates generated under NAICS.

c. JSC will take all practical steps to avoid loss of life, injury to personnel, property loss, mission failures, and test failures. Every JSC team member, full-time or part-time, is entitled to a safe and healthful workplace.

d. Even though this is everyone's responsibility, personnel from the Safety and Mission Assurance (S&MA) Directorate and the Occupational Health Branch have authority to stop any operations that pose a clear, present, and unwarranted danger to any person or NASA property. Don't resume these operations until the danger is removed.

e. We must have open lines of communication between safety and health personnel and other disciplines such as product and quality assurance, biomedical operations and research, life sciences projects, and human factors projects.

f. JSC's safety and health program must be proactive rather than reactive. This means preventing mishaps by finding and controlling hazards before mishaps occur.

g. We must pay special attention to facilities involving multiple organizations, contractors, and shifts. In these facilities we must:
   - Clearly define safety and health responsibilities.
   - Promptly communicate safety and health information to all people.

h. We must learn from our mistakes, constantly improve our program, and share our lessons with others.

4. Your rights under JSC's safety and health program

At JSC you have the same rights under OSHA as you would at any workplace, including the right to contact OSHA with any safety or health concern you feel you cannot resolve at JSC. As a JSC employee or manager, you have the right to:

a. Stop or refuse to do any task if you believe that:
   - It will put you or your coworkers at risk of sudden death or serious injury.
   - There is no time to resolve the matter through normal hazard reporting channels.

b. Leave any area where imminent danger conditions exist as described in subparagraph a above.

c. Report hazards and have your name kept confidential as described in Chapter 2.6 of this Handbook. This includes the right to contact OSHA about safety and health concerns.

d. Be a member of or be represented on safety and health committees.

e. Participate in safety or health activities without having to take leave.

f. Be trained about the hazards of your job and how to protect yourself.

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g. Have access to the following on request:
   - Safety and health requirements that apply to your job
   - Your medical exposure records and protection of your records under the Privacy Act of 1974
   - JSC's Log and Summary of Occupational Injuries and Illnesses (OSHA Form 300)
   - Results of inspections, hazard evaluations, and mishap investigations

h. Have information about JSC's safety and health program.

i. Comment on NASA and JSC occupational safety and health requirements.

j. Be free from restraint, interference, coercion, discrimination, or reprisal for:
   - Reporting hazards
   - Participating in safety and health activities
   - Exercising any other rights you have from this Handbook or federal law

5. Recourse if your rights are denied

You have the full protection of the law should your rights be denied or threatened. This includes freedom from reprisals. NASA will respond promptly and fully to alleged denials or reprisals.

If you are a civil service employee, you may file a complaint or grievance. Your Human Resources representative can help you with the details. There are two official venues for filing a complaint or grievance:

a. Grievance procedures in the agreement between JSC and the American Federation of Government Employees (AFGE) or in agreements with other recognized labor organizations

b. The NASA Office of the Inspector General

"Reprisals," or punitive sanctions or actions taken against you by any individual or entity for participating in the JSC safety and health program in any way, are illegal and subject to personnel action and possible prosecution. The Executive Safety Committee must be told of any allegations of reprisal. JSC must send findings on any investigations of reprisal to NASA Headquarters and OSHA.

If you are a contractor, contact your safety and health office, your bargaining unit, or the JSC Safety and Test Operations Division. See also paragraph 2.8 of NPR 8715.1, "NASA Safety and Health Handbook Occupational Safety and Health Programs."

6. Public safety

We must take measures to protect the general public from injury or illness from JSC operations by eliminating or controlling risks to the public. Protecting the public includes:

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a. Analyzing JSC operations for hazards to the public and controlling those hazards.

b. Restricting access to hazardous areas at JSC.

c. Working with the outside communities to make the public aware of hazards from JSC operations.

d. Working with local officials on emergency planning and community safety activities.

7. Safety and health records

The safety and health records listed in this Handbook document that we are following our safety and health program. Some records are Center-level and some are organizational. You must follow the current versions of JPR 1440.3, "JSC Files and Records Management Procedures," for keeping, archiving, or destroying records.

Appendix 1 contains a summary of Center-level, contractor, and organizational records JSC must maintain.

Committees and responsibilities

8. Safety and health committees

The following Safety and Health committees oversee JSC's safety and health program and provide avenues to resolve safety and health issues:

a. The ***Executive Safety Committee*** oversees JSC's safety and health program by providing direction, policy, strategy, and goals related to safety and health. See Chapter 1.1 for more information.

b. The ***JSC Safety Action Team*** is an employee-run committee where employees can actively participate in providing inputs to, and resolving, safety and health issues. See Chapter 1.9 for more information.

c. The ***Contractor Safety Forum*** is a contractor-run committee to review and resolve contractor safety issues and to provide inputs to JSC's safety and health program. The Contractor Safety Forum will work with the other JSC committees to investigate and resolve safety issues.

9. Top management responsibilities

Responsibility for safety and health begins with top management. The following is a list of general responsibilities for top management in addition to the general responsibilities of line managers in paragraph 11 of this chapter. Other chapters of this Handbook list responsibilities for specific elements or tasks:

a. As the ***Director***, ***JSC***, you have the ultimate responsibility for providing a safe and healthful workplace at JSC and you responsible for:

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- Delegating the day-to-day safety and health responsibility to the Designated Safety and Health Official.
- Approving variances to JSC safety and health requirements as described in Chapter 1.4, "Written Safety and Health Program."

b. As the ***Deputy Director***, ***JSC***, you are the Designated Safety and Health Official for JSC. At each JSC field office, the office manager is the alternate designated safety and health official for that office. You are responsible for:

- Chairing the Executive Safety Committee.
- Providing resources, guidance, and direction for implementing JSC's safety and health program.
- Making sure JSC's safety and health program is implemented per federal and NASA requirements.
- Making sure JSC has independent safety and health organizations to help and ensuring that line organizations carry out JSC's safety and health program. These organizations must include safety and health officials at appropriate levels and adequate personnel to carry out JSC's safety and health program. This includes Certified Safety Professionals and Certified Industrial Hygienists.
- Making sure specialized expertise from other sources are available as necessary.
- Making sure all JSC organizations have adequate budgets to carry out JSC's safety and health program.
- Making sure JSC has requirements and procedures to carry out JSC's safety and health program.
- Making sure JSC has goals and objectives to reduce mishaps.
- Making sure JSC evaluates its safety and health program effectiveness.
- Setting priorities for correcting workplace hazards.

c. As an ***Organizational Director*** (or a Manager of a Directorate-level Office), you must fulfill the responsibilities of a line manager as described below and you are also responsible for:

- Making sure JSC's safety and health program is implemented in your Directorate or Office. This includes developing and documenting a process to meet the requirements of paragraph 1.1.4 of this Handbook.
- Serving on or designating a representative for the Executive Safety Committee.

10. JSC team member responsibilities

You are a JSC team member if you do any work at JSC or JSC field sites. The term "team member" includes all civil service and contractor employees (full time, part time, and

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temporary), all levels of civil service and contractor management, and any other workers on JSC property. As a JSC team member, you are responsible for your own safety and health and for looking after the safety and health of other JSC team members. You must fulfill the responsibilities listed in other chapters of this Handbook that apply to your job. Your general responsibilities are:

a. Following safety and health standards, rules, regulations, and guidelines issued by the Occupational Safety and Health Administration (OSHA), NASA, and JSC.

b. Correcting hazards yourself, if possible. Use established procedures to report and correct hazards.

c. Getting medical care if you suffer a job-related injury or illness.

d. Promptly reporting mishaps and close calls.

e. Cooperating with safety and health personnel during inspections, surveys, and investigations.

f. Using personal protective equipment when required to do so by safety and health standards, hazard evaluations, good work practices, or your supervisor.

g. Being able to describe your individual responsibility for safety and health.

h. Doing your job safely and responsibly.

i. Making sure that visitors you escort are aware of the hazards in the areas they will visit and take appropriate measures to protect themselves.

11. Line manager responsibilities

You are a line manager if you have any leadership responsibilities over employees, projects, or work areas. Line managers include all levels of management from the Director, JSC to Team leads or equivalent contractor levels. You must fulfill the JSC team member responsibilities listed in paragraph 10 above and responsibilities listed in other chapters of this Handbook that apply to your job. Your general responsibilities are:

a. Setting an example of good safety and health practices by:

- Showing an interest in safety and health.
- Being involved in safety and health activities.
- Having strong personal safety and health awareness.

b. Providing visible leadership in safety and health by:

- Showing your commitment to safety and health.
- Following up on safety and health matters.
- Attending safety meetings within your organization and including safety and health agenda items in your meetings.

c. Providing a safe and healthful workplace by:

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- Protecting your employees in imminent danger situations.
- Identifying hazards through hazard analyses, inspections, or other methods and controlling identified hazards as your resources allow. This includes hazards to the public.
- Making sure your employees follow the safety and health requirements that apply to their jobs.
- Making sure your employees immediately report hazards and mishaps to you.
- Making sure your employees receive appropriate medical care when injured at work.
- Making sure your employees and visitors to your work areas know the hazards in their workplace and duties, and what precautions they must take to protect themselves (e.g. safety devices, caution and warning devices, and personal protective equipment).
- Enforcing safe practices. Reprimand employees for unsafe behavior, if necessary. Reward employees for excellent safety and health performance.

d. Making sure your employees know about:

- JSC's safety and health program and the protection it gives them.
- Their rights and responsibilities from this chapter and federal law (such as Executive Order 12196, 29 CFR 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters," and 29 CFR 1977, "Discrimination Against Employees Exercising Rights Under the Williams-Steiger Occupational Safety and Health Act of 1970").
- How they can participate in safety and health activities.
- Disciplinary actions they can face for unsafe behavior.
- What to do in all emergencies.

e. Reporting lessons you learn about safety and health to the Safety and Test Operations Division, Occupational Health Branch, and other organizations that may benefit.

f. Making sure that you have a budget for such things as correcting hazards in your work areas and buying required safety equipment.

g. Cooperating with and helping safety and health personnel.

12. Facility manager responsibilities

As a facility manager, you are responsible for safety and health in your facility as well as fulfilling other facility responsibilities your management may assign. For more information, see the Facility Manager's Support Page at http://www4.jsc.nasa.gov/org/ja/facmgr.htm. You must fulfill the JSC team member responsibilities listed in paragraph 10 above and responsibilities listed in other chapters of this Handbook that apply to your job. Your

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general responsibilities are:

a. Coordinating safety and health in your facility, including areas between organizational lines.

b. Making sure that your facility and all operations in your facility follow federal, NASA, and JSC requirements.

c. Coordinating with building occupants and the Center Operations Directorate as necessary to resolve facility-related safety and health issues.

d. Making sure your building has a poster that tells you about NASA's and JSC's safety and health program. The Safety and Test Operations Division will provide a poster that meets 29 CFR 1960.12(c), "Dissemination of Occupational Safety and Health Program Information."

e. Posting safety information in your facility as necessary.

13. Contractor responsibilities

Contractors are a major part of JSC's workforce. All contractor employees and managers are JSC team members. Chapter 1.8 of this Handbook covers the process of selecting and overseeing safe contractors. Companies with JSC contracts are responsible for developing and maintaining safety and health programs that:

a. Follow all requirements that apply to private sector employers, such as OSHA, state, and local requirements as well as NASA or JSC requirements imposed by contract.

b. Flow appropriate safety and health requirements to their subcontractors.

c. Protect other JSC team members that may be impacted by their operations.

14. Visitor and guest researcher responsibilities

As a visitor or guest researcher, you are responsible for:

a. Making sure your work doesn't interfere with JSC facilities or operations.

b. Knowing and following all safety and health requirements for the area where you are working. This includes using any required personal protective equipment.

c. Being trained and certified for any hazardous operations you will be doing.

d. Completing other occupational health and safety training as necessary to meet OSHA, NASA, and JSC requirements; such as hazard communication, lockout/tagout, and laser safety. You must get approval before bringing hazardous materials, radioactive materials, or biological agents on-site.

e. Before beginning work, getting any required reviews and approvals for the type of work you will do, especially where there are impacts to JSC operations (e.g., hot work or work with radiation or radioactive materials, chemicals, or biological agents).

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15. Safety and Test Operations Division (NS) responsibilities

The Safety and Test Operations Division is responsible for:

a. Overseeing safety at JSC.

b. Supporting the line organizations as they implement JSC's safety and health program.

c. Developing and maintaining selected Centerwide safety processes such as mishap and close call reporting.

d. Providing safety training for JSC employees.

e. Making sure NASA Safety Reporting System posters are posted in major buildings.

f. Developing and maintaining a management system for tracking and advancing JSC's safety goals.

16. Occupational Health Branch (SD3) responsibilities

The Occupational Health Branch is responsible for:

a. Overseeing occupational medicine and health at JSC.

b. Supporting the line organizations in their occupational health responsibilities.

c. Developing and maintaining selected Centerwide health processes and programs such as hearing conservation, respiratory protection, ergonomics, hazard communication, hazardous materials ,and confined space entry.

d. Providing occupational health training for JSC employees.

e. Evaluating work areas for health hazards and communicating results to management and employees.

f. Developing and maintaining a management system for tracking and advancing JSC's health goals.

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Handbook information

17. Conflicts between this Handbook and the safety or health requirements of your organization

This Handbook takes precedence over all other JSC documentation in safety and health except for more stringent requirements that individual JSC organizations develop. If your organization has more stringent requirements than are in this Handbook, you must follow them. If you find any less stringent JSC requirements than are in this Handbook, bring them to the immediate attention of the Director of JSC's SR&QA Directorate.

18. How to use this Handbook

You don't need to read this entire Handbook. You must be familiar with the elements of JSC's safety and health program and the requirements that apply to your job. Use the Handbook to find specific requirements, as you need them.

This Handbook contains several features to help you find the requirements you need:

a. Table of contents and index

b. Subject index

c. Chapter titles

d. Chapter introductions that tell you who has to follow that chapter

19. Which parts of this Handbook you must follow

You must be familiar with all elements of JSC's safety and health program in Parts 1 – 4, You must follow any part of this Handbook that applies to your job. The table below tells you which parts apply to what job. You will find a similar table in the first chapter of each part.

If your job or facility operations involve . . .	***Then you must follow . . .***
Any work at JSC or JSC field sites	Part 5, Safety and health practices for everyone
Working with batteries Working with lasers Working in warehouses Preparing or serving food Working with cryogenic liquids or gases Handling new or unique hardware Working in chemical or research laboratories	Part 6, Safety and health requirements for certain hazardous tests

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If your job or facility operations involve . . .	***Then you must follow . . .***
Doing test operations Entering confined spaces Working with compressed gases	
Working in noisy areas Wearing a respirator Working with ionizing or non-ionizing radiation Coming in contact with biohazards, blood, or body fluids	Part 7, Health protection practices
Working in machine shops Working with electricity Welding, cutting, or brazing Lifting materials Working with hand or power tools Working on ladders, scaffolds, or elevated platforms	Part 8, Safety and health practices for manufacturing, installation, repair, and maintenance
Working with or transporting hazardous materials	Part 9, Safety and health practices for hazardous materials
Designing or constructing JSC facilities Operating hazardous or complex facilities	Part 10, Safety and health practices for JSC facilities and facility systems
Overseeing contracts or grants at JSC Participating on a Source Evaluation Board	Part 11, Safety and health requirements for JSC contracts and purchases

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Chapter 1.1
Management commitment

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 1.1

JSC must integrate authority and responsibility for employee safety and health into its overall management structure and employees must be involved. This includes:

a. **Policy.** Chapter 1.0 of this Handbook contains JSC's safety and health policy. Each employee and manager must understand and practice this policy. This handbook outlines the requirements, processes, responsibilities, and measurements for each program element, as well as requirements for working safely. Employees must understand the policies and requirements.

b. **Goals and objectives.** JSC management must set goals for the safety and health program and results-oriented objectives to meet those goals. The Executive Safety Committee sets goals and objectives for the Center. Each line organization is encouraged to set goals and objectives to improve safety and health in its organization. Employees must understand the goals and objectives, the desired results, and the measures for meeting them.

3. Management committees for safety or health

JSC management has established two permanent, standing safety and health committees. JSC, line managers, or employees may form other permanent or temporary committees as needed. Committees must meet the requirements in paragraphs 5, 6, and 7 of this chapter.

Under 29 CFR 1960.36, federal agencies may certify their safety and health committees with the Secretary of Labor. NASA Headquarters chooses not to have the Secretary of Labor certify safety and health committees within NASA.

JSC has the following committees:

a. The ***Executive Safety Committee*** is composed of senior management and others, as needed, and reports to the Center Director. The Executive Safety Committee must meet the requirements in paragraph 4.1 of JPR 1107.1, "The JSC Organizations," current version.

b. The ***Contractor Safety Forum*** reviews and resolves contractor safety issues and provides inputs to JSC's safety and health program. The Contractor Safety Forum will work with the other JSC committees to investigate and resolve safety issues.

c. ***Other safety or health committees***, either temporary or permanent, may be formed by management at any level of an organization.

   Ad hoc safety or health committees is one way management can involve employees in

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safety and health. The person who forms a committee will decide who the members will be. Other safety or health committees may:

- Address safety or health issues.
- Draft positions and recommendations on Centerwide issues and policies for the Executive Safety Committee or other committees.
- Develop work practices that are safe and healthful.
- Develop and conduct safety and health training, awareness, or motivation activities.
- Do safety and health inspections.

4. Implementing JSC's safety and health program in line organizations

As an organizational director or manager of a directorate-level office, you must develop and document a process for implementing JSC's safety and health program in your directorate or office. You may tailor the process to the program elements and requirements that apply to your directorate. You may implement the program through safety and health committees, staff meetings, or any other effective means of meeting the requirements below. Your process must, as a minimum:

a. Provide insight into the safety and health of your directorate or office employees.

b. Provide for communication of safety and health information among working-level employees, top management, and all other levels of management.

c. Make sure that all program elements and requirements that apply to your directorate or office are addressed and followed, and maintained.

d. Make sure significant issues and accomplishments of your directorate or office safety and health activities are forwarded to the Executive Safety Committee.

e. Monitor directorate or office safety and health performance and effectiveness of all program elements that apply to your directorate or office.

f. Keep records that show your process is effective, such as committee or staff minutes and required program documentation.

5. Membership in safety or health committees

Committee members may be elected by employees, be appointed by management, or volunteer. In addition to the members listed in paragraphs 3 and 4 of this chapter, division, branch, work area, and other committees must include the following as needed:

a. Union representatives

b. Contractor safety representatives

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c. Safety and health personnel

d. Technical advisors who have special expertise that a committee needs

e. Managers or employees from other JSC organizations

6. Length of service for members of safety or health committees

The time a member serves depends on the kind of committee. Follow these rules:

a. For permanent committees such as division, branch, or work area committees, members will serve for at least 1 year. Replace only a few members at one time to maintain the committee's knowledge and experience.

b. For temporary committees such as an ad hoc committee addressing a specific safety problem, members will serve until the committee finishes its work.

7. Functions of a safety or health committee

A safety or health committee must:

a. Take care of the following administrative duties:

- Meet at least monthly if it is a permanent committee.
- Meet as often as necessary to complete its work if it is a temporary committee.
- Record and send out minutes to members, higher management, attendees, and others such as those who have action items. Keep meeting minutes in a file.

b. Address issues by:

- Keeping the discussion on safety or health issues. Don't dismiss an issue because it seems unrelated to safety or health at first.
- Considering each suggestion or proposal carefully, no matter how trivial it may seem. Allow enough time to fully consider each item. Keep the discussion on the agenda and end the meeting when the agenda is covered.
- Assigning action items for issues the committee can't resolve during a meeting.
- Sending issues the committee can't resolve at its level to higher management. Work issues at the lowest possible level of management.

c. Keep a log of all action items to include:

- What the committee decided about each item.
- Who is responsible for each item. Contact those who don't respond on time.
- When the committee should get progress reports.
- When the final action is due and, if delayed, why.

d. Close out an action item only when the committee reaches a final decision and action is

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taken to complete it.

e. Consider only those matters that a manager can't or wouldn't take action to resolve. In these cases, the committee chairperson or representative will tell the manager what action the committee voted to take.

f. Respond to anyone who makes a suggestion or raises an issue to the committee in writing about the status or outcome of the suggestion or issue.

8. For more information on safety or health committees

You can find more information on safety or health committees and councils in these documents:

a. 29 CFR 1960, subpart F, "Occupational Safety and Health Committees"

b. 29 CFR 1960, subpart K, "Field Federal Safety and Health Councils"

c. JPR 1107.1, "The JSC Organizations"

9. Responsibilities

As a line manager, you must:

a. Form safety or health committees as necessary.

b. Chair safety or health committees as needed.

c. Encourage your employees to be involved in safety or health committees as members or chairpersons.

10. Safety and health records

The following records document management commitment:

a. Center-level records:

- Minutes of the Executive Safety Committee and Contractor Safety Forum.
- Documentation to support completion of tasks assigned by the Executive Safety Committee or Contractor Safety Forum.
- Documentation on setting and completing Center goals.

b. Directorate-level records include documentation to support the process in paragraph 4 above. Examples include Safety Committee (if held) or staff meeting minutes showing safety and health topics, safety and health communications, documentation to support completion of safety and health tasks, and documentation on setting and achieving directorate safety and health goals.

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11. Measurement

JSC measures management commitment by:

a. Whether the Executive Safety Committee meets at least monthly.

b. Progress on meeting goals within the prescribed timeframes and metrics related to specific goals.

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Chapter 1.2
VPP commitment

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 1.2

JSC must clearly demonstrate commitment to maintaining the requirements of VPP. This involves a daily commitment on your part to following JSC's safety and health program, which is organized around VPP requirements. By becoming a VPP Star site, we have voluntarily agreed to strive for continuous improvement in our safety and health program. Our continued participation in VPP depends on commitment from top management, line managers, AFGE Local 2284, and all employees.

Our commitment to VPP means we can expect a close partnership with OSHA in our pursuit of excellence. OSHA reviews the progress of VPP sites with the primary purpose of identifying additional areas of safety and health program improvements. These improvements may result in feedback specific to our site performance and also may contribute to continuously evolving VPP principles and guidelines. In our commitment to VPP and continued improvement, we agree to the assurances listed in paragraph 3 below and to provide OSHA information on our safety and health program as described in paragraph 4.

3. Assurances

To show our commitment to VPP, we will meet or exceed OSHA requirements in 29 CFR 1910 and 29 CFR 1960. We agree that:

a. We will explain VPP to all employees, including newly hired civil service and contract employees when they reach the site. This will include employee rights under VPP, under the Occupational Safety and Health Act, and under 29 CFR 1960.

b. We will correct, in a timely manner, all hazards discovered through employee notification, self-inspections, an OSHA on-site review, accident investigations, process hazard reviews, annual evaluations, or any other means or report, investigation, or analysis. We will also provide interim protection as necessary.

c. We will protect employees who are given health and safety duties as part of our safety and health program from discriminatory actions resulting from their carrying out such duties, just as section 11(c) of the Occupational Safety and Health Act of 1970 and 29 CFR 1960.46(a) protects employees for the exercise of their rights.

d. We will provide our employees access to the results of self-inspections and accident investigations upon request.

e. Our participation in VPP is voluntary and we look forward with great expectation and anticipation to a lasting VPP relationship with OSHA.

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4. Information for OSHA

We agree to maintain safety and health program documentation and make it available to OSHA. We will:

a. Maintain a current written safety and health program.

b. Keep all documentation listed in the current VPP Federal Register Notice.

c. Maintain any agreements between management and collective bargaining agent(s) concerning the functions of any joint labor-management safety and health committee and its organization and any other employee involvement in the safety and health program.

d. Keep comparable records for the period of VPP participation to be covered by each subsequent evaluation until OSHA communicates its decision about continued approval.

e. Make available for evaluation purposes any data necessary to evaluate the achievement of goals not listed above.

f. Provide OSHA each year by February 15th our injury incidence and lost workday case numbers and rates, hours worked, estimated average employment for the past full calendar year, and a copy of the most recent annual evaluation of the site's safety and health program.

g. Send our combined injury incidence and lost workday case numbers and rates, hours worked, and estimated average employment for the past full calendar year for all contractors whose employees worked at least 1000 hours in any one quarter on our site during the year.

5. Notification of our participation in VPP

We notify new employees of our participation in VPP by the following:

a. New Employee Orientation provided by the JSC Human Resources Office.

b. Safety Through Everyone's Participation (STEP) classes.

c. Human Resources New Employee Web site, http://newemployee.nasa.gov/NEO/civil_service/neo_set_A.htm

6. Responsibilities

As a manager at any level, you must make sure those under you are aware of JSC's participation in VPP and visibly support JSC's safety and health program.

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7. Safety and health records

The Safety and Test Operations Division must maintain the following Center-level records and make current copies available for each OSHA VPP on-site review:

a. A commitment statement from the current Director, JSC, that agrees to the items in paragraphs 3 and 4 above. Within 60 days after a change of Center Director, we must send a new statement to OSHA.

b. A letter of support for VPP signed by the current President, AFGE Local 2284. Within 60 days after a change in either the President, AFGE Local 2284, or Director, JSC, we must send a new letter to OSHA.

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Chapter 1.3
Planning

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 1.3

JSC must include safety and health as a part of the overall management planning process. This includes:

a. Establishing goals and objectives as mentioned in Chapter 1.1. Employees must have the opportunity to be involved in setting objectives.

b. Budgeting funds and allocating resources for safety and health.

c. Planning for safety and health training.

3. Goals and objectives

The Executive Safety Committee sets goals and objectives for the Center after considering inputs from the JSC Safety Action Team and tracks progress on meeting the goals. Line organizations are encouraged to set their own goals and objectives in their organizational safety and health committees.

4. Funding for safety and health items

Please see Chapter 1.6, “Authority and Resources,” for more details.

5. Planning for safety and health training.

This involves following the processes in Element 4 (Chapters 4.1 – 4.6) to make sure that all line managers and employees are properly trained.

6. Responsibilities for planning

a. The **Executive Safety Committee** is responsible for:

- Setting Center goals and objectives.
- Tracking progress on Center goals and objectives to completion.
- Making sure JSC has an adequate budget for safety and health.

b. **Directorate Safety Committees** are responsible for:

- Tracking directorate goals and objectives to completion.
- Requesting funds for safety and health items within the Directorate.

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- Making sure the Directorate adequately plans for safety and health training.

7. Safety and health records

There are no unique records to document planning for safety and health. The following Center-level records from other sub-elements support planning:

a. Documentation to support tracking and completion of goals, Sub-Element 1.1.

b. Budget documentation, Sub-Element 1.6.

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Chapter 1.4
Written safety and health program

1. Who must follow this chapter

You must follow this chapter if you:

a. Need guidance on safety and health requirements or standards.

b. Need a variance to any safety and health requirement.

c. Need to recommend changes to Center-level safety and health requirements.

d. Maintain Center safety and health requirements.

e. Maintain safety and health documentation for your organization.

2. Description of Sub-Element 1.4

This Handbook contains JSC's written safety and health program. Parts 1 - 4 cover all major elements of VPP and their sub-elements. Our program also meets the requirements in 29 CFR 1960 and all federal and NASA safety and health policies and requirements. Parts 5 – 11 include safety and health requirements for specific tasks or situations.

The Handbook is available on line through the JSC Safety and Total Health Homepage. It is a controlled document and the on-line version is the official version. You must check the on-line version to verify that you are using the current requirements.

3. OSHA, federal, and other standards you must follow

You must follow safety and health standards issued under the Occupational Safety and Health Act and other federal regulations. This includes the following standards:

a. ***OSHA standards.*** JSC must follow safety and health standards issued by OSHA under Section 6 of the Occupational Safety and Health Act. We may follow alternate standards that NASA Headquarters and the Secretary of Labor approve as described in 29 CFR 1960.17. This Handbook will reference any alternate standards that exist for NASA in the appropriate chapters.

b. JSC must follow these ***other federal standards:***

- Federal Aviation Administration standards applicable to public aircraft, since NASA operates its aircraft as public aircraft
- Department of Transportation standards for shipping and handling hazardous materials
- Environmental Protection Agency standards for recovering, controlling, and disposing of hazardous wastes
- Nuclear Regulatory Commission standards for handling radioactive sources
- The American Disabilities Act requirements for disabled employees

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c. JSC must follow any ***consensus standards*** referenced in this handbook.

4. NASA and JSC requirements and standards JSC must follow

You must follow any NASA Headquarters safety and health requirements and standards called out in this handbook such as:

b. NASA Policy Directives (NPDs)

c. NASA Procedural Requirements (NPRs)

d. NASA or JSC Standards

e. JSC Policy Directives (JPDs)

f. JSC Procedural Requirements (JPRs)

You must follow any NASA, JSC, or other standards as well as NPDs, NPRs, JPDs, and JPRs referenced in this Handbook.

5. Standards for JSC civil service employees working at another site

If you work at a non-JSC site, follow these rules:

a. Follow local requirements and standards if another NASA center or federal agency oversees the site.

b. Follow JSC or local requirements and standards at other sites (including foreign countries), whichever is more stringent.

c. Tell your management if the requirements or standards at another federal agency's requirements conflict with NASA, JSC, or OSHA standards. The following must be done:

- You must follow the most stringent standards until the conflict is resolved.
- If the conflict involves NASA standards, your management must tell the NASA designated safety and health official of the conflict.
- If the conflict involves OSHA standards, the NASA designated safety and health official must tell the Secretary of Labor and the other federal agency of the conflict so that it can be resolved.

6. Variances to safety and health requirements and standards

Variances are a means to get authorization to take a different approach to meet the intent of the requirement, rather than to ignore requirements. To get a variance:

a. Prepare a written request for variance that includes:

- What the variance is. Reference the requirement or standard. Search the requirement

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to its original source. Some NASA or JSC requirements may actually be OSHA requirements.

- Time period for the variance. List a date range or "indefinite."
- The reason you need the variance. Give detailed justification on why you can't follow the requirement or standard.
- Actions taken to control the hazard, such as how you will provide equal protection to your employees. If you don't provide equal protection, you must justify the increased risk.
- Approval signature from your director or program manager (directorate level).

b. Send the request to the Director, S&MA, or Director, Space and Life Sciences, for health requirements, who will approve or disapprove the request and send it to higher management for more approvals if necessary.

c. This table tells you who must approve certain variances and what other requirements apply.

Variances to . . .	***Must be approved by . . .***	***Requirements and comments . . .***
JSC requirements or standards	Director, JSC (with concurrence from the Director, S&MA. Director, Space and Life Sciences, concurrence is necessary for variances to health requirements)	• None
NASA Headquarters NPD requirements	NASA Headquarters through the Director, S&MA (or Director, Space and Life Sciences, for health requirements), and the Center Director	• You can find NASA's variance policy in paragraph 1.19 of NPR 8715.3, "NASA Safety Manual," current version
NASA Headquarters NPR requirements or NASA Standards with "shall" statements	Center Director through the Director, S&MA (or Director, Space and Life Sciences, for health requirements)	• JSC must notify NASA Headquarters, code QS, of these variances within 14 days of approval and status yearly with input to the Annual OSHA Report
NASA Headquarters NPR requirements or NASA Standards with "should" statements	Responsible Director through the Director, S&MA (or Director, Space and Life Sciences, for health requirements)	• JSC must notify NASA Headquarters, code QS, of these variances within 14 days of approval and status yearly with input to the Annual OSHA Report

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OSHA standards	Secretary of Labor through the Director, S&MA (or Director, Space and Life Sciences for health requirements), Center Director, and NASA Headquarters	• Requests must include very detailed justification and an alternate standard that provides equal or greater protection • This process takes at least 3 months • OSHA rarely approves variances • See 29 CFR 1905, "Rules of Practice for Variances, Limitations, Tolerances, and Exemptions"
Other federal, state, or local standards such as EPA, DOT, or Texas Natural Resources Conservation Commission (TNRCC)	NASA Headquarters and the agency that issued the standard	• See the standard for details on how to get a variance • JSC's Environmental Services Office must also approve requests for variances from any environmental protection standard such as EPA and TNRCC
Consensus standard	Whoever the standard authorizes	• See the standard • JSC may be allowed to approve a variance

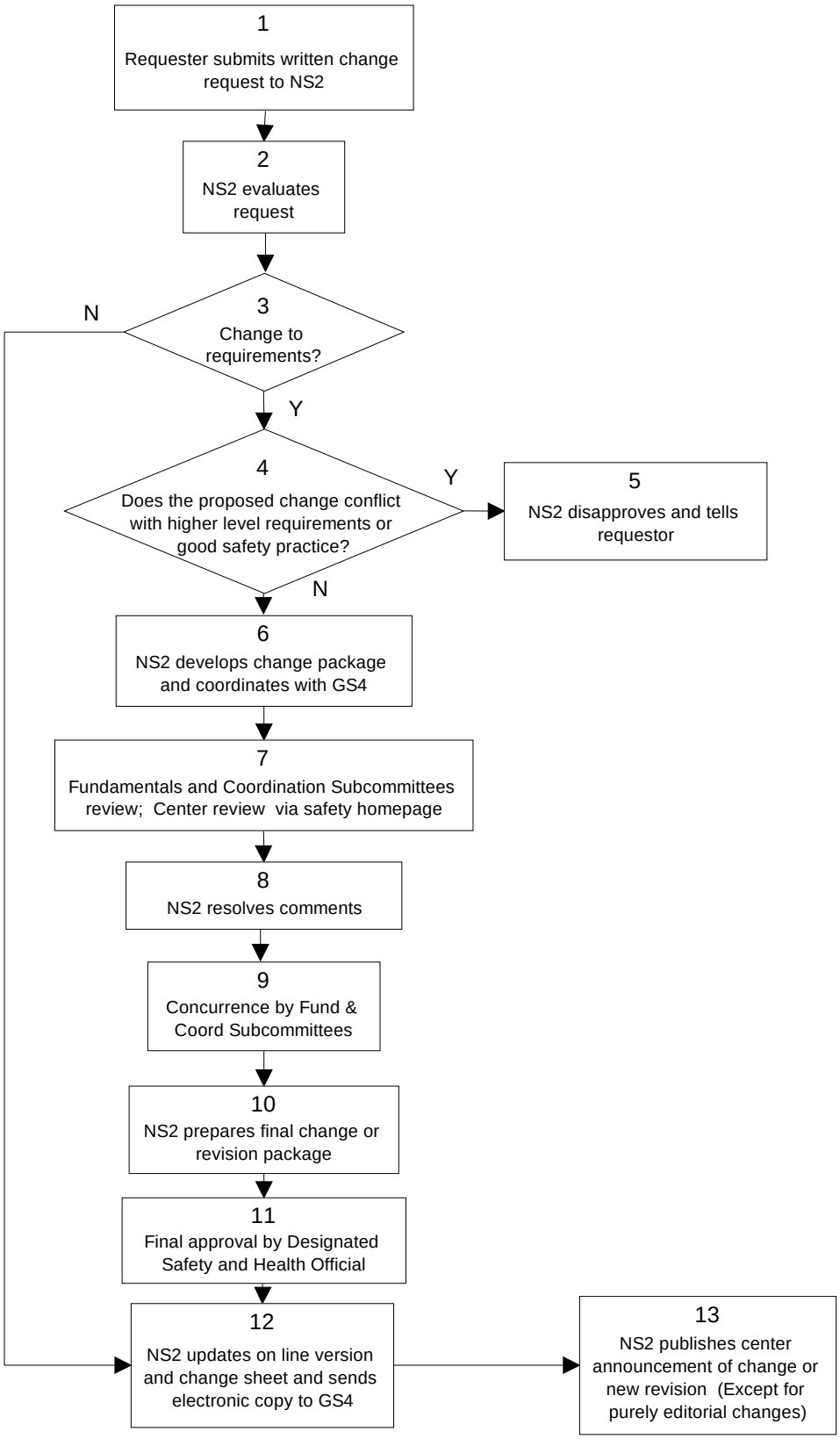
7. Changing this Handbook

We may change this Handbook due to changes in higher-level requirements or due to better ways of doing business. The following flowchart outlines the process for suggesting and making changes to the Handbook. Your change request must include the following:

a. The paragraph and subparagraph reference and page number.

b. The suggested change.

c. Reason for the change.



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8. Responsibilities

The JSC Safety and Test Operations Division is responsible for maintaining this Handbook and posting changes to the Safety and Total Health Homepage.

9. Safety and health records

The following records document JSC's safety and health program:

a. Center level records:

- Current JPR 1700.1
- Change records to JPR 1700.1
- Variance documentation—we must send yearly summary to NASA HQ, Code Q, of any variances JSC approves to NASA-level requirements

b. Organizational-level records – No organizational-level records are required. You are encouraged to keep copies of variances granted for your work areas.

Chapter 1.5
Management leadership

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 1.5

Management leadership must start with the Center Director and flow down to all levels of management. As a JSC manager at any level, you must provide visible leadership in the safety and health program. This must include:

a. Establishing clear lines of communication with employees.

b. Setting an example of safe and healthful behavior.

c. Creating an environment that allows for reasonable employee access to top site management.

d. Making sure that all workers at the site, including contract workers, are provided equally high-quality safety and health protection.

e. Clearly defining safety and health responsibilities in writing, with no unassigned areas. You must ensure that your employees are able to describe their individual and collective responsibilities for safety and health.

3. Responsibilities

As a manager at JSC, you must fulfill all safety and health responsibilities in paragraph 2 above.

4. Safety and health records

As a line manager, you must keep current performance plans (civil service employees) or an equivalent document for your company (contractor employees) that document written safety and health responsibilities for those under you.

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Chapter 1.6
Authority and resources

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 1.6

JSC must provide adequate authority and resources for a successful safety and health program. This includes:

a. Assigning the necessary authority to those with safety and health responsibilities. Responsibilities must be clearly communicated and supported with training. All shifts must be covered.

b. Providing adequate resources to those who have safety and health responsibilities. This includes resources such as:

c. Time

d. Training

e. Personnel

f. Equipment

g. Budget

h. Access to information and experts

i. Appropriate use of experts such as Certified Safety Professionals, Certified Industrial Hygienists, licensed health care professionals and other experts as needed based on the risks at JSC

3. Authority

Safety and health responsibilities mentioned in paragraph 1.5.2.e (Chapter 1.5) must include the necessary authority to carry them out.

4. Funding for safety and health resources

JSC must provide adequate funding for its safety and health program. JSC must review safety and health budgets yearly.

a. Line organizations must have funding to:

- Eliminate or control hazards in the work place.
- Provide required or desired personal protective equipment and other safety or health equipment.
- Provide safety and health training unique to their mission and not available through

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the Safety Learning Center.

- Provide other safety and health resources as needed.

b. The S&MA Directorate, Space & Life Sciences Directorate (Occupational Health Branch), and Mission Operations Directorate (Emergency Planning Office) must request funding for:

- Adequate safety, health, and emergency response personnel to oversee JSC's safety and health program.
- Safety and health training at the Safety Learning Center.
- Safety, health, and emergency response equipment for such things as sampling work areas, analyzing samples, and fighting fires.
- Promotional items for safety and health awareness and motivation.
- Technical information such as books, standards, periodicals, and publications.
- Occupational health activities such as monitoring noise or radiation levels.
- Contracts for safety and health tasks.

5. Responsibilities

Responsibilities for authority and resources are as follows:

a. ***Organizational directors*** are responsible for evaluating their needs for safety and health resources at least yearly and requesting the necessary funds as described in sub-paragraph 4.a above.

b. The *S&MA* ***Directorate***, ***Space & Life Sciences Directorate*** (Occupational Health Branch), and ***Center Operations Directorate*** (Emergency Planning Office) must assess their needs for resources at least yearly and request the necessary funds as described in sub-paragraph 4.b above.

6. Safety and health records

These are Center-level financial records showing safety items. The Office of the Chief Financial Officer keeps general financial records and the Center Operations Directorate keeps records of safety modifications or repairs.

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Chapter 1.7
Line accountability

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 1.7

JSC must hold line managers and employees accountable for meeting their safety and health responsibilities. This includes:

a. Clearly defining and implementing authority and responsibility for safety and health protection.

b. Evaluating line managers each year on their safety and health performance.

c. Having a documented system for correcting deficient performance.

d. Including safety and health in each employee's performance evaluation.

3. Requirements

As a manager, you must include the factors listed in paragraphs 4, 5, and 6 below in the performance appraisals of your subordinate line managers as described in the JSC Personnel Manual, Part 4, Subpart 1.

You must also include safety and health in the performance appraisals of your employees as described in the JSC Personnel Manual, Part 4, Subpart 1. The appraisals must include the following:

a. Understanding the hazards the employee is exposed to and how to control them.

b. Fulfilling safety and health responsibilities. This includes the general responsibilities listed in this Handbook and specific responsibilities you assign.

c. Any other relevant safety and health factors.

4. Safety and health performance standards for JSC line managers

As a civil service line manager, you will be held accountable for meeting your safety and health responsibilities. Authority and responsibility for safety and health protection are clearly defined in your performance plan. Your higher management will evaluate your safety and health performance based on how well you:

a. Define your organization's safety and health requirements and liabilities.

b. Make sure your workplace meets all safety and health regulations that apply.

c. Make sure your employees and managers have required safety and health training.

d. Make sure your employees are aware of the hazards in their workplace, understand

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needed safeguards, and are trained employees as required.

e. Establish and communicate safety responsibilities to your managers and employees.

f. Take actions to reduce personal injury or unsafe use of facilities and resources.

g. Make sure your work areas are completely inspected at least quarterly.

h. Make sure mishaps, close calls, and hazards are promptly and completely investigated.

i. Make sure actions are taken immediately protect people and property and long term actions developed to prevent recurrence.

j. Discuss safety issues and concerns at staff and group meetings or other forums.

5. Safety and health performance standards for JSC facility managers

As a civil service facility manager, you will be held accountable for meeting your safety and health responsibilities. Authority and responsibility for safety and health protection are clearly defined in your performance plan. Your higher management will evaluate your safety and health performance based on how well you:

a. Attend required safety and health training.

b. Issue and carry out procedures that meet OSHA, NASA, and JSC safety policies and directives.

c. Have a system to review plans, procedures, and operations within your facility for hazards to personnel or property.

d. Make sure that unforeseen hazardous operations or imminent dangers to personnel or property are shut down until risks are clearly understood by personnel and corrective actions are taken.

e. Coordinate potentially hazardous operations with the Safety and Mission Assurance Directorate.

f. Make sure that mishaps in your facility are promptly reported, investigated, and corrected, and that facility employees get the lessons learned.

g. Make sure operating conditions in the facility are safe.

h. Ensure your buildings are completely inspected at least quarterly.

6. Responsibilities

As a line manager, you are responsible for evaluating the safety performance of all those who directly report to you under the standards in paragraphs 3 – 6 above. This includes subordinate managers, facility managers, and employees. You must include safety and health performance in your yearly performance appraisals described in the JSC Personnel Manual, Part 4, Subpart 1.

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7. Safety and health records

As a line manager, you must maintain current performance appraisals and any supporting documentation as described in the JSC Personnel Manual, Part 4, Subpart 1 or contractor equivalent.

Chapter 1.8
Contractor worker coverage

1. Who must follow this chapter

You must follow this chapter if you:

a. Are involved with selecting contractors.

b. Oversee existing contracts at JSC.

2. Description of Sub-Element 1.8

JSC must provide equal safety and health protection to contract workers as well as civil service employees. Contract workers must follow JSC's safety and health rules, requirements, and processes. This includes a system for overseeing contractor safety and health performance which:

a. Ensures that the contractor's site employees are provided effective safety and health protection.

b. Drives improvement in contractor safety and health performance.

c. Considers safety and health performance when hiring contractors.

d. Evaluates contractor safety and health performance and provides for a recovery plan if contractor performance is below standards.

e. Collects injury and illness data and hours for contractors who work a total of 1000 hours or more in any calendar quarter.

3. JSC's basic safety and health requirements for contractors

JSC must make sure contractors follow JSC safety and health requirements and impose these requirements in the contracts. JSC must monitor contractor safety and health programs and:

a. Enforce JSC's safety and health requirements for each contract.

b. Promptly control any hazards that contractors don't control.

c. Consider company safety and health programs when selecting contractors.

d. Evaluate contractor safety and health program. This includes imposing penalties for not following JSC safety and health requirements. These penalties could include terminating a contract for willful or repeated violations of JSC requirements.

4. Responsibilities of JSC contractors

The following is a list of responsibilities JSC generally expects contractors to fulfill. They may be tailored to individual contracts at the discretion of the Contracting Officer and the Safety and Test Operations Division. In general, contractors must:

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a. Provide for the safety and health of their employees and subcontractors no matter where they work (such as in JSC-owned or leased facilities, with government equipment, or together with government employees).

b. Maintain an effective safety and health program and follow all safety and health requirements that apply to the contract.

c. Protect JSC team members and members of the public that may visit or work in areas where their employees or subcontractors work.

d. Provide JSC safety data on JSC Form 288.

e. Provide a safety and health line item in their budgets.

f. Notify their Contracting Officer and the Safety and Test Operations Division if they find any NASA facilities or NASA operations that don't follow 29 CFR 1910, "Occupational Safety and Health Standards, General Industry," or 29 CFR 1926, "Occupational Safety and Health Standards, Construction Industry."

g. Provide products, equipment, and services that meet JSC, NASA, and OSHA safety and health requirements in design and operation without modifications or restrictive procedures.

h. Make sure their subcontractors (if any) follow JSC, NASA, and OSHA safety and health requirements. Document this "flow down" of safety and health responsibility.

i. Avoid foreseeable, accidental work interruptions that could delay JSC programs. Prevent contamination of property, supplies, and equipment.

j. Allow their contracting officer, JSC safety or health personnel, and State or federal OSHA personnel access to their operations for safety or health inspections or investigations.

k. Handle OSHA citations against their company as described in paragraph 2.6 of NPR 8715.3, "NASA Safety Manual."

5. Requirements

When selecting or overseeing a contract, you must follow Part 11 of this Handbook. Part 11 provides the processes and requirements for selecting safe contractors and evaluating their safety and health performance.

6. Responsibilities

Part 11 of this Handbook contains the responsibilities for selecting and overseeing contractors.

7. Safety and health records

The Office of Procurement must keep Center-level records on JSC contractors as required by

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the contract or other JSC requirements to include:

a. Contractor OSHA 300 ("OSHA Log and Summary of Occupational Injuries and Illnesses") logs and supporting information.

b. Documentation on contractor selection that shows safety and health was considered in selecting the contractor.

c. Documentation showing contractor evaluation that includes safety and health.

d. Disciplinary action taken on a contractor because of safety and health reasons.

e. Any other safety and health documentation required by an individual contract such as safety and health plans.

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Chapter 1.9
Employee involvement

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site.

2. Description of Sub-Element 1.9

All JSC team members must have the opportunity to participate in the planning and operation of JSC's safety and health program and in decisions that affect their safety and health. To be a VPP Star site, JSC must provide at least three active and meaningful ways to participate in safety and health problem identification and resolution. This involvement must be in addition to the individual right to notify appropriate managers of hazardous conditions and practices and to have issues addressed. Examples of acceptable employee involvement include but are not limited to the following::

a. Participating in ad hoc safety and health problem-solving groups.

b. Participating in audits and worksite inspections.

c. Participating in accident and incident investigations.

d. Developing or participating in employee improvement suggestion programs.

e. Training other employees in safety and health.

f. Analyzing job or process hazards.

g. Acting as safety observers.

h. Serving on safety and health committees constituted in conformance to the National Labor Relations Act.

3. Employee involvement in safety and health at JSC

Employee involvement is an essential part of our safety and health program. As a JSC employee, you have the opportunity to actively participate in JSC's safety and health program in a meaningful way. You are a member of the safety and health team. You may participate in the following ways:

a. Work on safety and health committees.

b. Work on ad hoc groups to solve safety and health problems.

c. Train other employees in safety and health matters.

d. Conduct job hazard analyses and other kinds of safety and health analyses.

e. Work on committees that plan and conduct safety and health awareness campaigns.

f. Become an organizational representative or point of contact for safety and health or a fire warden.

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g. Be a safety observer for hazardous operations.

h. Work on teams that audit safety and health programs, inspect facilities and operations, sample work areas, or investigate mishaps, close calls, and other safety and health issues.

i. Analyze data and corrective actions from your workplace such as health samples, mishap trends, close call trends, or inspection reports.

4. The JSC Safety Action Team

The JSC Safety Action Team is composed of working-level employees and reports to the Center Director. It is an excellent way for employees to be involved in and influence safety and health at JSC. The JSC Safety Action Team must meet the requirements in paragraph 4.2 of JPR 1107.1.

5. Responsibilities

Responsibilities for employee involvement are as follows:

a. As a ***JSC Team Member***, you are responsible for finding ways to be involved in safety and health activities as described in paragraphs 2 and 3 above.

b. As a ***line manager***, you must:

- Allow your employees to be involved in safety and health activities.
- Involve your employees in safety and health decisions and activities within your organization.

6. Safety and health records

The following records document employee involvement:

a. Center-level records – the JSAT must keep minutes of its meetings.

b. Organizational-level records – as an employee, you must maintain any records that show your employee involvement. As a line manager, you must maintain any records that show your involvement of your employees. These records may include:

- Training records that show employees giving safety and health training.
- Attendance records for safety and health meetings or other forums where employees present safety or health topics.
- Photographs of employees participating in safety and health activities such as Safety and Total Health Day.
- Lists of safety and health activities and names.
- Any other records that show employee involvement in safety and health activities.

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Chapter 1.10
Safety and health program evaluation

1. Who must follow this chapter

You must follow this chapter if you are involved in preparing JSC's annual safety and health program evaluation. This is mostly the responsibility of safety and health professions, though line organizations may provide information for the evaluation on request.

2. Description of Sub-Element 1.10

JSC must have a system for evaluating the operation of its safety and health program each year. This system judges our success in meeting our safety and health goal and objectives, and will help us determine needed changes to continually improve worker safety and health protection.

a. The evaluation report must be a written narrative report with recommendations for timely improvements, assign responsibility for those improvements, and document timely, adequate follow-up action or the reason no action was taken.

b. The evaluation must assess the effectiveness of all elements in JSC's safety and health program.

c. Competent JSC, NASA, or other private sector persons who are trained or experienced in evaluating safety and health programs may do the evaluation. The evaluation must follow the format specified by OSHA, VPP Region VI.

Process for Program Evaluation

3. Performance Evaluation Profile (PEP)

JSC Team members must take the PEP yearly to provide at least a statistical sample. The PEP is a survey designed to measure employee and manager perceptions about safety and health. Low perceptions or discrepancies between employee and management perceptions could indicate problems in the safety and health program. Scores will be available by directorate and for the entire Center. Each directorate will receive a report with its scores and a proposed action plan. Since the PEP is a perception survey, it isn't adequate for the safety and health program Evaluation by itself, but provides useful information for the evaluation.

4. Evaluate previous year's report

Evaluate the previous year's report by reviewing:

a. Parts 1 - 4 of this Handbook to make sure you are familiar with the requirements.

b. Status of all actions listed in the previous year's report, including any closure

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documentation.

5. Evaluate current year's safety and health performance

Evaluate this year's performance by the following steps:

a. Assess current status of program elements through any of the following:

   b. Interviews with subject matter experts.

   c. Self-audits and inspections.

   d. Results of this year's PEP.

   e. Any available leading metrics.

   f. Investigation and trend data.

   g. Any other methods available.

h. Provide detailed description and evaluations for each Chapter based on the assessments in 5.a. The report must follow the format required by OSHA Region VI Voluntary Protection Program Manager.

i. Determine actions needed to improve health and safety at JSC.

j. Document responsible parties, closure criteria, status, and estimated closure dates for each recommended action in 5.c.

6. Publish the Annual Safety and Health Self-Evaluation Report

To publish the evaluation report:

a. Make sure all Center directorates have input to and opportunity to comment on the report through the Executive Safety Committee (or equivalent), its subcommittees, or other methods to be arranged.

b. Get approval signatures from:

   c. NS Division Chief.

   d. SD, Occupational Health Branch.

   e. Coordination Subcommittee Chair.

   f. JSC Safety Action Team Chair.

   g. Executive Safety Committee Chair.

h. Send original signed report to the OSHA Voluntary Protection Program Region VI Manager. NS and SD will each keep a copy.

i. Post report on JSC's Safety and Total Health web page.

j. Send a copy to NASA Headquarters, Safety and Risk Management Division, Code QS.

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7. Responsibilities

Responsibilities for the safety and health program evaluation are as follows:

a. The ***Safety and Test Operations Division*** is responsible for:

   a. Developing the evaluation report jointly with the Occupational Health Branch. The Safety and Test Operations Division has the final authority over the report.

   b. Publishing the final report.

b. The ***Occupational Health Branch*** is responsible for developing the evaluation report jointly with the Safety and Test Operations Division.

8. Safety and health records

The following Center-level records document JSC's safety and health program evaluation:

a. A copy of each year's program evaluation.

b. Documentation on tracking self-evaluation actions to closure.

c. PEP results.

Safety and Test Operations Division keeps items a and c. The Executive Safety Committee keeps item b.

9. Measurement

The following factors will measure safety and health program evaluation:

a. Meeting the February 15 deadline for submitting the report to OSHA.

b. Progress on and completion of the actions assigned by the program evaluation.

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Appendix 1

Miscellaneous guidelines and instructions

This appendix contains one attachment:

Records and Reports

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Appendix 1
Records and reports

1. Center-level safety and health records

JSC must keep the records described in the following table. Records are kept in a central location for easy access and many records have backup copies stored at a federal records retention center. JSC must keep records back to the beginning of the fiscal year of the last OSHA VPP review or longer if required by OSHA or NPR 1441.1, "Records Retention Schedules." Any format that includes the pertinent information is acceptable unless otherwise noted in the table.

JSC must protect all safety and health records under the Privacy Act of 1974.

Record . . .	***Chapter***	***Required format . . .***	***Other requirements . . .***
Executive Safety Committee and subcommittee minutes	1.1	None	Executive Safety Committee & subcommittees keep
Contractor Safety Forum minutes	1.1	None	Contractor Safety Forum keeps
Tracking completion of tasks assigned by Executive Safety Committee or Contractor Safety Forum	1.1	None	Executive Safety Committee & Contractor Safety Forum keep
Tracking completion of Center-level goals	1.1 also supports 1.3	None	Executive Safety Committee keeps
A commitment statement from the current Director, JSC	1.2	None	Safety and Test Operations Division keeps; within 60 days after a change of Center Director, we must send a new statement to OSHA
A letter of support for VPP signed by the current President, AFGE, local 2284.	1.2	None	Safety and Test Operations Division keeps; within 60 days after a change in either the President, AFGE local 2284, or Director, JSC, we must send a new letter to OSHA
JPG 1700.1 and change records	1.4	None	Safety and Test Operations Division keeps
Variance documentation for both Center-level and higher level variances	1.4	None	Safety and Test Operations Division keeps until the variance expires; we must send yearly summary to NASA HQ, Code Q, of any variances JSC approves to NASA-level requirements
Center-level financial records showing safety items	1.6; also supports 1.3	None	The Office of the Chief Financial Officer and the Center Operations Directorate keep

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Appendix 1
Records and reports
(continued)

Record . . .	*Chapter*	*Required format . . .*	*Other requirements . . .*
Records on JSC contractors to include: • Contractor OSHA 300 ("OSHA Log and Summary of Occupational Injuries and Illnesses") logs and supporting information • Documentation on contractor selection that shows safety and health was considered in selecting the contractor • Documentation showing contractor evaluation that includes safety and health • Disciplinary action taken on a contractor because of safety and health reasons • Any other safety and health documentation required by an individual contract such as safety and health plans	1.8 Part 11	OSHA 300 must be in the format required by OSHA Any format that includes the pertinent information is acceptable for the other items	Safety and Test Operations Division keeps current logs Office of Procurement keeps all other records
JSC Safety Action Team (JSAT) minutes	1.9	None	JSAT keeps
Safety and health program self-evaluation	1.10	As required by OSHA VPP Region VI	Safety and Test Operations Division keeps
Documentation on tracking self-evaluation actions to closure	1.10	None	Executive Safety Committee keeps
PEP results	1.10	None	Safety and Test Operations Division keeps
Information for NASA's Annual Report to OSHA	1.10	None	The Safety and Test Operations Division will send its information for this report to NASA Headquarters when Headquarters requests it, using OSHA publication 2014 as a guide. This must include documentation required by NPR 8715.1 and NPR 8715.3.
Industrial hygiene records—sampling and analysis	2.2	None	Occupational Health Branch keeps
Safety and Health design comments	2.3	None	The Safety and Test Operations Division keeps safety comments; the Occupational Health Branch keeps health comments
Design review documentation and acceptance test and inspection records	2.3	None	The Center Operations Directorate
Operational Readiness Inspection reports and records	2.3 & 10.3	None	Safety and Test Operations Division keeps indefinitely

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Appendix 1
Records and reports
(continued)

Record . . .	*Chapter*	*Required format . . .*	*Other requirements . . .*
Records on annual Safety and Test Operations Division safety inspections	2.5	Findings recorded in the Hazard Abatement Tracking System	The Safety and Test Operations Division keeps records of safety inspections; the Occupational Health Branch keeps records of health inspections
Employee reports of hazards and close calls	2.6	Close Call and Safety Action Hotline tracking databases	Safety and Test Operations Division keeps these records
Log of occupational injuries and illnesses This log records federal employee job-related injuries and illnesses that are OSHA reportable	2.7	OSHA Form 300 Data kept in FRED, JSC's mishap reporting and tracking system, and printed as necessary	The Safety and Test Operations Division records the information in FRED within 1 working day after finding out about the injury or illness. The log must include cases reported to the Office of Workers' Compensation Programs.
Annual Summary of Federal Occupational Injuries and Illnesses	2.7	OSHA Form 300 Must follow OSHA Publication OMB No. 1220-0029, "Recordkeeping Guidelines for Occupational Injuries and Illnesses"	The Safety and Test Operations Division will: a Post copies of the summary where employee notices are posted by Dec. 14 of each year. Copies of the summary must remain posted for at least 30 calendar days. b Take steps to make sure no one alters, defaces, or covers the copies c Send a copy of the summary to NASA Headquarters by October 30 of each year
Mishap board reports & records (including supporting evidence, transcripts, and minutes of board meetings)	2.7	NPR 8621.1, Appendix H-3	Safety and Test Operations Division keeps
Mishap Reports	2.7	FRED, NASA Form 1627	Safety and Test Operations Division keeps
Records to support Center-level trend analysis such as minutes where trends discussed, committee reports on trends analyzed	2.8	None	Safety and Test Operations Division, Occupational Health Branch, JSAT, Executive Safety Committee keep as appropriate

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Appendix 1
Records and reports
(continued)

Record . . .	*Chapter*	*Required format . . .*	*Other requirements . . .*
Other OSHA required records at the Center level (such as lockout/tagout audit reports, hearing conservation records)	3.2	As required by OSHA	Per OSHA Safety and Test Operations Division keeps safety records; Occupational Health Branch keeps health records
Chemical inventory to show we don't fall under the Process Safety Management Standard	3.3	None	Occupational Health Branch keeps
Center-level maintenance schedules, procedures, and records	3.4	None	The Center Operations Directorate keeps
Hazard Abatement Tracking System (HATS)	3.5	HATS database	The Safety and Test Operations Division keeps
Employee medical records	3.6	None	Occupational Health Branch keeps these records at the JSC Clinic
Log of federal workers' compensation cases	3.6, Appendix 3B	Form CA-1, CA-2, or CA-6	Occupational Health Branch keeps
JSC 05900 – Emergency plan	3.8	None	Emergency Planning Office keeps current copy
Training attendance records and course documentation for JSC Safety Learning Center and Occupational Health Services classes	4.1 – 4.6	None	The Safety and Test Operations Division keeps records for safety training; the Occupational Health Branch keeps records for health training.
Nuclear Regulatory Commission license and radiation exposure records	6.3	Per NRC requirements	Radiation Safety Officer keeps
JSC hazardous material inventory and central repository for Material Safety Data Sheets	9.2	None	Occupational Health Branch keeps

2. Access to JSC's safety and health records and reports

The following individuals may see JSC records and reports on request:

a. JSC's Executive Safety Committee, JSAT, employees, former employees, and employee representatives may see JSC logs and yearly summaries.

b. Authorized representatives from the Department of Labor or Health and Human Services may see any JSC safety and health records or reports.

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3. Safety and health documentation for line organizations

As a line manager, you must maintain the documentation listed in the following table as it applies to the work your organization does. Documentation may be electronic or hard copy. You may consolidate some documentation at higher levels of management, such as directorate or division, as appropriate. As a minimum, you must keep back to the beginning of the fiscal year of the last OSHA VPP review or longer if required by OSHA or NPR 1441.1. You are only required to keep a current copy of certain records as indicated in the table. Any format that includes the pertinent information is acceptable unless otherwise noted in the table.

Documentation . . .	***Chapter . . .***	***Remarks***
Organizational safety committee minutes (including construction committee minutes and inspection records as appropriate)	1.1 10.1 for construction	None
Tracking completion of tasks or goals assigned by DSC or other organization-level committees if assigned	1.1	None
You are encouraged to keep documentation on variances granted for your organization	1.4	Keep until the variance expires
Performance plans showing S&H responsibilities	1.5	Keep current plans only
Performance appraisals that include safety and health	1.7	Keep current appraisals only
Documentation of employee involvement which may include: a Training records that show employees giving or receiving safety and health training b Attendance records for safety and health meetings, especially where employees present safety or health topics c Photographs of employees participating in safety and health activities such as Safety and Total Health Day d Lists of safety and health activities and names e Any other records that show employee involvement in safety and health activities	1.9	None
Design review, ORI, URR, and TRR documentation (Hazardous material hazard analyses, other hazard analyses & JHAs – Chapter 2.4 – may also support this element)	2.3	None
Job hazard analyses	2.4	Keep only current analysis and update yearly
Hazard analyses and hazard evaluation reports	2.4	Keep for life of system & update every 5 years

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Appendix 1
Records and reports
(continued)

Documentation . . .	*Chapter . . .*	*Remarks*
Inspections by your organization	2.5	None
Actions taken on employee reports of hazards or close calls directly to you	2.6	None
Your are encouraged to keep completed NASA Forms 1627 and supporting documentation	2.7	None
You are encouraged to keep records of any trend analysis you do within your organization	2.8	None
Procedures or work instructions that document safe work practices Directives or other documentation that provide safety and health rules for individual work areas or organizations PPE hazard analyses and other PPE documentation required by Chapter 5.6 of this Handbook Documentation required for hazard control programs described in the chapters listed in paragraph 7 of Chapter 3.2 Hazard analyses and job hazard analyses (Chapter 2.4) that document hazard controls that support this sub-element	3.2	Keep only current procedures, directives, rules, and analyses.
Other OSHA-required records at the organizational level	3.2	Format and timeline as required by OSHA
Process Safety Management documentation (if required)	3.3	Format and timeline as required by OSHA
Organizational maintenance schedules and procedures	3.4 or 10.4	Keep only current procedures & schedules
Organizational maintenance records to show completed maintenance	3.4 or 10.4	None
Tracking for hazards not tracked in HATS to include work requests or other supporting documentation	3.5	None
Posted JF 1240s	3.5	Keep only while posted
Current roster of employees requiring enrollment in medical surveillance and medical screening programs	3.6	None
Records of disciplinary action for safety violations	3.7	None
Organizational emergency action plans and Facility Evacuation Plans	3.8	Keep current plans only
Training and certification plans and records on training or certification by your organization	4.1, 4.2, 4.3, 4.6, & 5.8	Keep current plans and records only

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Appendix 1
Records and reports
(continued)

Documentation . . .	*Chapter . . .*	*Remarks*
JSC Form 2150 to document employee participation in fire drills or fire evacuation training	4.4	None
Documentation supporting required organizational emergency drills other than fire drills	4.4	None
Canceled Confined Space Entry Permits	6.10	Keep for 1 year only
Inventory of hazardous chemicals in your facilities	9.2	Keep current inventory only
Facility Baseline Documentation records	10.4	Keep for life of the facility
Facility & Operations records (such as TRR documentation or documentation on engineering controls)	Parts 5 - 10	None

4. Safety and health records and reports management provides employees

a Post copies of all safety and health evaluations and inspections, hazard analyses, and job safety analyses in a readily accessible location.

b Place a copy of the work area hazardous material inventory and material safety data sheets (MSDS) in a readily accessible location (see Chapter 9.2).

c Provide employees copies of their individual exposure monitoring results when requested to do so by Occupational Health Services.

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Part 2
Worksite analysis

1. Description of Element 2

Part 2 describes Major element 2 of the JSC Safety and Health Program, "Worksite Analysis." JSC management and employees must thoroughly understand all hazardous situations to which employees may be exposed and recognize and correct all hazards as they arise.

Element 2 includes the following sub-elements:

2.1 Management Understanding (of work site hazards)

2.2 Industrial Hygiene Program

2.3 Pre-Use Analysis

2.4 Hazard Analysis

2.5 Routine Inspections

2.6 Employee Hazard Reporting Systems

2.7 Mishap and Incident Investigations

2.8 Trend Analysis

The requirements, processes, and responsibilities for Element 2 are defined in the chapters for the sub-elements.

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Chapter 2.1
Management understanding

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 2.1

JSC line managers must understand all hazards that employees may be exposed to and how to control them. This involves comprehensive safety and health surveys, at intervals appropriate for the nature of workplace operations and other methods for identifying hazards. This includes identifying both safety and health hazards.

3. Requirements and processes

JSC has many diverse work areas with several kinds of hazards. As a line manager, you must identify, understand, and control its hazards through any of the following methods.

a. Facility or work area hazard analyses and job hazard analyses. See Chapter 2.4.

b. Industrial hygiene surveys. See Chapter 2.2.

c. Techniques for "Pre-Use Analysis" found in Chapter 2.3.

4. Responsibilities for management understanding

As a ***line manager***, you are responsible for:

a. Making sure hazards in your areas are identified, understood, and controlled and that the risks of those hazards are assessed.

b. Making sure any hazards to the public are controlled.

c. Paying special attention to facilities involving multiple organizations, contractors, and shifts so that you:

- Clearly define safety and health responsibilities.
- Promptly communicate safety and health information to all people.

5. Safety and health records

There are no unique records to document management understanding of hazards. Records required by the Chapters mentioned in Paragraph 3 above support this sub-element.

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Chapter 2.2
Industrial hygiene program

1. Who must follow this chapter

You must follow this chapter if you are involved with industrial hygiene studies at JSC. If you suspect a health problem in your work area, you must contact the Occupational Health Branch as stated in Paragraph 4.a below.

2. Description of Sub-Element 2.2

JSC must identify health hazards and employee exposure levels by:

a. A sampling rationale based on data, including reviews of work processes, Material Safety Data Sheets, employee complaints, exposure incidents, medical records, and previous monitoring results.

b. A sampling strategy that includes baseline and later surveys and that assess employees' exposure through screening and full shift sampling when necessary.

c. Using nationally recognized procedures for all sampling, testing, and analysis with written records of results.

3. Industrial hygiene studies

Industrial hygiene studies monitor potential employee exposures to physical, chemical, and biological health hazards such as noise, radiation, or hazardous materials and determine if they are within allowable limits. Industrial hygienists do the studies under nationally recognized industrial hygiene procedures and protocols. The studies involve:

a. Sampling work areas for physical, chemical, and biological stressors.

b. Testing or analyzing the samples.

c. Comparing exposures to exposure standards and regulations.

d. Recommending corrective actions to reduce exposures to acceptable levels.

e. Communicating results to managers and workers.

4. Responsibilities

Responsibilities for industrial hygiene are as follows:

a. ***Line organizations*** are responsible for contacting the Occupational Health Branch if they suspect their employees may be exposed to health hazards.

b. The ***Occupational Health Branch*** is responsible for:

- Developing and maintaining site-wide exposure assessment databases.
- Baseline sampling and periodic sampling of work areas as required.

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- Responding to requests from line organizations for sampling of suspected health hazards.

5. Safety and health records

The Occupational Health Branch must maintain sampling and analysis records. This includes providing results of individual health evaluations to employees.

Line organizations must post copies of health evaluations in a readily accessible location.

6. Measurement

JSC will measure industrial hygiene by meeting established schedules for industrial hygiene sampling.

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Chapter 2.3
Pre-use analysis

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 2.3

JSC must analyze all newly acquired or altered facilities, processes, materials, equipment, or phases before use begins, to identify safety and health hazards, environmental impacts, and means to prevent or control them.

3. Requirements

JSC handles pre-use analyses as follows:

a. For new or modified facilities and proposed programs or projects:

- Safety, health, and fire protection engineers must review the drawings and participate in design reviews. All new or modified facilities require at least acceptance inspections and tests of fire protection systems. See Chapter 10.1 of this Handbook for more details.
- You must make sure an environmental review is done during the planning phase as described in JPR 8550.1, "JSC Environmental Compliance Procedural Requirements." The "environmental review" is required by the National Environmental Policy Act (NEPA) to identify and assess the potential environmental effects for proposed programs and projects. The Project Manager conducts the environmental review during the earliest planning stages, before the point when NASA's ability to implement reasonable alternatives if precluded.

b. Hazardous, unique, or critical facilities require an operational readiness inspection as described in Chapter 10.3 of this Handbook. Hazard analyses are included.

c. Less hazardous facilities may have a less rigorous readiness review that uses Chapter 10.3 of this Handbook as a guide. Hazard analyses are included.

d. Ground tests that could pose hazards to test subjects or test personnel must have a Test Readiness Review as described in Chapter 6.9 of this Handbook. Hazard analyses are included.

e. Hazardous materials require a hazard analysis as described in Chapter 9.1 of this Handbook.

f. Employees in potentially hazardous jobs must have a Job Hazard Analysis as described in Chapter 2.4 of this Handbook.

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4. Responsibilities

Responsibilities for pre-use analyses are as follows:

a. As a ***Line manager,*** you are responsible for:

- Making sure the analyses in Paragraph 3 above are done as required.
- Making sure the Safety and Test Operations Division and the Occupational Health Branch are involved in evaluating any new facilities, equipment, materials, or processes and any changes to your facilities, equipment, materials, or processes.

b. ***The Center Operations Directorate*** is responsible for:

- Notifying the Safety and Test Operations of plans for new or modified facilities, and providing drawings and notice of design reviews.
- Conducting environmental reviews according to JPR 8550.1.

c. ***The Safety and Test Operations Division*** and the ***Occupational Health Branch*** are responsible for:

- Reviewing facility drawings for safety and health.
- Supporting design reviews, Test Readiness Reviews, and operational readiness inspections as needed.

5. Safety and health records

Records to document pre-use analyses may include:

a. For new or modified facilities, Center-level records include:

- Design review documentation and acceptance test and inspection records kept by the Center Operations Directorate.
- Records of safety and health comments kept by the Safety and Test Operations Division or Occupational Health Branch.
- Records of the NEPA environmental reviews kept by the Environmental Office.

b. If an operational readiness inspection is done on a facility, the organization that owns the facility must keep a copy of the operational readiness inspection package as described in Chapter 10.3 of this Handbook.

c. For less hazardous facilities where a less rigorous readiness review was done, the organization that owns the facility must keep a copy of the review package.

d. Organizations that do hazardous ground testing that could pose hazards must keep Test Readiness Review documentation.

e. Hazard Analysis as described in Chapter 2.4 of this Handbook also support this sub-element.

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Chapter 2.4
Hazard Analysis

1. Who must follow this chapter

You must follow this Chapter if you:

a. Do job hazard analyses or hazard analyses.

b. Are a project manager, Contracting Officer, JSC's Center Director, or the Director, Safety & Mission Assurance (S&MA), Paragraph 17 of this Chapter lists your responsibilities.

2. Description of sub-element 2.4

JSC must routinely examine and analyze safety and health hazards associated with individual jobs, processes, or phases and include results in training and hazard control programs described in Chapter 3.2 of this Handbook. This may include job hazard analysis, hardware or facility hazard analysis, or process hazard review.

3. What this chapter covers

This Chapter gives you basic requirements for doing job hazard analyses and other hazard analyses and for managing risk for ground-based jobs and systems. See Space Shuttle or Space Station requirements for more information on space systems.

Your hazard analysis may also include the required environmental impact assessment to make sure all environmental aspects have been considered and the impacts are controlled. The assessment is required by JSC's Environmental Management System to assess JSC's activities, products, or services that have effects on the environment – both positive and negative. It must follow JPR8553.1, "JSC Environmental Management System Procedural Requirements."

4. Job hazard analysis

You must do a job hazard analysis for any job you believe to be hazardous. In this Chapter, "job" means a task someone does, not his or her position. You must review your job hazard analysis yearly or when the job changes. Job hazard analysis must follow Appendix G of JSC 17773 "Preparing Hazard Analyses for JSC Ground Operations." Appendix G of JSC 17773 follows the format and methodology of OSHA pamphlet 3071 "Job Hazard Analysis."

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Hazard analysis and system safety

5. When a hazard analysis is required

A hazard analysis is an organized method for identifying hazards and hazard controls in a system at any point in its life cycle. JSC 17773 gives you more details on how to recognize and analyze hazards.

You must start planning for and doing hazard analyses and environmental impact assessments in the early design phases for any of the following systems and operations:

a. Aircraft systems.

b. Facilities and hazardous facility systems such as test or oxygen systems.

c. Support equipment such as test, maintenance, or training equipment.

d. Software for any of the above systems.

e. Prototypes of any of the above systems.

f. Other systems or operations when required by other chapters of this handbook.

g. Operations and support activities, such as:

- Constructing facilities and making hardware.
- Experimenting on and testing systems.
- Storing, packing, or transporting systems.
- Checking out and using systems.
- Maintaining or modifying systems.
- Retrieving, disassembling, or disposing of systems.

6. Basic elements of a system safety program

A system safety program may be simple or complex, depending on the project. You must follow these steps and may tailor them to your project:

a. Start with a preliminary hazard analysis on each proposed concept.

b. Use the preliminary hazard analysis to:

- Document the hazards of each design concept or operation you are considering.
- Review lessons learned from past experience.
- Define safety and health requirements for the project.
- Help you select which design concepts or operations to choose.
- Plan future safety and health efforts. These could include what other hazard analyses and system safety techniques are necessary, such as subsystem hazard analyses,

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operation and support hazard analyses, fault tree analyses, and hazard operability studies.

c. Use hazard analyses to support trade-off studies of different design and operational concepts during each phase of the project.

d. Trace all pertinent details of the hazard analysis and review from the initial identification of the hazard through its resolution and any updates. Use the continuous risk management approach.

e. Decide which hazard controls to use. Eliminate hazards with design measures as much as possible. Use other controls for those you can't eliminate by design.

f. Analyze your system's proposed operation for hazards. Consider all phases of your system's operation such as test, startup, operation, maintenance, and disposal.

g. Decide what risk is acceptable to your project.

h. Assess and accept the risks of the system or its operation after you have controlled the hazards by:

- Using the most effective hazard controls that will be cost effective and won't prevent the system's mission from being accomplished.
- Looking at the risk each hazard poses and deciding if it's acceptable or if you should do more to control it and lower the risk.

i. Have the right level of management accept risks.

j. Document all risk decisions and their rationale.

k. Send copies of safety analysis reports and hazard analyses to NASA Headquarters as requested.

7. What hazard analyses must contain

Your hazard analysis must contain at least the following information:

a. The system's name and location.

b. The hazards of the system and their causes. Include hazards from human factors as well. You must also consider hazards of interfaces between systems and interfaces between the equipment and the facility.

c. The consequence of each hazard if it were to cause a mishap. For example, death, major injury, minor injury, or estimated property damage and dollar amount.

d. Any existing engineering or administrative controls for each hazard.

e. Proposed engineering or administrative controls for each hazard, if the existing controls are inadequate.

f. What would happen if the engineering or administrative controls were to fail.

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g. A qualitative evaluation of the possible safety and health effects before and after the controls are in place.

h. Who was on the team that did the hazard analysis.

i. When was the last time you analyzed the system.

j. A qualitative evaluation of the risk before and after the hazard controls are in place. This is the risk that management will have to accept.

8. Assessing risk

You must use a risk assessment code (RAC) matrix to assess the risk of each hazard. JSC uses this system to make sure that risk assessments are consistent. To use this matrix:

a. Find the "severity" or the worst-case outcome of a mishap from the hazard along the left side of the matrix.

b. Find the "frequency" that you expect the mishap to occur across the top of the matrix.

c. Find the RAC in the box where the "severity" and "frequency" cross.

		PROBABILITY ESTIMATE (FREQUENCY)			
		A Frequent Likely to occur one or more times a year	**B Probable** Likely to occur once in 1 - 2 years	**C Occasional** May occur once in 2 - 5 years	**D Remote** Unlikely to occur, but possible within 5 years to end of system life
SEVERITY	**I Catastrophic** Death, several serious injuries or illnesses, or damage over $1,000,000	1	1	2	3
	II Critical Serious injury or illness, several lost workdays, or Damage between $250,000 - $1,000,000	1	2	3	3
	III Marginal Lost workday, several minor injuries, or Damage between $25,000 - $250,000	2	3	4	4
	IV Negligible Minor injury or damage less than $25,000	3	3	4	4

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9. What each RAC means

The table below tells you what action you must take for each RAC. For systems in design, you must eliminate or control the hazard before the system goes into operation. For existing systems, you must investigate and abate the hazard as described in Chapters 3.2 and 3.5 of this Handbook.

If the RAC is . . .	***Then the risk is . . .***
1	Unacceptable – All operations must cease immediately until the hazard is corrected or until temporary controls are in place and permanent controls are in work. A safety or health professional must stay at the scene at least until temporary controls are in place. RAC 1 hazards have the highest priority for hazard controls.
2	Undesirable – All operations must cease immediately until the hazard is corrected or until temporary controls are in place and permanent controls are in work. RAC 2 hazards are next in priority after RAC 1 hazards for control. Program Manager (Directorate level), Organizational Director, or equivalent management is authorized to accept the risk with adequate justification
3	Acceptable with controls – Division Chief or equivalent management is authorized to accept the risk with adequate justification
4	Acceptable with controls – Branch Chief or equivalent management is authorized to accept the risk with adequate justification

10. Controlling hazards

Use these steps to decide what corrective action to take for any hazard found during your analysis. Take the following actions in the order below to control a hazard. Go to the next step only if the present step or previous steps aren't feasible or are too costly:

a. Change the design to eliminate or reduce the hazard. For example, use a less hazardous material or lower voltage if you can.

b. Install safety devices or guards. For example, use safety interlocks, machine guards, or relief valves if you can.

c. Install caution and warning devices. For example, use oxygen monitors or alarms if you can.

d. Use administrative controls, such as special work procedures, training, administrative barriers, and signs.

e. Use personal protective equipment.

f. Accept the risk as described in Subparagraphs 6.h and 6.i of this Chapter.

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You must also make sure that all hazards are controlled. To do this, you must track each hazard and keep it "open" until one of the above actions has occurred.

System safety plan and reviews

11. Safety and health plan

As a project manager, you must develop a safety and health program plan that describes your safety and health effort. You may combine the two plans, if possible. Use Attachment 2.4A, Appendix 2B as a guide. The plan must:

a. Be done before the project begins.

b. Describe engineering and management tasks for system safety.

c. Tailor the system safety program to the project based on the project's complexity, cost, criticality, or management structure.

d. Allow for free communications among all persons and organizations working on the project.

e. Be updated as the design matures.

f. Include budgets, responsibilities, and applicable safety and health requirements.

g. Include a system safety task schedule that supports the project schedule.

12. Safety reviews

As a project manager, you must have a safety review either before or as a part of each project review. Project reviews may include preliminary design reviews or 30% design review, operational readiness inspections, etc. Safety reviews must:

a. Status your system safety program.

b. Review hazards found before the review and prioritize them by risk.

c. Review other system safety products such as safety assessment reports.

d. Decide if you should change the design, study other options, or do more hazard analysis.

Other requirements and responsibilities

13. Maintaining a hazard analysis or job hazard analysis

You must keep the analysis and review it at least every five years while the project is active or before making any changes to the hardware, software, or operation. This will allow you to see how valid your analysis was after you have had some experience with the system.

You must review job hazard analyses every year or when the job changes.

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14. Changes to the job, system or operation

If you intend to change your job, system or operation, including changes to process or chemicals used in a process, you must:

a. Hold a safety review, update the existing hazard analysis, or do a new hazard analysis to make sure that the change doesn't create a hazard.

b. Analyze any change proposed to correct a hazard to see if it will effectively control the hazard.

15. Other requirements for job hazard and hazard analyses

In addition to this Chapter, you must follow the requirements in these documents.

For . . .	***Follow this standard . . .***
Job hazard and hazard analyses on JSC ground-based systems	JSC 17773 NPR 8715.3, Chapter 3 NASA STD 8719.7, "Facility System Safety Guidebook"
Software safety	NASA STD-8719.13, "Software Safety"
Failure tolerance requirements for safety critical functions	Paragraph 1.8 of NPR 8715.3
Product safety	29 CFR 1960.34(b)
Ground-based chemical processes	29 CFR 1910.119
Environmental impact assessments of new or different activities, products or services	JPR 8553.1, "JSC Environmental Management System Procedural Requirements"

16. For more information on job hazard and hazard analyses

You can find more information on job hazard and hazard analyses in these documents:

a. Chapter 3 and Appendix D, E, and I of NPR 8715.3, "NASA Safety Manual," current version.

b. Langley Research Center Handbook 1740.4, "Facility System Safety Analysis and Configuration Management," current version.

c. NPR 8820.2, "Facility Project Implementation Handbook," current version.

d. MIL-STD-882, "System Safety Program Requirements," current version.

17. Responsibilities

Responsibilities for hazard analysis and job hazard analysis are as follows:

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a. ***The Center Director*** has the final authority for all system safety products and risk management decisions for systems and facilities at JSC and JSC field sites. He or she must appoint a senior manager at JSC and each field site to serve as the site manager for risk management decisions involving JSC personnel, property, and operations.

b. A ***project manager*** for any new or modified system, facility or operation at JSC or a JSC field site must:

- Develop a system safety program for your project early in the planning phase.
- Make sure everyone on the project follows your system safety program.
- Approve a safety management plan and any system safety program plans that may be required.
- Report hazards that could result in death, major injury or major property damage to anyone or anything outside the project and other hazards, as required, to higher management.
- Fulfill the responsibilities in Paragraphs 3.5.1 and 3.10.2 of NPR 8715.3.

c. The ***Director, S&MA,*** must provide personnel to:

- Provide guidance to JSC organizations on system safety programs, job hazard, and hazard analyses. Review programs and analyses.
- Make sure system safety products are complete and accurate and management is properly accepting risk and documenting its decisions.
- Support project and safety reviews to make sure the system safety program is being followed.

d. The ***Occupational Health Branch*** will help JSC organizations conduct job hazard or hazard analyses for potential occupational health hazards in the workplace.

18. Safety and health records

The following organizational-level records document hazard analysis:

a. Organizational-level records:

- Line managers and employees must keep current copies of job hazard analyses.
- Ground programs must keep copies of system safety plans and hazards.

b. Center-level records - Records on environmental impact assessments are maintained in the Environmental Management System Control plan as described in JPR8553.1, “JSC Environmental Management System Procedural Requirements.”

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Chapter 2.5
Routine inspections

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site. Paragraph 14 of this chapter lists the responsibilities of facility managers, line managers, contractor safety representatives, the Safety and Test Operations Division, and the Occupational Health Branch.

2. Description of Sub-Element 2.5

JSC must have a system for routinely inspecting selected work areas monthly so as to cover the entire site quarterly and:

a. Is done by employees trained in recognizing hazards and may include other employees.

b. Follows written procedures or guidance.

c. Results in written reports of findings.

d. Tracks hazard elimination or control to completion.

3. Purpose of safety, fire, and health inspections and evaluations

Safety and health inspections and evaluations identify hazards in the workplace so they can be corrected.

4. Safety, fire, and health inspections and evaluations at JSC

This table lists the kinds of safety, fire, and health inspections and evaluations JSC does. Inspections must look for safety, fire and health hazards unless otherwise noted.

What kind?	*Who does them?*	*How often?*
Construction area self-inspections to find hazards	• Construction company managers and employees • Directorate safety and health committee members	• Weekly • Monthly by directorate safety and health committee members
Regular safety, fire, and health inspections to find hazards	• Safety and Test Operations Division • Occupational Health Branch	• Yearly or more often if necessary

Table continues on next page.

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What inspections?	*Who does them?*	*How often?*
Director walkthroughs	• Organizational Directors	• Twice a year
Facility manager walk-throughs to inspect for safety, health, and fire hazards	• Facility managers are responsible for making sure their buildings are inspected • Managers responsible for the work area and employees in the work area may also participate or do separate inspections	• Inspect a few areas monthly and cover the entire building quarterly
Special inspections and surveys to look at suspected hazards	• Safety and Test Operations Division • Occupational Health Branch	As requested by safety and health committees, employee representatives, or employees After an employee complaint
Unannounced inspections to find hazards	• Safety and Test Operations Division • Occupational Health Branch	As needed
Follow up inspections to make sure hazards are corrected	• Safety and Test Operations Division • Occupational Health Branch	As necessary to make sure hazards are corrected
Baseline surveys get a baseline on hazards of new and newly acquired facilities, processes, materials, or equipment	• Operational readiness inspections • User readiness reviews • Informal survey teams • Safety, fire, and health professionals	Before the new or newly acquired facilities, processes, materials, and equipment are used

5. Fire risk surveys

The Safety and Test Operations Division will survey all JSC work areas and operations periodically or when a facility is built or modified. The fire risk survey isn't intended to be an all-encompassing engineering survey, but will try to find obvious fire hazards with normal facility operations.

The survey will look at areas such as:

a. Exit routes and posted facility evacuation plans.

b. Manual and automatic fire detection systems.

c. Manual and automatic fire suppression equipment.

d. Heating, ventilation, and air conditioning systems, if accessible.

e. Normal and emergency lighting systems and power systems.

f. Separation and protection of hazardous operations and material.

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g. Elevators.

h. The adequacy and reliability of the water supply.

i. Fire department response.

j. Alarm monitoring equipment.

k. Emergency procedures to include Emergency Action Plans.

l. Existing fire risk analysis and inspection results.

m. Other fire safety features as deemed necessary.

For correcting deficiencies See also Chapters 3.2, “Hazard Elimination and Control,” and 3.5, “Hazard Correction Tracking,” of this Handbook.

6. Inspections of inactive work areas or equipment

You must inspect inactive work areas or equipment at least yearly. If you plan to reactivate inactive work areas or equipment, you must hold a thorough readiness review to identify hazards and take necessary actions to correct all hazards.

7. Preparing for an inspection

As a line manager, whether you are doing a self-inspection or being inspected by someone else, you must:

a. Gather and review all safety, fire, and health information such as safety, fire, and health procedures, injury and illness records, previous inspection reports, hazard reports, and corrective action reports. Give outside inspectors the results from your last self-inspection.

b. Decide what you will inspect. You may restrict your own inspections to only areas where your employees work. Suggest what areas to inspect to outside inspectors.

c. Stop operations that could be hazardous to those on the inspection.

d. Provide special passes or badges for outside inspectors if necessary. Make arrangements with the Security Branch ahead of time if needed.

e. Provide necessary personal protective equipment (PPE) to your employees who go on the inspection. Tell outside inspectors what PPE they need to bring such as hard hats, safety shoes, or respirators before the inspection if possible. Provide outside inspectors with PPE that is unique to your work area such as gloves or suits. Everyone on the inspection must use PPE as required.

f. Arrange for employee representatives to participate. Employee representatives aren’t required, but must be given the opportunity to participate. Employees or employee groups must have the opportunity to choose employee representatives.

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8. Inspections by individuals or small teams

To do a self-inspection:

a. Find all the safety, fire, and health hazards you can by:

- Using checklists you develop or checklists from the Safety and Test Operations Division or Occupational Health Branch
- Using standards from this handbook, NASA requirements, or Occupational Safety and Health Administration (OSHA) requirements.
- Questioning any condition you think may cause a mishap.

b. Question employees in the work areas about safety, fire, and health matters.

c. Keep records of your inspections and track the hazards to closure. Records must include at least the following information:

- What hazards you find
- When and where (building and room) you found them
- What actions you take to correct the hazards
- When you correct each hazard

d. Correct hazards on the spot if possible.

e. Ask the Safety and Test Operations Division or Occupational Health Branch for a special inspection or industrial hygiene survey for things you aren't sure of.

f. Tell all employees the inspection results.

g. Correct all hazards within a reasonable amount of time as described in Chapter 3.5.

Certified industrial hygienists, certified safety professionals, professional engineers, and other safety, fire, and health professionals are available to help you with inspections and hazard correction as needed.

9. Inspections by the Safety and Test Operations Division or Occupational Health Branch

Safety, fire, and health inspectors are authorized to enter any work area that isn't hazardous to themselves or your employees. You must cooperate with safety and health inspectors when they enter your work areas. They have the right to refuse to allow anyone to accompany them who would interfere with a fair and orderly inspection. Safety, fire, and health inspectors must follow any special procedures you have for entering your work areas. The inspectors will:

a. Review safety, fire, and health information before the inspection or ask for it when they arrive.

b. Bring the materials and equipment they need for the inspection such as checklists, PPE,

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and monitoring equipment. They won't bring any PPE that is unique to your work area.

c. Hold an opening conference to tell managers and employees what they plan to inspect. They may inspect an entire building or work area, or just a part of a work area.

d. Keep records on their findings. They will note any hazards corrected on the spot and make sure inspection records reflect the corrections.

e. Interview employees and managers in the work areas. Employees interviewed have the right to bring any hazards to the attention of the inspectors.

f. Tell the manager in charge of a work area about any condition that they reasonably expect could cause death or serious injury immediately. That manager must correct the condition immediately or take temporary measures to protect his or her employees.

g. Hold an exit conference to discuss the inspection results with managers and employees.

h. Send the manager in charge and the facility manager a written report on the inspection that will include the procedures followed for the inspection and findings. Include any conditions that require a JSC Form 1240, "JSC Notice of Safety or Health Hazard and Action Plan," as described in Chapter 3.5. Reports on safety inspections must be sent within 15 days. Reports on health inspections or surveys must be sent within 30 days after completion.

i. Track open hazards in the Hazard Abatement Tracking System kept by the Safety and Test Operations Division. See Chapter 3.5 for more details.

10. Follow-up to an inspection

After you, as a manager, finish the exit conference of an inspection, you must:

a. Tell all employees the inspection results.

b. Develop action plans to correct all hazards within a reasonable amount of time as described in Chapter 3.5.

c. Post JSC Form 1240 after you get the written report. Keep each form posted for at least 3 days or until the hazard is corrected.

11. Inspections by OSHA, National Institute for Occupational Safety and Health (NIOSH), or the Nuclear Regulatory Commission (NRC)

When OSHA, NIOSH, or NRC representatives come to inspect JSC work areas, JSC will:

a. Allow them to enter any JSC workplaces, whether occupied by government or contractor employees, to inspect or evaluate workplace conditions. The Security Branch will handle access to secure areas.

b. Require them to show identification, and receive any necessary security clearances.

c. Give the inspectors:

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- Safety, fire, and health information on the worksites they will visit
- Photographic support as needed and if available

d. Arrange for them to interview employees during their visit.

e. Escort them during their visits. The following persons must escort them:

- Representatives of any contractors who work in the work area to be inspected
- A representative from the Occupational Health Branch for NIOSH visits and OSHA visits that involve health issues
- A representative of the Safety and Test Operations Division for OSHA visits; a representatives of the Safety and Test Operations Division may also escort NIOSH visitors
- A representative from the Radiation Safety Office for NRC, NIOSH, or OSHA visits that involve radiation issues.
- A manager or employee representative from work area to be inspected

f. Keep OSHA and NIOSH reports on civil service employee areas at the Safety and Test Operations Division or the Occupational Health Branch.

g. Notify NASA Headquarters code QS of any impending inspections or investigations and send the results of the inspection to code QS.

12. OSHA or NIOSH inspections of contractor areas

You must report the following to the Safety and Test Operations Division and Occupational Health Branch within 10 working days after you get the OSHA or NIOSH report:

a. A copy of the report

b. A summary of any findings

c. A summary of actions you will take to correct the findings

13. For more information on safety and health inspections

You can find more information on safety and health inspections in these documents:

a. 29 CFR 1910, “Occupational Safety and Health Standards, General Industry”

b. 29 CFR 1926, “Occupational Safety and Health Standards, Construction Industry”

c. 29 CFR 1960, “Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters”

d. *A Strategy for Occupational Exposure Assessment*, Editor Neil C. Hammond, American Industrial Hygiene Association, Akron, Ohio, 1991

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14. Responsibilities

Responsibilities for safety, fire, and health inspections are as follows:

a. As a JSC ***facility manager***, you must:

- Make sure that self-inspections are done in your building as described in Paragraphs 4, 5, 6, and 7 above. You may count inspections by line managers or employees. This includes making sure documentation of the inspections is available.
- Do a complete safety walkthrough of your building at least once a year to inspect for safety, health, and fire hazards. You may fulfill this by accompanying Safety and Test Operations Division personnel on their annual inspections.
- Make sure action is taken on all inspections as described in Paragraph 10 above.

b. As a JSC ***line manager***, you must:

- Make sure that self-inspections are done in your work areas as described in Paragraphs 4, 5, 6, and 7 above. You may count inspections by line managers or employees. This includes making sure documentation of the inspections is available.
- Make sure action is taken on all inspections as described in Paragraph 10 above.
- Involve employees in safety and health inspections.

c. As a ***contractor safety representative***, you must help contractor or NASA safety and health inspections as necessary.

d. The ***Safety and Test Operations Division*** and ***Occupational Health Branch*** must:

- Have qualified safety, fire, and health inspectors.
- Make sure safety and health inspectors have enough documented training and experience in finding, evaluating, and correcting hazards.
- Note health issues during safety inspections and report them to the Occupational Health Branch.
- Note safety issues during health inspections and report them to the Safety and Test Operations Division.
- Notify NASA Headquarters, Office of Safety and Mission Assurance, of OSHA or NIOSH inspections or investigations of JSC or contractor operations.

15. Safety and health records

The following records will document safety and health inspections:

a. Center-level records – the Safety and Test Operations Division and Occupational Health Branch must keep records of annual inspections and track findings in the Hazard Abatement Tracking System.

b. Organizational-level records – as a facility managers or line managers, you must keep

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records of your inspections and make sure the inspections are recorded in the Building Inspection Tracking System or equivalent system for your organization. Inspection records must include:

- Date and time of the inspection.
- Areas or rooms inspected.
- A list of participants.
- Findings and actions taken. You may document the findings and actions in a tracking system or database.

c. Organizational-level records – JSC Form 1240 posted in work areas to inform employees of hazards.

16. Measurement

JSC will measure routine inspections by whether all work areas are inspected at least quarterly.

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Chapter 2.6
Employee hazard reporting system

1. Who must follow this chapter

You must follow this chapter if you work at JSC. At a JSC field site, you must follow the local process that meets the intent of this chapter.

2. Description of Sub-Element 2.6

JSC must have a reliable system for employees, without fear of reprisal, to notify management in writing about conditions that appear hazardous and to receive timely and appropriate responses. The system must include:

a. Provisions for anonymous reports.

b. Provision for feedback to reporters.

c. Tracking responses and tracking hazard elimination or control to completion.

3. Reporting hazards

The JSC Close Call Reporting System is the primary means for reporting hazards at JSC Houston. At JSC field sites, use the local reporting systems. You may first report hazards to your supervisor or facility manager before submitting a written report if you don't desire confidentiality. You must take whatever steps you can to either protect people from the hazard. or fix a hazard before submitting a report. Calling Work Control (x32038) for small maintenance items will get a work request in process and expedite the fix. However, calling Work Control may compromise your confidentiality.

If you can't get your issue resolved, you may also report it to NASA Headquarters or OSHA as described in sub paragraphs 4.g - 4.i below.

A ***hazard*** is an unsafe, unhealthful, or uncontrolled environmental condition that could lead to a mishap or environmental impact if it isn't corrected. For example, a frayed electrical cord, an electrical cord across a walkway, and a possible toxic gas leak are hazards.

4. Methods to report hazard

If you see a hazard or suspected hazard, take one or more of the following actions. You are encouraged to use steps a – e first:

a. Correct the hazard yourself if you can, tell your supervisor what you did. You are encouraged to call Work Control (x32038) for small maintenance items to get a work request in process. Then report the hazard with the action you took on JSC Form 1257, JSC Close Call Report as described in sub-paragraph d below. If you can't correct the hazard, take measures to protect other employees such as blocking off the area or marking a trip hazard.

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b. Report the hazard to your supervisor or higher management if you can't correct it yourself and turn in a JSC Form 1257, JSC Close Call Report as described in sub-paragraph d below. Take measures to protect other employees such as blocking off the area or marking a trip hazard.

c. Report the hazard to your facility manager if you get no satisfaction from your management. Take measures to protect other employees such as blocking off the area or marking a trip hazard.

d. Fill out a Close Call Report (JSC Form 1257) and fax it to the number on the form. A hazard is a potential close call. Use JSC Form 1257 for JSC or JSC Form 1257-E for Ellington Field. Your name will be kept confidential unless you check the box on the form. See your site's procedures if you work at a JSC field site.

e. Call the JSC Safety Action Hotline ((281) 483-7500). The Safety and Test Operations Division handles Safety Action Hotline calls. Your name will be kept confidential unless you give permission for your name to be released.

f. Call the Center Director's Safety Hotline ((281) 483-1234) if you get no satisfaction from the Safety and Test Operations Division. Your name will be kept confidential unless you give permission for your name to be released.

g. Send in a NASA Safety Reporting System (NSRS) form. Fill out an NSRS form, found in several buildings at JSC, and mail it to the address shown on the form. Your name will be kept confidential.

h. Report it directly to NASA Headquarters through Director, Safety and Risk Management Division ((202) 358-0006), or Chief Health and Medical Officer ((202) 358-2390), if you get no satisfaction from JSC. Use this method only if you don't care if your name is kept confidential.

i. Call the Occupational Safety and Health Administration (OSHA) Office (1-800-321-OSHA or 1-800-321-6742) if you get no satisfaction from NASA Headquarters. This number is available 7 days a week, 24 hours a day. Your name will be kept confidential.

5. When you should get a response to a hazard report

This table tells you when you can expect a response to a hazard you report to JSC organizations. For any report involving imminent danger, JSC will immediately take measure to protect employees and then start an investigation within 24 hours or during the next working day. An investigation of less serious hazards will start within 3 working days. NASA Headquarters and OSHA will investigate your report as soon as possible. You must be told in writing within 15 days if it is determined that there are no reasonable grounds to believe a hazard exists.

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If you report it to . . .	*Then . . .*
Your supervisor or facility manager	Your supervisor or facility manager must tell you what corrective action he or she has taken within 15 calendar days or tell you when he or she will have an answer.
The Safety and Test Operations Division directly or through the Safety Action Hotline	A Safety and Test Operations Division representative must tell you what corrective action will be taken or tell you when he or she will have an answer within 15 calendar days.
The Occupational Health Branch directly or through the Safety Action Hotline	An Occupational Health Branch representative must tell you what corrective action will be taken days or tell you when he or she will have an answer within 30 calendar days.
The Center Director's Hotline	A Center Director's representative must tell you what corrective action will be taken or tell you when he or she will have an answer within 30 calendar days.
The NASA Safety Reporting System (NSRS)	NASA Headquarters sets the timeframe for NSRS investigations. Since the NSRS is completely anonymous, you will only receive a confirmation that your report was received. For feedback on what action was taken, you will need to check the NSRS newsletter.

6. Processing a hazard report

The flowchart in Attachment 2.6A, Appendix 2B outlines the process for handling hazards reported through the JSC Close Call Reporting System. Calls to the Safety Action Hotline will be handled in a similar manner, except that a representative from the Safety and Test Operations Division will investigate the report.

The Safety and Test Operations Division will assess the risk of hazards reported through the Close Call Reporting System and the Safety Action Hotline as described in Chapter 3.2, "Hazard Elimination and Control," paragraphs 3 – 5 of this Handbook. Paragraph 6 of Chapter 3.2 contains the requirements for investigating and correcting hazards.

7. Responsibilities

Responsibilities for hazard and close call reporting are as follows:

a. As a ***Line manager,*** you are responsible for making sure hazards are reported and corrected.

b. As a ***Facility Manager,*** you are responsible for:

- Making sure hazards reported through Close Call system are investigated and corrected.
- Making sure your building has at least one poster that tells you about JSC's Close Call Reporting System if your facility is normally occupied by employees. Keep it stocked with Close Call Reporting forms.

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c. The ***Safety and Test Operations Division*** is responsible for:

- Administering the Close Call Reporting System and the Safety Action Hotline.
- Coordinating with the Environmental Office on environmental hazards.
- Providing NSRS posters and forms in selected buildings and making sure NSRS reports assigned to JSC are investigated and corrected.

8. Safety and health records

The following records document employee hazard reporting:

a. Center-level – the Safety and Test Operations Division maintains:

- The Close Call Tracking System to track Close Call reports and their resolution.
- Records of NSRS reports assigned to JSC and their resolution.

b. Organizational-level – as a line manager or facility manager, you must keep records on hazards reported to you and the action taken. You are also encouraged to keep a record of each Close Call Report you investigate.

9. Measurement

JSC will measure hazard reporting by:

a. The time to send a new report out for action.

b. Response times from the actionees.

c. The time to send responses to the reporters.

d. The nature of employee feedback – negative and positive.

e. Hazards corrected by reporters.

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Chapter 2.7
Mishap and Incident Investigation

1. Who must follow this chapter

You must follow this Chapter if you:

a. Work at JSC or a JSC field site as a civil servant or contractor.

b. Are a line manager, facility manager, contractor safety representative, director or temporary official in charge of a mishap scene. Paragraph 20 of this Chapter lists your responsibilities. Paragraph 20 of this Chapter also lists the responsibilities of JSC's Center Director and the Director, Safety & Mission Assurance (S&MA).

Paragraph 21 of this Chapter lists the responsibilities of the safety and test operations division, the Occupational Health Branch, the security branch, the legal office, the Public Affairs Office, the information systems directorate, contracting officers, and technical representatives.

2. Description of sub-element 2.7

JSC must have a system to investigate mishaps and incidents that:

a. Includes written procedures or guidance.

b. Trains investigators.

c. Produces written reports of findings.

d. Tracks hazard elimination or control to completion.

e. Seeks the underlying causes of the mishap or event to prevent recurrence and avoids blaming the employee.

f. Covers "close call" incidents.

g. Provides feedback and lessons learned to employees.

3. What this chapter excludes

This Chapter covers how to report and investigate mishaps during JSC ground operations. It excludes the following:

a. Emergency response to a mishap. You can find those requirements in Chapter 3.8.

b. Liability, disciplinary action, or program direction.

c. Response to spaceflight mission failures.

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Reporting mishaps and close calls

4. Actions if a mishap or close call occurs

If a mishap occurs in your area, you must follow these steps (see also Attachment 2.7A, Appendix 2B for more information):

a. Call your emergency number if the mishap is an emergency. Emergencies include:

- Mishaps that cause major injuries to one or more persons or major property damage.
- Mishaps that result in a condition that is immediately dangerous to life or health.
- Any unplanned or uncontrolled hazardous material spills or releases.
- Any unplanned fire or explosion.
- Mishaps that require prompt emergency response.

Remember, your emergency numbers are: x33333 at JSC & SCTF, x44444 at Ellington Field, 9-1-1 at any offsite location, and x5911 at White Sands Test Facility.

b. Prevent further injury, damage, or environmental spill or release.

c. Secure the mishap scene.

d. Safeguard mishap evidence.

e. Report the mishap or close call as described in Paragraph 5 or 6 of this Chapter.

f. If you think the mishap could involve death, permanent disability, hospitalization of three or more persons or damage greater than or equal to $250,000, contact the Safety and Test Operations Division, the S&MA Directorate, or the Center Director's Office immediately. NASA Headquarters and OSHA require JSC to report these mishaps immediately.

g. Refer news media inquiries to JSC Public Affairs Office.

The Director of Public Affairs is the only person allowed to coordinate releases of information to the news media.

5. Reporting close calls

Report close call events where no injury, property damage, or environmental spill, release, non-compliance, or non-conformance occurred on JSC Form 1257 or the electronic form in the Incident Reporting Information System (IRIS). The investigation will follow this Chapter. At JSC, a ***close call*** is an event that could have caused injury, property damage, or environmental release, spill, non-compliance, or non-conformance, but didn't. For example, someone falls from a ladder and is not injured, someone almost gets cut because a machine guard is missing, or a spill almost occurs because a lid is missing from a waste containment

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drum. Close calls may result from hazards or unsafe acts. The Safety and Test Operations Division will assign a RAC for close call reports as described in Chapter 3.2, "Hazard Elimination And Control," paragraphs 3 – 5 of this Handbook.

Report actual damage and environmental remediation costs under $1000 on NASA Form 1627, even though NASA Headquarters defines it as a "close call."

6. Reporting a mishap

A mishap is an event that causes unplanned or unexpected injury, property damage, or impact to the environment. For example, death or injury to a test subject and irreparable damage or impact to natural or cultural resources are mishaps. Failure of a test object isn't a mishap if you expected the failure to occur as a result of the test.

The supervisor of the injured employee or the manager in charge of the area where damage or a hazardous material release or spill occurred is responsible for making sure the mishap is reported. However, anyone who witnesses the mishap may report it. You must report all mishaps except those excluded by Attachment 2.7B, Appendix 2B. To report a mishap:

a. You must fill out an initial written report within one working day on NASA Form 1627 (Part A only) and send it to the Safety and Test Operations Division or use the electronic form in IRIS. For injuries or illnesses, sending an injured or ill employee to the JSC Clinic will automatically initiate a mishap report. There is no need to fill out an initial report if the injured employee goes to the JSC Clinic. Then, complete any additional information requested by the Safety and Test Operations Division within one working day. You must follow up with your investigation results within two weeks.

b. You must also report the mishap to your facility manager as soon as possible.

c. You may report the mishap immediately to the Safety and Test Operations Division by telephone.

d. You must report at least the following mishaps (civil service or contractor) to your higher management and, ultimately, to the Center Director who must notify NASA Headquarters:

- Any Type A or B mishap involving damage, injury or death. Immediately call the center director, deputy director, or Director. S&MA. JSC must notify Headquarters within one hour.
- Any injury or illness involving lost work days. Notify the center director to allow Headquarters notification within 24 hours.
- Any non-occupational fatality on site, such as one due to a heart attack. These cases won't be recorded, but the center director must notify headquarters within 24 hours.
- Any serious injury or illness off the job. Reporting is voluntary on the part of the employee or family. These cases won't be recorded.

e. You must report mishaps that occur in foreign locations as described in Paragraphs 7, 8, and 9 of this Chapter.

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Close calls and mishaps at international locations

7. Close calls and mishaps you must report at international locations

You must report:

a. Any injury or occupational illness to JSC civil service or contractor personnel.

b. Any damage to JSC equipment.

c. Close calls where JSC personnel could have been injured or JSC equipment could have been damaged.

8. How to report a close call or mishap at an international location

If a mishap occurs, you must follow the reporting process in this Chapter as closely as your situation will allow. Call the JSC Safety and Test Operations Division at (281) 483-2084 during normal JSC duty hours (central time) or the JSC Emergency Operations Center at (281) 483-4658 outside of normal JSC duty hours to report the mishap. You must:

a. Report the mishap to JSC via telephone within one hour if it involves death, serious injury, or property damage over $250,000.

b. Report the mishap via telephone within 24 hours if it involves other injuries, property damage less than $250,000, or if it's a close call.

c. Report the mishap or close call to your Directorate management as soon as possible.

d. Fax a mishap report (NASA Form 1627) to the Safety and Test Operations Division or the electronic form in IRIS within 24 hours at (281) 244-0983 for mishaps that involve injury or property damage.

e. Fax a close call report (JSC Form 1257) to the Safety and Test Operations Division or the electronic form in IRIS within 24 hours at (281) 244-0983 for close calls.

9. What to do if you are injured at work while on foreign travel

You must report to the JSC Clinic on your first business day after returning to work at JSC. This will allow the clinic personnel to make sure you have recovered or will recover and to update your medical records.

10. Investigating mishaps in foreign countries

Your organization and the Safety and Test Operations Division will make sure the mishap is investigated under NASA requirements and international agreements.

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Investigating mishaps

11. How to investigate a mishap as an individual or member of a small team

All mishaps require an investigation. Mishap investigators must have training listed in Paragraph 18 of this Chapter. The Environmental Office will take the lead for mishap investigations that are strictly environmental and will help line management with others that involve environmental issues. Line managers or facility managers may delegate an investigation to employees or employee teams. The investigation results, to include action plan or rationale why no action is necessary, is due within two weeks of the mishap unless you request an extension through the Safety and Test Operations Division.

When you investigate a mishap, you must find the causes of the mishap and decide what actions you will take to prevent the mishap from happening again. To investigate a mishap:

a. Start your investigation as soon as all emergencies are under control. You may ask the Safety and Test Operations Division for help. A Safety and Test Operations Division representative may already be on the way to the scene. Providing medical help to injured persons and preventing further injury or damage take priority over the steps listed below. After a mishap, you must first:

- Identify potential witnesses and get statements from them.
- Secure the mishap scene and protect it from being disturbed.
- Safeguard evidence such as samples and photographs.
- Secure all records such as checklists, videos, and electronic data.

JSC's Center Director may appoint a mishap investigation board to investigate your mishap. If he or she appoints a board, you must stop your investigation, keep the mishap scene and evidence secure, and cooperate with the board.

If you think a mishap investigation board should investigate your mishap, contact the Safety and Test Operations Division.

b. Refer any news media personnel that ask about the mishap to the Public Affairs Office.

The Director of Public Affairs is the only person allowed to coordinate releases of mishap information to the news media.

c. Consult any experts you need to sample the mishap scene or analyze the data.

d. Interview witnesses. You must keep witness statements confidential.

e. Examine all evidence and analyze all mishap data to the appropriate investigation level described in Paragraph 12 below. You may also use the current version of the checklists in Appendix 6 of JSC 29406, "JSC Mishap Investigation Board Handbook" as guidelines.

f. Document the results of your investigation and action plan or actions taken. Submit the results to the Safety and Test Operations Division as follows:

Verify this is the correct version before you use it by checking the online version.

- Provide the required products for the mishap type listed in Figure 5 and Paragraph 1.7 of NPR 8621.1 "NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping."
- Document the results of mishap investigations, where there as an injury or any damage on an electronic investigation form you receive via electronic mail NASA Form 1627 or in IRIS. Include any additional documentation required in NPR 8621.1.
- Document the results of a close call investigation (no injury or damage) on the close call response form provided when the investigation is assigned or in IRIS.

g. The investigator's supervisor must review and concur with the results of mishap investigations. The close call reporter will have an opportunity to review and comment on the results of close call investigations.

h. Have your facility manager concur on the proposed action if the mishap involved the building or hazardous materials.

i. Document lessons learned as described in Paragraph 16 of this Chapter.

j. Work the action plan and track to closure as described in Paragraph 13 of this Chapter.

Don't use your investigation to find fault, determine disciplinary action, or defend JSC from lawsuits. Your investigation is only to prevent the mishap from happening again.

12. Investigation levels for mishaps and close calls

When you investigate a mishap or close call, you must find the cause(s) of the mishap or close call and decide what actions you will take to eliminate or control the hazard. See Attachment 2.7C of Appendix 2B for more details on OSHA and NASA mishap categories. Contact the Environmental Office for mishaps that are strictly environmental. Take the following steps to investigate a mishap or close call:

a. For Type C mishaps - lost time injuries (including restricted duty injuries), damage greater than or equal to $25,000 and less than $250,000:

- Do a full root cause analysis using an established root cause method. The cause may be simple, but try to look beyond the obvious. Perhaps the hazard was caused by some deficiency in the management system. Perhaps it was caused by human error, which resulted from deficiency in the management system.
- Evaluate the root causes and determine which ones you need to fix to prevent injuries or future hazards.
- Develop an action plan to change, control, or prevent those root causes from causing injuries or future hazards. The plan may involve one item or many. Remember to turn in work requests, if necessary. If your investigation shows that no action is necessary, you must provide rationale.

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- Provide the products required for Type C Mishaps listed in Figure 5 and Paragraph 1.7 of NPR 8621.1 "NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping" in a commonly available electronic format such as PDF or Microsoft Office software.

b. For other injuries and damage cases, RAC 1 and 2 close calls, and RAC 3 and 4 close calls that involve an event (as opposed to merely reporting a hazard):

- Determine the root cause(s). Avoid blaming the employee without looking into the cause. The obvious cause may be that the employee didn't follow procedures. However, this may have happened because there were no procedures or because management didn't train the employee in the procedures.
- Develop an action plan to address the causes. Your action plan may involve one item or many. Remember to turn in work requests, if necessary. If your investigation shows that no action is necessary, you must provide rationale.
- Provide the products required for Type D Mishaps and close calls listed in Figure 5 and paragraph 1.7 of NPR 8621.1, "NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping" in a commonly available electronic format such as PDF or Microsoft Office software.

13. Taking action after an investigation

The following rules apply to action plans developed during mishap and close call investigation:

a. If you assign actions to other organizations such as the Center Operations Directorate to modify the building or the Occupational Health Branch to sample the work area, contact those organizations ahead of time. If they don't refuse the action within five working days, they have accepted the action. It is their responsibility to complete the actions.

b. If you or another organization want to change any estimated completion dates for any actions, you must get approval from your director.

c. The Safety and Test Operations Division will track actions in IRIS until they are completed and verified.

d. Verification of completed action will be as follows:

- For lost time mishaps (including restricted duty cases), mishaps involving damage greater than or equal to $25,000 and less than $250,000, the Facility Manager must first verify completion and the Safety and Test Operations will follow up with an independent verification.
- For less serious mishaps than mentioned in the first bullet above and RAC 3 or 4 close calls, the Facility Manager verification will be sufficient to close the mishap or close call. The Safety and Test Operations Division may also follow up with an independent verification.

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14. Mishap investigation boards

Mishap investigation boards are a formal method for investigating serious or potentially serious mishaps or close calls. Mishap investigation boards must follow JSC 29406 and are required for the following mishaps:

a. Any mishap involving death or damage greater than or equal to $1,000,000. Normally, NASA Headquarters will appoint the board for a Type A mishap, but may delegate it to the JSC Center Director.

b. Any mishap involving permanent disability, hospitalization of three or more persons, or damage greater than or equal to $250,000 and less than $1,000,000. JSC's Center Director will appoint the board.

c. Any other lower level mishap or close call with a high potential for death or serious injury or damage or with a high visibility as determined by the S&MA Directorate or Center management. Organizational Directors also have the option to appoint Directorate level boards for mishaps they consider significant. Candidates for mishap investigation boards include:

- High potential for death, serious injury or damage and high visibility mishaps.
- Mishaps causing significant schedule delays.
- Mission or test failures that significantly reduce the potential for successful achievement of mission or test objectives, or affect other government organizations or the general public.

15. Contractor mishaps and mishaps investigated by outside agencies

Contractors will investigate mishaps (including environmental mishaps) that involve only contractor personnel or equipment at an offsite location as described in their contracts and in Paragraph 1.10.3 of NPR 8621.1. Contractor mishaps involving injury to NASA personnel or property must be investigated as outlined in this Chapter.

JSC may accept investigations by outside agencies, such as OSHA or law enforcement agencies as described in Paragraph 1.10 of NPR 8621.1. JSC personnel must support these investigations as needed.

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Other requirements and responsibilities

16. Sharing lessons learned from mishaps or close calls

When you finish your investigation, you must decide if you have any lessons learned to share with other organizations that would prevent them from having a similar safety, health, or environmental mishap.

a. If you have any lessons learned, you must attach them to your final mishap or close call report when you send the report to the Safety and Test Operations Division. Enter the lessons learned into the NASA Lessons Learned system at http://llis.gsfc.nasa.gov. See Paragraph 7.6 of NPR 8621.1.

b. The Safety and Test Operations Division will share lessons learned with:

- JSC employees and organizations that would benefit through means such as alerts, announcements, or special reports.
- Organizations outside JSC that would benefit through the Government Industry Data Exchange Program, product safety bulletins, or other means.

17. Notification of mishaps

If a mishap occurs, the S&MA Directorate must:

a. Notify NASA Headquarters by phone within one hour of any Type A or Type B mishaps and other high visibility mishaps, mission failures, and close calls, using NASA Form 1627A. Notify the Office of Safety and Mission Assurance during normal duty hours and the NASA Headquarters Emergency Center, (202) 358-1616 during non-duty hours.

b. Notify the nearest OSHA office within eight hours of any mishap that causes a death or hospitalization of three or more persons. This includes mishaps that cause death or hospitalization of three or more persons within 30 days of the mishap. The report must contain the following:

- What happened, the date and time it happened, and where it happened.
- Who suffered a death, injury, or illness, and, by name, who else was involved.
- How serious the injuries or illnesses are.
- What actions JSC took after the mishap.

c. Notify the Office of Safety and Mission Assurance during normal duty hours of mishaps and close calls that do not require immediate reporting, but, in the judgment of the Safety and Test Operations Division, may receive high visibility from the public, the press, or have recurrence control implications beyond the local Center.

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d. Decide through the Center Director if any other organization such as the EPA, FEMA, NASA Headquarters, or local authorities should be notified under JSC's emergency preparedness plans.

e. Follow JPD 1712.1 "Management Notification Policy for Use in the Event of Serious Illness, Injury, or Death" current version.

f. Send a summary of the mishap report for any mishap described in Subparagraph a above to OSHA's Office of Federal Programs through NASA Headquarters.

g. Provide NASA Headquarters Office of Safety and Mission Assurance with major mishap reports as required by NPR 8621.1 "NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping."

h. Provide an electronic report to NASA Headquarters for reportable mishaps within one working day of the mishap and updates, including closure, via IRIS within one week of receiving the data.

18. Training for mishap investigators

Mishap investigators must have the following training:

a. "Introduction to Mishap Investigation" on SATERN (Site for On-Line Learning and Resources), course number SMA-00x-05.

b. Root Cause Analysis through the JSC Safety Learning Center or NASA Safety Training Center.

19. For more information on reporting and investigating close calls and mishaps

You can find more information on reporting and investigating close calls and mishaps in these documents:

a. NPR 8715.1, "NASA Safety and Health Handbook, Occupational Safety and Health Programs."

b. Letter UO, dated August 6, 1993, "Federal Agency Recordkeeping" from the Director of Occupational Health and Aerospace Medicine Division, NASA Headquarters.

c. JSC 05900, "JSC Emergency Preparedness Plan" including all annexes.

d. JPD 1382.1, "Release of Information to News Media" current version.

20. Individual responsibilities for reporting and investigating mishaps

a. ***Line managers*** must:

- Make sure close calls and mishaps in your area are reported as described in Paragraphs 5 and 6 of this Chapter.

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- Investigate all type C mishaps, incidents, and first aid injuries as described in Paragraph 12 of this Chapter.
- Take necessary actions to correct hazards discovered during your investigation as described in Paragraph 13 of this Chapter. This includes temporary measures to protect your employees and the environment while you wait on building or equipment changes. Improve on your action periodically.
- Support mishap investigation boards as necessary.
- Always remind your employees that reporting close calls and mishaps is necessary. Reward those who promptly report close calls and mishaps and reprimand those who don't.
- Monitor the recovery of any employee with a lost-time injury. Arrange for that employee to return to work on light or restricted duty as soon as possible.
- If the mishap results in a death, or personal injury requiring immediate hospitalization or in damage estimated to exceed $10,000 to Government or private property refer to NPR 3792.1, "NASA Plan for a Drug-Free Workplace," to determine whether additional action outside the safety mishap reporting and investigating process should be taken.

b. As a ***contractor safety representative***, you must help contractor or NASA management with close call and mishap reporting and investigation as necessary.

c. As a ***facility manager***, your knowledge of your facility is important to a mishap investigation. You must:

- Respond to close calls and mishaps that occur in your facility.
- Make sure close calls and mishaps that occur in your facility are reported and investigated.
- Investigate close calls. Support mishap investigations as necessary.
- Make sure that employees in your facility know about action plans and lessons learned.

d. An ***organizational Director*** at JSC must:

- Develop processes for reporting and investigating close calls and mishaps that occur in your directorate.
- Review open close call or mishap reports in your Directorate and make sure they are closed in a timely manner.
- Provide services from your directorate that other JSC organizations need to correct hazards found during investigations such as testing, evaluating data, modifying buildings or equipment, or sampling work areas.
- Be aware of mishaps in your directorate and notify the deputy center director of lost time mishaps.

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e. If JSC's center director appoints you ***temporary official in charge of a mishap scene***, you must:

- Oversee the mishap scene until a mishap investigator or board takes over.
- Keep the Director, S&MA, or Center Director informed of your status.
- Cooperate with the incident commander at the scene of a hazardous material spill. The incident commander is in charge of the scene.

f. The ***JSC Center Director*** must:

- Be the chief spokesperson for all JSC mishaps with local, state, and federal authorities and the news media through the Public Affairs Office.
- Support investigations of NASA mishaps by other federal agencies that have authority to investigate NASA mishaps (such as the National Transportation Safety Board) for aircraft mishaps and U. S. Department of Labor for occupational mishaps). Support investigations of mishaps experienced by other federal agencies, foreign governments, and private industry per agreements.
- Appoint a temporary official in charge of a mishap scene for major mishaps if necessary. The temporary official in charge will usually be: for JSC mishaps, the S&MA Director; for aircraft mishaps, the aviation safety officer of the Flight Crew Operations Directorate; or, for mishaps at JSC field sites, the chief of the local quality assurance, reliability, and safety office.
- Make sure the temporary official in charge of a mishap scene gets necessary support until the mishap investigator or board takes over.

g. The ***Director, S&MA*** must:

- Notify JSC senior management and other organizations of all immediately reportable mishaps as described in Paragraph 17 of this Chapter.
- Recommend to JSC's center director how mishaps should be categorized (such as type A or B) and investigated.
- Notify the Office of Inspector General and the Office of the Chief Counsel immediately if it is reasonably suspected that a mishap resulted from criminal activity so that the OIG and chief counsel can appropriately coordinate their activities with the responsible workplace official.

h. ***Contracting Officers and their technical representatives*** must:

- Make sure that JSC contractors understand and follow NASA and JSC contract requirements for reporting and investigating close calls and mishaps.
- Include applicable mishap and close call reporting and investigating procedures detailed in the NASA Federal Acquisitions Regulations Supplement into contracts covering NASA programs and operations.

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21. Organizational responsibilities for reporting and investigating mishaps

a. The ***Safety and Test Operations Division*** must:

- Provide JSC with a list of personnel trained in mishap investigations.
- Keep records of close call and mishap reports and investigations and track all items to completion.
- Coordinate with the Environmental Office on environmental mishap and close call investigations.
- Help with close call and mishap investigations and actions as necessary.
- Review and approve close call and mishap reports and action plans. Evaluate reports for possible lessons learned.
- Verify that actions are completed.

b. The Environmental Office must:

- Help the Safety and Test Operations Division with environmental mishap and close call investigations.
- Help the Safety and Test Operations Division to review and approve environmental mishap and close call reports and action plans
- Evaluate close all and mishap reports for possible environmental lessons learned.

c. The ***JSC medical clinic*** (Occupational Health Branch) must:

- Fill out JSC Form 340 when an employee has an injury or illness on the job. Send copies to the Safety and Test Operations Division and the injured employee's supervisor or company.
- Inform the employee's supervisor and the Safety and Test Operations Division immediately of a fatality or of a suspected disabling injury or illness
- Provide any necessary occupational health and industrial hygiene support required by other JSC organizations to fulfill any of the responsibilities of this Chapter.
- Provide medical or pathological information required to fulfill the requirements of this Chapter under the Privacy Act of 1974.

d. The ***Security Branch*** must:

- Make sure that mishap scenes are secured.
- Make sure that evidence and important information are preserved for the investigation.
- Investigate motor vehicle accidents.

e. The ***Legal Office*** must:

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- Have ground rules to protect the privileged status of witness statements, witness testimony, or other matters related to a mishap.
- Review mishap information or reports before they are released from JSC control to make sure the facts are correct and can be released.

f. The ***Public Affairs Office*** must:

- Prepare releases of any mishap information to the news media or other organizations outside JSC under JPD 1382.1, "Release of Information to News Media," current version.
- Have the JSC Legal Office and anyone else connected with the mishap, such as the mishap investigator or board chairperson, review information to make sure that the facts are correct and can be released.
- Protect the privileged status of witness statements, witness testimony, and other matters related to a mishap under Legal Office ground rules.
- Follow procedures for public announcements by NASA found in agreements with other agencies or contractors when releasing mishap information.
- Coordinate information releases as described in Paragraph 3.10 of NPR 8621.1.

g. The ***Information Resources Directorate*** must provide photographic and other information services on a priority basis when needed by mishap investigations.

22. Safety and health records

The following records document mishap and incident investigation:

a. Center-level – the Safety and Test Operations Division must maintain:

- Copies of NASA Form 1627.
- A tracking database to track mishap data, investigation, and close out.
- Submit mishap information to IRIS.
- Copies of JSC mishap investigation board reports and supporting material such as procedures, minutes, tape recordings, etc.
- Log of occupational injuries and illnesses, OSHA Form 300 as described in Appendix 1.
- Annual Summary of Federal Occupational Injuries and Illnesses on OSHA Form 300 as described in Appendix 1.

b. Organizational-level – as a line manager, you are encouraged to keep records on mishaps in your work areas to include copies of completed NASA Forms 1627 and any supporting documentation.

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23. Measurement

The following factors will measure mishap and incident investigation:

a. Timeliness of mishap reporting.

b. Timeliness of investigation and follow up.

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Chapter 2.8
Trend analysis

1. Who must follow this chapter

You must follow this chapter if you are a line manager at any level.

2. Description of Sub-Element 2.8

JSC must have a system to analyze trends by a reviewing injury, illness, and close call experience and hazards identified through inspections, employee reports, accident investigations, or other means. The purpose is to identify patterns with common causes and eliminate or control the causes.

3. Trend analysis processes

Trend analysis may occur at any level within JSC. Trend analysis involves:

a. Regularly reviewing all kinds of data such as:

- Mishap reports to include injury categories, root causes, activities, environments, etc.
- Close call reports to include categories and locations.
- Inspection reports and findings.
- Other available data

b. Looking for patterns in the data that indicate common types, causes, locations, or other categories. This may involve questions such as:

- Is the number of close calls, mishaps, or hazards in my work areas increasing or decreasing?
- Do any of my work areas have several mishaps, close calls, or hazards of a common kind such as back injuries or trips and falls?
- Do mishaps, close calls, or hazards involve an environmental release, spill, non-conformance, or non-compliance?
- Do you see similar root causes in mishaps, close calls, or hazards?
- Are there patterns in employee behaviors?

4. Analyzing and correcting trends

Trends may take one of three directions:

a. ***Negative trends*** indicate a safety or health issue that is growing worse with time and need corrective or preventive action. Investigate negative trends to see if a common cause(s) exists. Actions to reverse the trend must remove the common cause(s) or

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provide awareness of the trend if no common cause(s) can be found. Investigating negative trends involves one of the following:

- Center-level committees or teams appointed by the Executive Safety Committee or the JSC Safety Action Team to investigate a specific trend or suspected trend must follow SLP 4.14, "Corrective and Preventative Action."
- Committees or teams within the line organizations may follow SLP 4.14 at the discretion of the appointing official.
- If you don't follow SLP 4.14, you must ask why the trends exist and look for underlying causes. Analyze patterns to determine why they are occurring. Root cause analysis is encouraged. Develop action plans to eliminate the causes, provide awareness, and reporting lessons learned.

b. ***Neutral trends*** indicate a safety conditions that are stable. After discovering a neutral trend, you may want to establish the conditions that contribute to the apparent stability of the observed data or related process. You may use any technique that allows you to effectively characterize the observed stabilities using one or more of any applicable technique.

c. ***Positive trends***, which provide an opportunity for learning and capitalization. After discovering a positive trend, you may want to identify the specific reasons behind this apparent improvement. In doing so, you may want to consider whether the positive trend is a result of cyclic variation (typically associated with human factors) or if is traceable to a critical success factor such as a process improvement. The conclusions may be published as lessons learned, shared in specific forums where target audiences are likely to benefit from this information, published as an online resource, etc.

5. Responsibilities

Responsibilities for trend analysis are as follows:

a. The ***Safety and Test Operations Division*** and the ***Occupational Health Branch*** are responsible for:

- Reviewing safety and health data for trends and other significant items.
- Bringing the top mishap and close call categories, trends, and other significant items to the Executive Safety Committee or the JSC Safety Action Team for further action.
- Providing line organizations with safety and health data and suggesting to line managers ways they can improve their safety and health performance.
- Providing information on environmental trends to the Environmental Office.

b. As a ***line manager***, you are encouraged to:

- Keep records on mishaps, close calls, and hazards in your work areas. Look for trends in these reports. You may also include any helpful information outside your organization.

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- Analyze your safety and health data such as mishap or inspection reports and use your analysis to improve your safety and health program. Is the number of mishaps, close calls, or hazards increasing or decreasing in your work area? Are certain categories of mishaps, close calls, or hazards increasing or decreasing? Are there common causes in your mishaps, close calls, or hazards?
- Tell your employees what you learn from your analysis and what actions you plan to take.

6. Safety and health records

The following records document trend analysis:

a. Center-level records include any records to indicate that trends were analyzed and action taken such as briefing packages, committee reports, minutes of meetings where trends are discussed, etc.

b. Organizational-level records -- Records to support organization-level trend analysis such as minutes where trends discussed and actions taken on trends analyzed, etc. Note, this is not required, but encouraged.

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Appendix 2A

Forms

The following forms listed in this appendix are available electronically via forms search at the following web address: http://forms.jsc.nasa.gov/

JSC Form 1257	JSC Close Call Report
NASA Form 1627	NASA Mishap Report
NASA Form 1627A	NASA Initial Safety Incident Report

The following forms are not available electronically. Contact Forms (Supply and Distribution) at extension 36164 unless otherwise stated below to get a copy, or copy one out of this appendix:

JSC Form 340	JSC Report of Occupational Injury or Illness

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Appendix 2B

Miscellaneous guidelines and instructions

This appendix contains the following attachments:

2.4A System Safety Program Plan Outline

2.6A Close Call Process

2.7A Immediate Response to a Mishap

2.7B Exceptions to reporting requirements

2.7C OSHA and NASA Mishap Categories

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Attachment 2.4A
System safety program plan outline

1. What is a system safety program plan (SSPP)?

An SSPP describes your system safety effort for a project or part of a project. It is part of a formal, disciplined system safety program.

You may tailor your SSPP to your project. It must include the entire life of the project from concept, to operations, to phase-out, and disposal.

2. SSPP requirements

An SSPP should follow the guidelines in Appendix I of NPR 8715.3, "NASA Safety Manual."

Each institutional and flight program may have different requirements for an SSPP. This attachment outlines a generic SSPP. See the system safety requirements for the program you are working on for more details.

An SSPP must:

a. Describe the scope of the project.

b. Describe any relationships between system safety and other project requirements, tasks, and elements. You should cross-reference these to avoid duplication.

c. List any documents and specifications your system safety effort will use either as directives or as guidance.

d. Identify system safety engineering requirements, tasks, and responsibilities on an item-by-item basis.

e. Be updated as the project direction or requirements change.

SSPP contents

3. System safety organization

The SSPP must describe:

a. The system safety organization or function. Include charts to show the organizational and functional relationships, and lines of communication.

b. The responsibility, authority, and accountability of system safety personnel and other organizations (including contractors and subcontractors) involved in the system safety effort. Assign an organization to be responsible for each task. Identify the authority for resolving all identified hazards. Include the title, address, and telephone number of the System Safety Program Manager.

c. How the system safety organization is staffed for the length of the project. Include manpower loading and qualifications of key personnel.

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d. The interfaces between the system safety organization and other related disciplines such as Engineering, Occupational Safety and Health, Reliability, Quality Assurance, or Medical Support at all levels of the project (NASA, contractor, and subcontractor).

4. System safety project milestones

The SSPP must:

a. Identify safety milestones. Review the effectiveness of the system safety effort at critical safety checkpoints (such as design reviews, self-evaluations, operational readiness reviews, audits, etc.).

b. Schedule safety tasks. Show start and finish dates, report dates, review dates, and manpower loading, as they relate to other project milestones.

c. Identify other engineering tasks such as design analyses, tests, or demonstrations that also apply to the system safety program. Include the estimated system safety personnel to do these tasks as part of this section.

5. System safety and risk management

The SSPP must:

a. List the safety standards and system specifications the project either must follow or will adopt as a requirement. Include any system safety requirements or definitions that aren't covered in JSC documents.

b. Describe how you will coordinate the system safety efforts of different parts of the project. Include charters of any system safety groups and methods to:

- Distribute system safety requirements to action organizations.
- Coordinate and integrate hazard analyses.
- Hold management and engineering reviews.
- Report program status.

c. Describe the procedures for assessing risk. Include:

- Hazard severity categories.
- Mishap probability (or frequency) levels.
- The method for finding risk levels such as a risk matrix.
- The acceptable risk levels for the project.

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d. Describe the management controls to make sure the project follows safety requirements. Include the process for making management decisions and the level of management required to accept different levels of risk. Include methods to make management aware of and take action on:

- Critical and catastrophic hazards.
- Corrective actions to hazards.
- Mishaps or malfunctions.
- Variances to safety or program requirements.

6. Hazard analyses

The SSPP must describe how you will do hazards analyses for the project to include:

a. The analysis techniques and format you will use to identify hazards, their causes, their effects, and recommended corrective actions.

b. What analysis techniques you will use and when you will use them.

c. How you will integrate hazard analyses from different organizations such as contractors and subcontractors.

d. A single closed-loop system for tracking hazards to closure.

7. System safety data

The SSPP must:

a. Describe the approach for researching, distributing, and analyzing historical hazard or mishap data.

b. Identify the data management needs for making risk decisions.

c. Identify safety-related data you will reference and how you will keep the data. State how Safety & Mission Assurance may access the data.

8. Safety verification and audits

The plan must describe:

a. The verification and audit requirements and procedures to make sure that the system safety program has been implemented.

b. The procedures to make sure safety information is available for management and engineering review and analysis.

c. The review procedures to make sure hazardous tests and especially tests involving human test subjects are conducted safely.

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9. Training

Describe techniques and procedures to make sure that engineers, test subjects, technicians, operators, and support (including maintenance) personnel understand the objectives and requirements of the system safety program.

10. Other safety reviews or surveys for your project

List any other reviews or audits that will help you evaluate the safety of your project during design or operation. These reviews may include any of the following:

a. Special surveys for very hazardous systems or for changes to these systems to make sure that risks are properly identified and managed.

b. A review by experts outside your project during readiness reviews such as test readiness reviews, operational readiness inspections, or acceptance reviews.

c. System safety audits by JSC organizations or NASA Headquarters for major projects and facilities. These audits should be done periodically and consider:

- Did the system perform as planned?
- Were all the hazards identified and controlled effectively?
- Did the hazard and risk analysis result in effective risk decisions?
- Have design or operational changes increased the risk of the system?

d. A review by the Operations and Engineering Board during the detailed design phase as described in Paragraph 1.11.3 of NPR 8715.3, “NASA Safety Manual” for major facilities. The Operations and Engineering Board is a NASA Headquarters panel that reviews certain facilities it chooses to or is required to review. You will be notified if the Operations and Engineering Board will review your facility.

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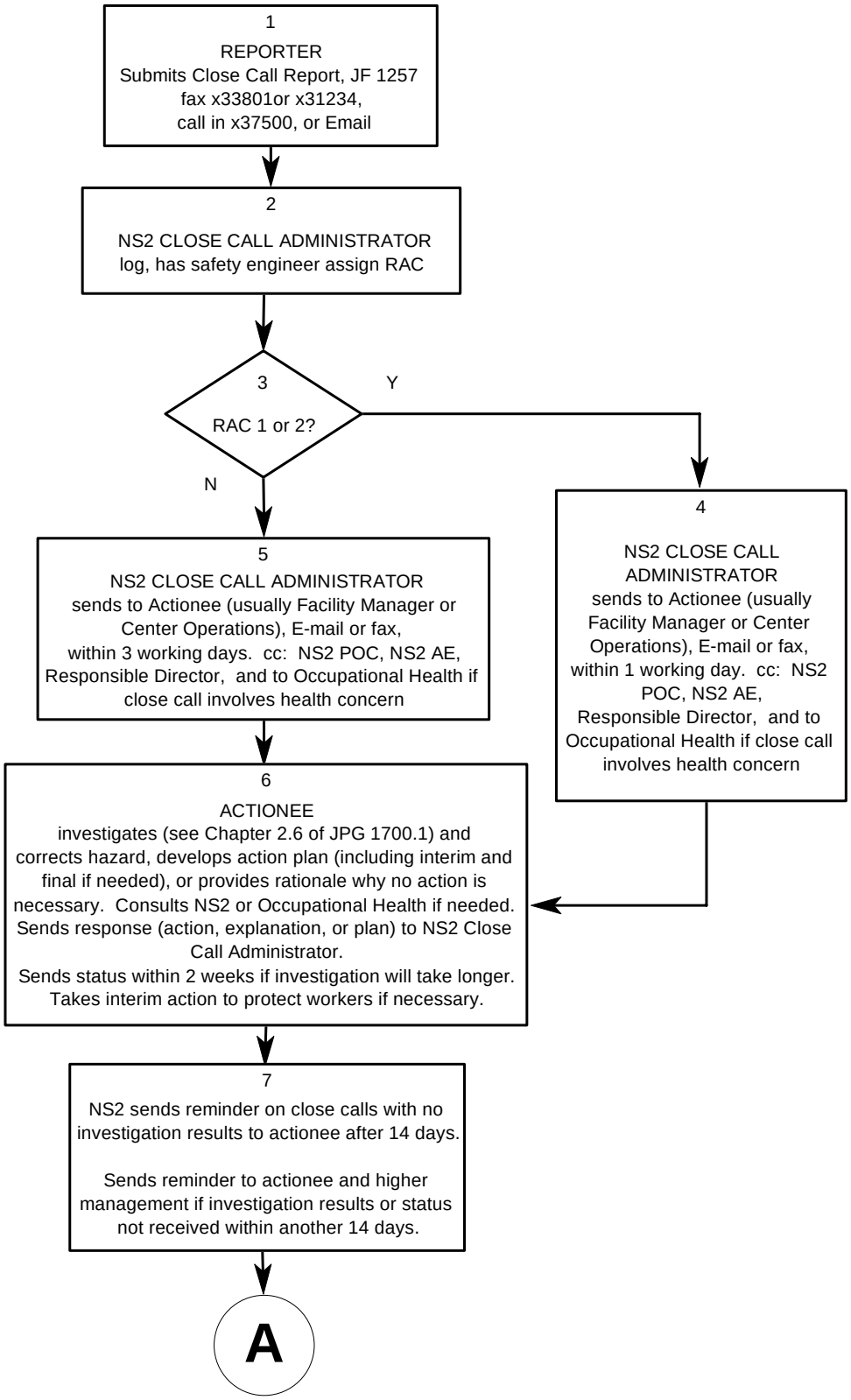
Attachment 2.6A
Close call process



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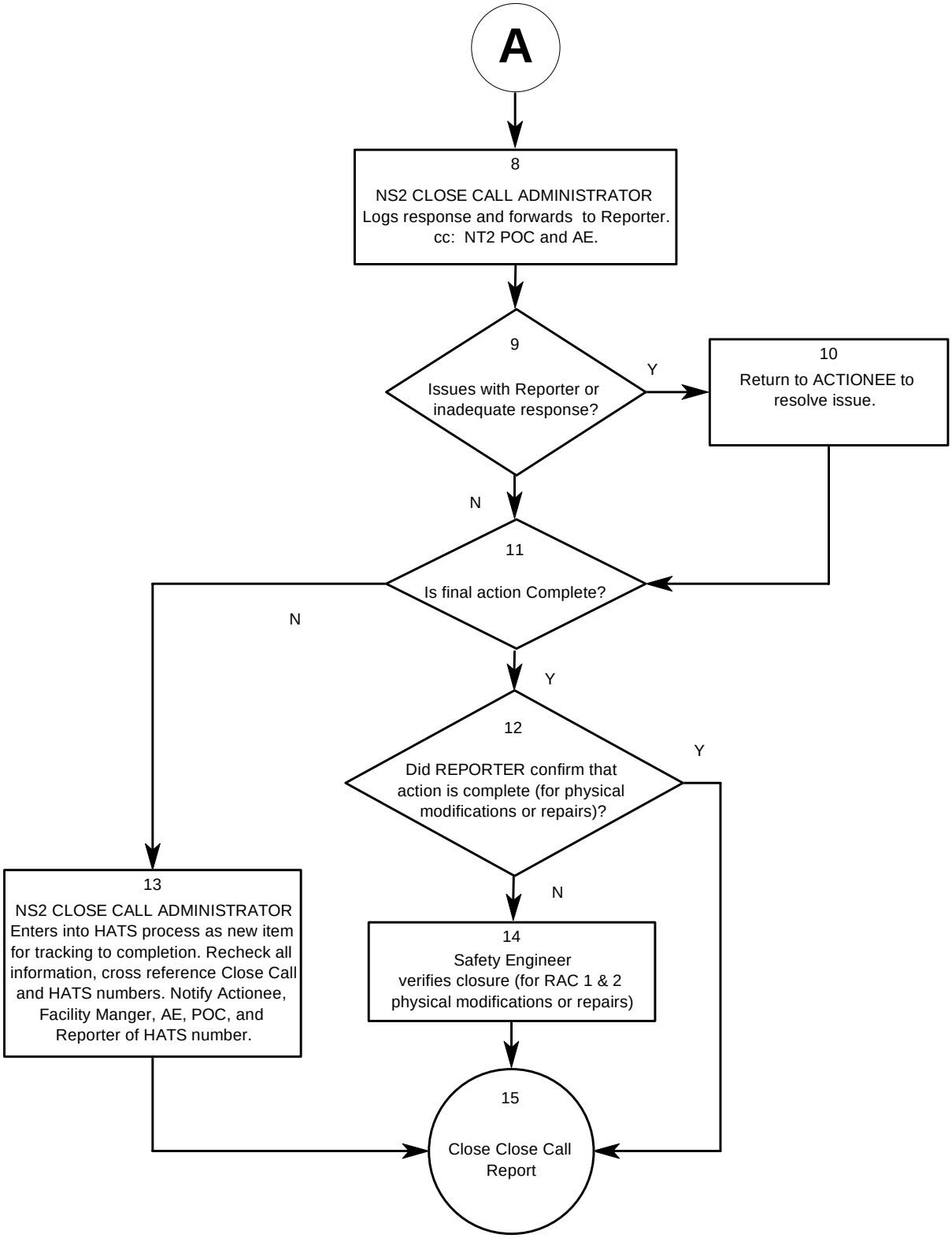
Attachment 2.6A
Close Call Process
(continued)



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Attachment 2.7A
Immediate response to a mishap

See list of emergency numbers on next page.

If you are on the scene or the first one to arrive:

1. PULL MANUAL FIRE ALARM BOX or DIAL (33333 at JSC or 44444 at Ellington Field) for fire, explosion, chemical spills, air emissions (vapor cloud or smoke), personnel rescue, or building evacuation. Give this information to dispatcher when you telephone:
   - Your name and telephone extension that they may call during the emergency
   - Exact location of the emergency
   - Type and extent of emergency

Stay on the telephone until the dispatcher acknowledges receipt of information.

If mishap is an on-site vehicle accident, call Security at extension 34658. If injuries have occurred, call extension 33333.

2. Help the injured only if you can do so without endangering yourself. Never move an injured person unless failure to do so will result in further injury or death. If you can't help or move the injured or ill person, wait for emergency personnel such as the Fire Department or Incident Response Team to arrive.

3. Limit further injury to people, property damage, and impact to the environment as much as possible only if you can do so without endangering yourself.

4. Take ambulatory injured or ill persons to the Clinic, Building 8.

5. Get names and addresses of witnesses.

6. Restrict access to scene and evidence of mishap until investigator arrives or investigation is complete.

7. Notify your supervisor of the emergency and actions taken; request that he or she notify the Safety and Test Operations Division at extension 32084.

8. In cases of off-site accidents involving NASA property, or JSC or contractor personnel:
   - Seek help from nearest medical or fire facility.
   - Follow other appropriate actions such as items 2, 3, 5, 6, and 7 above.

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Attachment 2.7A
Immediate Actions After a Mishap
(continued)

Emergency numbers

Dial 33333 (JSC) or 44444 (Ellington Field) Day or Night to Report:

- Injury - Ambulance
- Fire
- Vehicle Accident - Security
- Hazardous Materials Release or Spill - Incident Commander

For Other Important Numbers:

- 34111 - Clinic
- 32038 - Facilities Maintenance and Repairs
- 37896 - Occupational Health Branch
- 34900 - Safety and Test Operations Division
- 37084 - Radiological Health Office
- 33061 - Utility Interruptions or Failure
- 33501 - Environmental Office (daytime only)

Ellington Field, Day or Night, Dial:

- 44444 - Ambulance
- 44444 - Fire
- 33333 - Security

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Attachment 2.7B
Exceptions to reporting requirements

NASA follows OSHA recordkeeping requirements, 29 CFR 1904, to determine recordability of mishaps. You aren't required to report the following property damage mishaps:

1. Malfunction or failure of component parts that are normally subject to fair wear and tear and have a fixed useful life less than the complete system or unit of equipment if:

   a. There was adequate preventative maintenance.

   b. The malfunction or failure is the only damage.

   c. The only action is to replace or repair that component part.

   This exception doesn't apply to a malfunction or failure of a component part that results in damage to another component.

2. A test failure involving damage to equipment or property as a result of testing, provided that all of the following are true:

   a. The test article is not flight hardware.

   b. The testing is part of an authorized research/development/qualification/certification program.

   c. Damage is limited to the test article and test instrumentation.

   d. Risk of damage to the test article and test instrumentation resulting from failure was accepted explicitly (i.e., documented) by program/project management and concurred on by the Center safety office.

   e. The test team performs a test failure analysis and generates a technical report instead of treating it as a mishap and completing a mishap report.

3. Property damage from vandalism, riots, civil disorders, or felonious acts such as arson or sabotage.

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Attachment 2.7C
OSHA and NASA mishap categories

JSC follows both OSHA and NASA definitions for mishap categories. The following table correlates OSHA and NASA definitions.

OSHA Category	NASA category
Death or hospitalization of 3 or more persons for more than observation is immediately reportable to OSHA within 8 hours.	*Type A Mishap* (one or more of the following) Death A permanent total disability Hospitalization of 3 or more persons within 30 workdays of the mishap Damage greater than or equal to $1,000,000
Lost Workday Case Involving Days Away from Work	*Type B Mishap* (one or more of the following) Permanent partial disability Hospitalization of 1 or 2 persons within 30 workdays of the mishap Damage greater than or equal to $250,000 and less than $1,000,000
Lost Workday Case (LW) – Cases which involve days away from work or days of restricted work activity, or both. Lost Workday Case Involving Days Away from Work (LW-DA) – workdays (consecutive or not) on which the employee would have worked but could not because of an occupational injury or illness, not including the day of the injury. Lost Workday Case Involving Restricted Duty (restricted work activity) (LW-RD) – workdays (consecutive or not – not including the day of the injury) on which, because of an injury or illness: (1) The employee was temporarily assigned to another; or (2) the employee worked at a permanent job less than full time; or (3) the employee worked at a permanently assigned job but could not do all duties normally connected with it.	*Type C Mishap* (one or more of the following) Lost Workday Case Restricted duty Transfer to another job Damage greater than or equal to $25,000 and less than $250,000
No corresponding OSHA category	*Mission or Test Failure* Prevents accomplishing primary mission or test objectives
No corresponding OSHA category	*Environmental Impact* Results in a unplanned and uncontrolled hazardous material spill or release or an environmental violation or fine.
Medical Treatment Case as defined by OSHA	*Thpe D* (one or both of the following) Injury or illness without Lost Time that requires "Medical Treatment" as defined by OSHA Damage greater than or equal to $1,000 and less than $25,000
First Aid Case as defined by OSHA Not OSHA - Recordable	*First Aid Case* Injury or illness that requires only first aid treatment.
No corresponding OSHA category	*Close Call* (one or both of the following) An event or condition that could have resulted in an injury, illness, or significant interruption of work or environmental spill, release, non-compliance, or non-conformance, but did not.

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	Damage less than $1000.

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Part 3
Hazard prevention and control

1. Description of Major Element 3

Part 3 describes Major Element 3 of the JSC safety and health program, "Hazard prevention and control." JSC must eliminate or control site hazards identified by hazard analysis, inspections, mishap investigations, etc.

Element 3 includes the following sub-elements:

3.1 Certified professional resources

3.2 Hazard elimination and control

3.3 Process safety management

3.4 Preventive maintenance

3.5 Hazard correction tracking

3.6 Occupational health care program

3.7 Disciplinary system

3.8 Emergency preparedness

The requirements, processes, and responsibilities for Major Element 3 are defined in the chapters for the sub-elements.

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Chapter 3.1
Certified professional resources

1. Who must follow this chapter

This Chapter applies to JSC in general. You must be aware that certified professional safety and health personnel exist at JSC and use them effectively.

2. Description of Sub-Element 3.1

JSC line organizations must have access to Certified Safety Professionals (CSPs) to provide advice on safety matters and Certified Industrial Hygienists (CIHs) to provide advice on health matters.

CSPs are available through the Safety and Test Operations Division. CIHs are available through the Occupational Health Branch. You may contact this office for help.

3. Responsibilities

Responsibilities for certified professional resources are as follows:

a. The ***Safety and Test Operations Division*** and ***Occupational Health Branch*** are responsible for providing CSPs and CIHs to the Center.

b. As a ***line manger***, you are responsible for identifying CSPs and CIHs within your organizations and using available CSPs and CIHs as necessary to advise you on hazard controls in your work areas.

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Chapter 3.2
Hazard elimination and control

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site.

2. Description of Sub-Element 3.2

JSC must eliminate or control site hazards identified during hazard analyses, inspections, close call reports, or mishaps, by the systems and by using the hierarchy outlined below. All affected employees and visitors must understand and follow hazard controls. Hazard controls must adequately eliminate or control the hazards in the work area. We must include hazard controls in training, positive reinforcement, and correction programs. The following hierarchy, subparagraphs a – d below, governs JSC's actions to eliminate or control hazards, with (a) being the most desirable. Subparagraph e deals with required hazard control programs and is a part of hazard elimination and control, but separate from the hierarchy for eliminating or controlling hazards:

a. **Engineering controls.** These are the most reliable and effective type of controls and must be considered before using the other controls mentioned. Engineering controls are design changes that directly eliminate (ideally) a hazard or limit the severity or likelihood of a potential mishap, such as reducing pressure or amount of hazardous material, substituting less hazardous material, reducing noise produced, designing fail-safe systems, leak before burst, providing fault tolerance or redundancy, ergonomics, etc.

   A category of engineering controls, although not as reliable as true engineering controls, includes protective safety devices such as guards, barriers, interlocks, grounding and bonding systems, pressure relief valves to keep pressure within a safe limit, etc. These items typically seek to reduce indirectly the likelihood of the hazard. These controls are often linked with caution and warning devices like detectors and alarms that are either automatic (do not require a human response) or manual (require a human response).

   See paragraph 7 below for more information.

b. **Administrative controls.** These controls significantly limit daily exposure to hazard by controlling or manipulating the work schedule or manner the work is done, such as job rotation. See paragraph 8 below for more information.

c. **Safety and health rules.** This is a type of administrative control that includes written workplace rules, safe and healthful work practices, and procedures for specific operations. Work practice controls modify the manner in which an employee does his or her work. Modifications may reduce exposure through methods such as changing work habits, improving sanitation and hygiene practices, or making other changes in the way an employee does a job. Rules must be reviewed regularly for effectiveness and enforced fairly. See paragraph 9 below for more information.

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d. **Personal protective equipment (PPE).** This includes any PPE required by Federal, NASA, or JSC requirements or deemed necessary by hazard analysis. See paragraph 10 below for more information.

e. Hazard control programs. This includes all required programs to control specific hazards in the work area such as Lockout/Tagout, Respiriatory Protection, Hearing Conservation, etc. We must have written control programs that are implemented, updated by management as needed, and used consistently by employees. See paragraph 11 below for a list of JSC's hazard control programs and the appropriate chapters in the Handbook.

3. Determining the risk of a hazard

After you have identified a hazard, you must identify the risk of the hazard to determine how serious it is. This allows us to prioritize hazard correction. Risk considers both the severity of a mishap that could result from a hazard and the chance the mishap could occur. You must document both the risk assessment before controls are in place and the risk assessment after controls are in place. Use a risk assessment code (RAC) matrix to assess the risk of each hazard:

a. Find the "severity" or the worst-case outcome of a mishap from the hazard along the left side of the matrix.

b. Find the "frequency" or probability that you expect the mishap to occur across the top of the matrix.

c. Find the RAC in the box where the "severity" and "frequency" cross.

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SEVERITY	PROBABILITY ESTIMATE (FREQUENCY)			
	A Frequent Likely to occur one or more times a year.	**B Probable** Likely to occur once in 1 - 2 years.	**C Occasional** May occur once in 2 - 5 years.	**D Remote** Unlikely to occur, but possible within 5 years to end of system life.
I Catastrophic Death, several serious injuries or illnesses, or damage over $1,000,000	1	1	2	3
II Critical Serious injury or illness, several lost workdays, or Damage between $250,000 - $1,000,000	1	2	3	3
III Marginal Lost workday, several minor injuries, or Damage between $25,000 - $250,000	2	3	4	4
IV Negligible Minor injury or damage less than $25,000	3	3	4	4

4. Actions to take based on the RAC

The table below tells you what action you must take for each RAC. Investigation and abatement must follow paragraph 6 below and Chapter 3.5 of this Handbook.

If the RAC is . . .	*Then the risk is . . .*
1	Unacceptable – All operations must cease immediately until the hazard is corrected or until temporary controls are in place and permanent controls are in work. A safety or health professional must stay at the scene at least until temporary controls are in place.
2	Undesirable – All operations must cease immediately until the hazard is corrected or until temporary controls are in place and permanent controls are in work. Program Manager (Directorate-level), Organizational Director, or equivalent management is authorized to accept the risk with adequate justification.*
3	Acceptable with controls – Division Chief or equivalent management is authorized to accept the risk with adequate justification.*
4	Acceptable with controls – Branch Chief or equivalent management is authorized to accept the risk with adequate justification.*

* You must never accept the risk of violating JSC, NASA, local, state, or federal requirements. If you think you can't follow any such requirement, you must request a variance as described in Chapter 1.4, "Written Safety and Health Program," of this Handbook.

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5. Determining the risk from exposures to physical, chemical, biological, and radiological health and environmental hazards

Determining the risk from exposure is a complicated process. It includes an evaluation of the hazard, the dose and exposure, acute and chronic health effects caused by the exposure, and other factors. While the table in paragraph 3 above indicates some severity estimates for degree of illness, it is best to determine these risks through a cooperative effort involving the line manager, employee, and occupational health professionals. Call the Occupational Health Branch, x36726, for help in evaluating these risks.

For environmental issues, determine the severity and frequency according to JPR8553.1, "JSC Environmental Management System Procedural Requirements."

6. Investigating and correcting a hazard

When you investigate a hazard where no event happened but a condition exists that may cause an injury, property damage, or an environmental release or spill, you must find the cause of the hazard and decide what actions you will take to eliminate or control the hazard. The Environmental Office will take the lead for hazard investigations that are strictly environmental and will help with others that involve environmental issues. Contact the Environmental Office for hazards that are strictly environmental. To correct a hazard, follow the hazard abatement process found in http://wwwsrqa.jsc.nasa.gov/HATS/. Take the following steps to investigate a hazard:

a. First make sure other JSC team members are protected from the hazard or environmental concern. This may include blocking trip hazards or spills with orange cones.

b. For RAC 1 and 2 hazards:

- Do a full root cause analysis using an established root cause method. The cause may be simple, but try to look beyond the obvious. Perhaps the hazard was caused by some deficiency in the management system. Perhaps it was caused by human error, which resulted from deficiency in the management system.
- Evaluate the root causes and determine which ones you need to fix to prevent injuries or future hazards.
- Take action to change, control, or prevent those root causes from causing injuries or future hazards.
- Document the results of your analysis and action plan or actions taken. Follow the hierarchy in paragraph 2 when determining the actions to take. Submit the results to the Safety and Test Operations Division. They will track the actions to closure and verify that actions are complete in the Hazard Abatement Tracking System (HATS). See Chapter 3.5 for more details.

c. For RAC 3 and 4 hazards:

- Evaluate and take actions to eliminate or control the hazard as necessary. Follow the hierarchy in paragraph 2 when determining the actions to take. If no action is

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necessary, you must provide rationale.

- You are encouraged to look beneath the surface for underlying causes of the hazard, especially if you have seen other similar hazards.
- Document the actions taken in the appropriate tracking system. If it will take you more than 30 days from the time it's identified through inspection or investigation to fix the hazard, you must enter it into the HATS. See Chapter 3.5 for more details. The Safety and Test Operations Division will automatically enter hazards reported through the Close Call system or the Safety Action Hotline into HATS as necessary.

7. Engineering controls

You must first try to use engineering controls to correct hazards in your work area before resorting to administrative controls. There are two kinds of engineering controls listed below in order of preference. You must use the first and resort to the second only if the first choice is too expensive or not feasible:

a. Change the design so you eliminate or reduce the hazard. For example, use a less hazardous material or lower voltage if you can.

b. Install safety devices or guards. For example, use safety interlocks, machine guards, or relief valves if you can.

8. Administrative controls

Administrative controls are less effective than engineering controls since they rely more on human performance. Use them only if engineering controls aren't feasible or are too costly. Administrative controls may include altered work schedules, training, administrative barriers, signs, and caution and warning devices. When you use administrative controls:

a. Everyone in the work area must understand and follow them.

b. They must affect the hazards they are to control.

c. Management must enforce them fairly.

d. Employees and management must update them as needed.

See Chapter 6.12 of this Handbook for specific requirements on chemical alarms.

9. Safety and health rules

Parts 5 – 10 of this Handbook contain safety and health rules for the entire Center. Individual work areas may need more specific rules, depending on the hazards.

You may also include special procedures in work instructions.

When you use safety and health rules:

a. Everyone in the work area must understand and follow them.

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b. They must affect the hazards they are to control.

c. Management must enforce them fairly.

d. Employees and management must update them as needed.

10. Personal protective equipment

PPE is no substitute for engineering or administrative controls. You must first try to eliminate or control a hazard before resorting to PPE. When PPE is required or used as a control in a hazard analysis or job hazard analysis, you must follow Chapter 5.6, "Personal Protective Equipment." This Chapter provides general requirements on PPE and requirements for specific types of PPE. Other chapters of this Handbook or OSHA standards (29 CFR 1910) indicate what PPE is required for specific jobs.

11. Hazard control programs

JSC has the following hazard control programs. You must follow the appropriate hazard control program(s) for your job. Use the table below as a guide and refer to the chapters listed for more details.

Hazard control program	***Chapter***	***Use when***	***Other Requirements***
Asbestos	5.7 Part 12	Working in asbestos area or with asbestos containing materials	None
Biosafety and Bloodbourne Pathogens	7.4	Working with blood or other biological materials	none
Confined Spaces	6.10	Entering confined spaces	none
Pressure Systems	6.11	Designing, building, or maintaining pressure systems	JPR 1710.13 (curent version)
Hearing Protection	7.1	Working in a noisy environment	none
Respiratory Protection	7.2	Working in areas where respirators are required	none
Radiation Protection	7.3	Working around radiation sources	none
Lockout/Tagout	8.2	Working on equipment with stored energy such as electrical, mechanical, or pressure.	none
Hazard Communication & Hazardous Materials	9.1 & 9.2	Working with hazardous materials	none
Pesticide Control	9.3	Applying Pesticides	none
Lead	9.4	Working around lead based materials	none

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Hazard control program	*Chapter*	*Use when*	*Other Requirements*
Ergonomics	5.5	Arranging your work station and designing your work activities	none

12 Responsibilities

Responsibilities for hazard prevention and control are as follows:

a. As a **line manager**, you are responsible for:

- Making sure hazards in your work areas are controlled, preferably with engineering controls and using other controls only as necessary.
- Developing and enforcing necessary safety and health rules and procedures for your work areas and employees.
- Making sure your employees use the appropriate PPE for their jobs.
- Making sure your employees follow the appropriate hazard control programs for their jobs.

b. The ***Safety and Test Operations Division*** and ***Occupational Health Branch*** are responsible for:

- Reviewing hazard controls as necessary.
- Maintaining Center-level safety and health rules.
- Maintaining Centerwide hazard control programs.

13. Safety and health records

The following organizational-level records will document hazard elimination and control:

a. Hazard analyses and job hazard analyses per Chapter 2.4 that document hazard controls support this sub-element.

b. Procedures or work instructions that document safe work practices.

c. Directives or other documentation that provide safety and health rules for individual work areas or organizations.

d. PPE hazard analyses and other PPE documentation required by Chapter 5.6 of this Handbook.

e. Documentation required for hazard control programs described in the chapters listed in paragraph 7 above or any other OSHA required documentation.

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Chapter 3.3
Process safety management

1. Who must follow this chapter

You must determine whether or not any new system or processes you introduce at JSC must meet the criteria for process safety management (PSM) as described below.

2. Description of Sub-Element 3.3

JSC in Houston presently has no processes that fall under OSHA's "Process safety management of highly hazardous chemicals" standard, 29 CFR 1910.119.

JSC's White Sands Test Facility has processes that fall under 29 CFR 1910.119 and must follow internal White Sands Test Facility requirements for implementing PSM.

3. Requirements

Reviews of new or modified processes must include an assessment of whether a new or modified process falls under 29 CFR 1910.119. If a new process meets the criteria for PSM, then the responsible organization must meet all applicable requirements in 29 CFR 1910.119.

4. Responsibilities

JSC managers are responsible for:

a. Evaluating new or modified processes to determine if they meet the PSM criteria in 29 CFR 1910.119. At JSC, you must avoid implementing new or modified processes that meet the PSM criteria unless there is no feasible alternative.

b. At JSC, reporting to the JSC Safety and Test Operations Division and Occupational Health and Human Test Support Office any processes that meet the PSM criteria and consulting with them to find an alternative if possible.

c. Making sure that the processes that meet the PSM criteria follow all applicable requirements in 29 CFR 1910.119.

5. Safety and health records

Center level records – chemical inventory to show which processes must meet PSM requirements.

Any processes that meet the PSM criteria must include any records required by 29 CFR 1910.119.

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Chapter 3.4
Preventive maintenance

1. Who must follow this chapter

You must follow this chapter if you:

a. Are a line manager at any level.

b. Maintain Center-level equipment or systems.

2. Description of Sub-Element 3.4

JSC must have a written system for, and ongoing documentation of, monitoring and maintaining workplace equipment such as preventive and predictive maintenance, to prevent equipment from becoming hazardous or causing an environmental non-compliance.

3. Maintenance requirements

If you operate JSC facilities or equipment, you must have a written maintenance system for the facility and equipment. You must maintain your facility and equipment so that it remains safe and maintain all safety, health, and environmental equipment so that it works when needed. The maintenance system must include maintenance:

a. Requirements and schedules based on manufacturer recommendations, federal, state, local, or NASA requirements, consensus standards, hazard analyses, etc.

b. Records.

4. Responsibilities

Responsibilities for preventive maintenance are as follows:

a. The ***Center Operations Directorate*** is responsible for maintaining major facility systems.

b. Line ***organizations that operate facilities or equipment*** are responsible for making sure their facility equipment is properly maintained.

c. The ***Safety and Test Operations Division*** is responsible for:

   d. Maintaining JSC fire detection and suppression systems.

   e. Reviewing or auditing maintenance records.

5. Safety and health records

The following Center-level and Organizational-level records will document preventive maintenance:

a. Maintenance procedures and schedules that document the process for maintaining

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systems or equipment and the required frequency.

b. Records that document that maintenance was done as scheduled.

c. Records on anomalies and trends discovered.

6. Measurement

JSC will measure preventive maintenance by whether or not required maintenance is done according to the schedules.

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Chapter 3.5
Hazard correction tracking

1. Who must follow this chapter

You must follow this chapter if:

a. You work at JSC or a JSC field site as a civil servant or contractor.

b. You are a supervisor, facility manager, contractor safety representative, or director. Paragraph 7 of this chapter lists your responsibilities.

Paragraph 7 of this chapter also lists the responsibilities of the Safety and Test Operations Division, contracting officers, and contracting officers' technical representatives.

2. Description of Sub-Element 3.5

JSC must have a system for initiating and tracking hazard elimination or control in a timely manner. The system must:

- Track all hazards identified through inspections, investigations, employee reports, surveys, etc. to completion.
- Include interim measures to protect employees and the environment from hazard while permanent action is in work.

3. Hazard correction and tracking

JSC tracks hazard correction to closure using abatement plans (also commonly referred to as action plans or corrective action plans) developed to address hazards found during hazard analyses, mishap investigations, close call investigations, inspections, surveys, and other similar activities where hazards are identified and analyzed.

Abatement plans consist of interim abatement and final abatement.

Interim abatement consists of temporary fixes to control the hazard until a permanent fix can be done. Interim abatement actions bring hazards under immediate control through temporary administrative controls, training, personal protective equipment, etc. You must take interim action as rapidly as possible to ensure protection of workers and equipment. Interim abatement must remain effective until final abatement is complete. The level of risk after interim abatement may or may not be lower than the original risk but must be no worse than a RAC 3 (see chapter 3.2 for details).

Final abatement consists of permanent fixes to control a hazard. This generally results in a lower level of risk using engineering controls as opposed to administrative controls.

Hazard correction and tracking at JSC must follow the hazard abatement process found online at http://wwwsrqa.jsc.nasa.gov/HATS/. This process involves teamwork when developing abatement plans, assigning actions, getting help to complete action items, and verifying closure.

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a. The Hazard Abatement Tracking System (HATS) is the principle system at JSC to track hazard correction to closure. All line organizations are expected to participate in this system. Contractors participate as specified in their contracts. The Safety and Test Operations Division maintains this system. You must enter hazards into HATS that meet any of the following conditions:

- The hazard has a risk assessment code (RAC) of 1 or 2. See Chapter 3.2 for a discussion of the RAC.
- You cannot fully abate the hazard within 30 days.
- Any actions arising from a mishap investigation (including investigation boards.)
- Any actions arising from a close call investigation not expected to be completed within 30 days of the being discovered in the investigation.
- You need Center funding to fully abate the hazard. This generally applies to construction-type correction actions such as Construction of Facilities projects and minor construction, renovation, or repair.
- Any hazard the Safety and Test Operations Division designates for tracking in HATS.

b. Line organizations, facility managers, and contractors may either use the HATS or their own tracking systems for hazards that do not meet the criteria of 3.a above. They must be able to track hazards to the following level of detail as a minimum:

- A description of the hazard including location, when found, who is responsible for the hazard (hazard owner), and a RAC.
- Interim and final abatement plans including actions required; actions taken; assignees by name, organization, and title; due dates; and closure dates.

Internal action tracking processes and systems used by line organizations and contractors must incorporate the basic features of the JSC hazard abatement process. Internal correction tracking processes must be documented and provided to the Safety and Test Operations Division for review and audit. You may do this by providing on-line, read-only access to Safety and Test Operations Division personnel or their designated representatives.

Caution:

You must never accept the risk of violating JSC, NASA, state, or federal requirements. If you think you can't follow any such requirement, you must request a variance as described in Chapter 1.4, "Written Safety and Health Program," of this Handbook.

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4. How to use your abatement plans

In addition to documenting your abatement actions, interim and final abatement plans can be effective communications tools. You have a responsibility to inform your employees of the hazards in the work place and how they are being corrected. JSC Form 1240, "JSC Notice of Safety or Health Hazard and Action Plan," was designed to meet the requirements of both OSHA and NASA. The JF 1240 is an automated report available from HATS. You must post it to warn employees of a hazard and protective measures and you may also use it foster communications about hazards as follows:

a. As a line manager (NASA or contractor) over the area or operation with the hazard, you are responsible for posting JF 1240 in your work areas.

b. As a facility manager, you are responsible for posting the JF 1240 if the area to be abated is not under the immediate control of a line organization or contractor.

c. You must post a JF 1240 posted at the point of the hazard. This ensures that anyone approaching the hazard will be warned and be able to protect himself.

- If final abatement likely will not occur within 30 days of the day the hazard was identified, you must complete both parts of the form and post it within 30 calendar days of identification of the hazard.

- If final abatement will likely occur within 30 days of the day the hazard was identified, you must either post only part 1 of JF 1240 or provide another forum to inform employees of the hazard in a timely manner and what was done to fix it. The decision to post such a form depends on the criticality of the hazard, who may be exposed to it, and the type of controls used. If you decide not to post the form, you must coordinate with the facility manager or the Safety and Test Operations Division.

d. You may use the JF 1240 in staff meetings, safety meetings, tool box sessions, or any other forum that is used to communicate with employees and other managers. When such forms are used in such meetings, it is highly recommended this be noted in minutes, agendas, etc.

If you are unable to get a JF 1240 as a completed form from HATS, contact HATS by e-email requesting a JF 1240 for each of the HATS items you desire. You can find HATS JSC's global e-mail address book under "HATS," or you can send an e-mail to HATS@ems.jsc.nasa.gov.

5. If you need more time or money to correct a hazard

The online hazard abatement process at http://wwwsrqa.jsc.nasa.gov/HATS/ tells you how to keep your abatement schedule up to date. Any hazards in HATS will be tracked automatically and reminders sent to the hazard owner and facility manager if an abatement plan is past due. Similarly, if an action item is past due, action assignees will be notified with

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a copy sent to the hazard owner and facility manager.

If you need more money because you cannot correct the hazard within your budget:

a. Make sure this is reflected in your abatement planning in the form of interim controls etc. as described above. Involve your personnel in the development of such plans wherever appropriate.

b. Make sure your hazard and your abatement plan is documented in HATS.

c. Use available funding processes to obtain the funds needed. Use NASA Form 1584, "Safety and Health Hazard Abatement Plan," if you must ask NASA Headquarters for funding.

- Send a copy to the JSC Safety and Test Operations Division.
- Send a copy to Code QS/Director, Safety and Risk Management Division, NASA-Headquarters, for safety issues.
- Send a copy to Code AE/Chief Health and Medical Officer, NASA-Headquarters, for health issues.

d. Make sure that progress to get funds is reported to HATS.

e. While awaiting funds, make sure your interim abatement controls remain effective.

6. Leased space off site

If you can't correct a hazard in a leased space yourself, notify the General Services Administration or the federal agency that leases the space of the hazard and ask for help to correct it in writing.

7. Responsibilities for tracking and correcting hazards

a. As a ***supervisor***, you must take necessary actions to correct hazards in your work areas. This includes temporary measures to protect your employees and the environment while you wait on building or equipment changes. Improve on your corrective action periodically.

b. As a ***contractor safety representative***, you must help contractor or NASA management with tracking and correcting hazards as necessary

c. As a ***facility manager***, your knowledge of your facility is important for correcting hazards. You must make sure:

- Hazards found in your facility are reported and corrected.
- Employees in your facility know about corrective action plans.

d. As an organizational ***director*** at JSC, you must:

- Develop processes for tracking and correcting hazards in your directorate.

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- Review open hazard reports for your directorate and make sure they are closed in a timely manner.
- Provide services from your directorate that other JSC organizations need to correct hazards such as testing, evaluating data, modifying buildings or equipment, or sampling work areas.

e. The ***Safety and Test Operations Division*** must:

- Review and approve hazard reports and corrective action plans.
- Coordinate with the Environmental Office on environmental issues.
- Help JSC contracting officers and technical representatives develop requirements for reporting and correcting hazards for their solicitations and contracts.

f. ***Contracting officers and technical representatives*** must make sure that JSC contractors understand and follow NASA and JSC contract requirements for tracking and correcting hazards.

8. Safety and health records

The following records document hazard correction tracking:

a. Center-level – the HATS database.

b. Organizational-level:

- Tracking systems in individual line organizations that document hazards not entered into HATS and their correction.
- Posted JSC Forms 1240, "JSC Notice of Safety or Health Hazard and Action Plan."
- Work requests and other documentation related to correcting hazards.

9. Measurement

The following factors will measure hazard correction tracking:

a. Timeliness in correcting hazards.

b. Timeliness in maintaining status of hazard correction.

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Chapter 3.6
Occupational health care program

1. Who must follow this chapter

You must follow this chapter if you work at or visit JSC.

If you work at a JSC field site, you must follow your local procedures and requirements that meet the intent of this chapter.

Paragraph 18 of this chapter also lists the responsibilities of line managers, the JSC Occupational Health Branch, JSC's Occupational Health Contract, and JSC's Medical Clinic.

2. Description of Sub-Element 3.6

JSC must have an occupational health care program that:

a. Uses licensed health care professionals to assess employee health status for prevention of and early recognition and treatment of illness and injury. JSC has a comprehensive occupational, preventive, and emergency medicine clinic to provide screening exams and treat illnesses and injuries.

b. Provides, at a minimum, access to employees certified in first aid and cardiopulmonary resuscitation (CPR). Emergency medical technicians are available through the JSC Clinic during normal business hours. Several employees are voluntarily trained in first aid and CPR.

c. Provides physician care and emergency medical care for all shifts within a reasonable time and distance. The JSC Clinic provides physician and emergency medical care during normal business hours. Outside of normal business hours, emergency medical care is available to JSC employees at Saint John's Hospital.

3. JSC field sites

JSC field sites are responsible for providing occupational health care that meets the intent of this chapter.

Medical treatment and "Clinic First" policy

4. What to do if you or a coworker suffer an injury or illness on the job

JSC has a "Clinic First" policy. You must seek prompt medical attention and notify your supervisor.

Whenever you are involved in a mishap, seek medical treatment for the injured person, come to the "clinic first," before doing anything else. Depending on the severity of the medical condition, either escort the injured or ill person to the JSC occupational medicine clinic or call the emergency numbers listed below.

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If you are a supervisor, you must:

a. Make sure the injured or ill employee is escorted to Center or site medical clinic.

b. Report the mishap and support the investigation as described in Chapter 2.6 of this Handbook.

c. Keep up with the status of the injured or ill employee by checking with the case management nurse at the Clinic.

If you are unsure about the severity of the injury or illness, call your emergency number. Remember your emergency numbers are:

x33333 at JSC & SCTF
x44444 at Ellington Field
911 at any off-site location
x5911 at White Sands Test Facility

Reporting emergency situations is mandatory.

5. If you think you've been exposed to a hazardous material or condition

Whether you notice any symptoms or not, you must report the incident to the Clinic and to your supervisor immediately.

6. Working outside of normal working hours

The JSC Clinic operation hours are from 0730 to 1700, Monday - Friday. If you or a co-worker suffer an injury or illness outside of these hours:

a. Depending on the severity of the medical condition either call the emergency numbers or access medical care at a local health care facility

b. As soon as possible – report any job-related injury or illness to your supervisor and the Center or site medical clinic.

7. If you don't notice a job-related injury or illness until you are off duty

You must report it to your supervisor and the center or site medical clinic at the beginning of the next business day.

8. If you see your own doctor or go to a hospital for a job-related injury or illness

You must report your doctor visit to your supervisor and the center or site medical clinic as soon as possible. If you are on travel or off site, call your supervisor and have him or her call the Clinic.

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9. Workers' compensation

For workers' compensation information:

a. Civil servants – Contact the Occupational Health Branch at x37792. (See Attachment 3.6A, Appendix 3B)

b. Contractor Employees – Follow your company policies or contact your human resources office.

10. Moving an injured or ill person to a clinic or hospital

Depending on the severity of the medical condition of the injured or ill employee, call the emergency numbers or notify your supervisor. If minor, escort the injured or ill employee to the Center or site medical clinic. If unsure of the severity of the medical condition call the emergency numbers. The injured or ill employee has the right to refuse transport or any additional medical care.

11. First aid kits

JSC has a comprehensive occupational and emergency medicine clinic that is available Monday through Friday 0730-1700 to treat minor, on-the-job injuries and illnesses. JSC requires that all injuries and illnesses be reported under our "clinic first" policy. However, supervisors may choose to provide first aid kits in areas where there is a special need because of a specific hazard or a chemical that warrants a specific antidote be closely available. The following is JSC's policy on first aid kits:

a. Consider the following guidelines when deciding if you need a first aid kit in your work area:

- Do workers engage in hazardous activities on second or third shift when the JSC Clinic is closed, e.g. machine shops, printing, etc.?
- Does the workplace have a specific chemical hazard that warrants an antidote to be close by? For example, dermal hydroflouric acid exposure requires immediate treatment with a neutralizer such as calcium gluconate. Hydrogen cyanide gas inhalation requires immediate treatment with amyl nitrate.
- Is the facility remote from the JSC Clinic such as Ellington Field or the Sonny Carter Training Facility?

b. Employees who will use first aid kits in the workplace must be trained in the use and limitations of the first aid supplies. First aid supplies are for self-treatment only, except when a specific chemical antidote is needed. The antidote is usually applied by someone other than the exposed employee. Employees who are required to administer antidotes may also need to be put into a bloodbourne pathogen program. Even if you use first aid in the workplace to treat a minor injury, you are still required to report to the JSC clinic as soon as reasonably possible afterward to ensure adequate treatment.

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c. JSC's Occupational Health Branch has a list of first aid supplies that are recommended for general industrial settings. Please consult the Occupational Health Branch if you need special chemical antidotes in your work area.

d. You must periodically inspect first aid kit supplies to verify inventory and ensure the supplies are within expiration dates. JSC's Occupational Health Branch will provide first aid kits and supplies to those areas where their use is necessary.

12. Case management – returning to work after an injury or illness from your job

At JSC the Nurse Case Manager (x31132) will help and coordinate your initial medical treatment and your return-to-work. After completing an assessment, the medical professionals, who include the Nurse Case manager, will determine fitness for duty. The determination will consider your private doctor's input. The determination can range from may return to may return with or without specific limitations. This determination will be communicated to you and your supervisor and the facts and outcome documented in your medical files.

Your supervisor and the medical and human resources offices must be involved in the case management of your on-the-job injury or illness and successful return to work. They must be involved in the process from the initial injury to the final return to work at 100% of your capabilities. The JSC occupational health case manager will work with both you and your management chain to discuss your initial diagnosis, duty status (return to work, limited duty, outside medical referral), and any other information necessary to help successfully return you to work.

Contractors are expected to have case management personnel (Health Professionals, Human Resources, Loss Control, etc.) to help in the case management process for their employees.

If you work at a JSC field site, follow site-specific policies.

Medical surveillance

13. Medical surveillance

Medical surveillance includes medical screening examinations and procedures used to protect workers who may be exposed to hazardous substances. It also shows that workers are physically and mentally fit to do certain hazardous or critical operations. Data gathered to establish a baseline parameter may help to recognize and treat occupational illnesses and injuries. Medical surveillance includes:

a. Identifying workers who need examination.

b. Performing and documenting those examinations.

c. Informing workers of the results.

d. Training.

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e. Evaluating data for trends and subclinical effects of exposure.

14. Requirements for placing you in a medical surveillance program

JSC uses a "hazard-based" method to decide which jobs or operations require medical surveillance. The need for medical surveillance is based primarily on exposures determined by industrial hygiene surveys. You may be required to have a physical examination because of your job, such as a painter, or because of some task you must do, such as wear a respirator. You must be under medical surveillance if:

a. You could be exposed to a physical, chemical, or biological hazard at or above the action level set by the Occupational Health and Safety Administration (OSHA) or American Conference of Governmental Industrial Hygienists (ACGIH). This is usually half of the permissible exposure limit (OSHA) or the threshold limit value (ACGIH).

b. You are required to by a standard that covers the chemical you will be working with.

c. The Occupational Health Branch decides you must have an examination based on knowledge of the workplace, job requirements, and review of occupational history.

15. Physical examinations at JSC

JSC's medical surveillance program includes the following physical exams:

a. A ***baseline examination*** before you start work in a job that could expose you to hazardous materials to:

b. Determine if you are suitable for the job.

c. Provide a baseline so medical personnel can later see any changes to your condition.

d. A ***periodic examination*** while you are working in a job that could expose you to hazardous materials.

e. A ***termination examination*** when you quit your job or are permanently removed from a job that could expose you to hazardous materials. It is important to document your state of health when you leave in case you later develop medical problems that could be a result of some exposure to hazardous materials.

f. A ***certification examination*** if your job might make existing health problems worse, or if the safety of others depends on your health. These exams are critical to controlling and eliminating occupational injury and illness and making sure certain employees can do their hazardous jobs safely. Check the personnel requirements for your work area to see if you need a certification examination.

16. Requesting a medical screening examination

Your supervisor must request an examination using the following process. There are some exceptions to this process, such as Respiratory Physical. Your supervisor is current on the

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specific process to be used.

a. Send JSC Form 270 (Johnson Space Center, Job-Related Physicals) to the JSC Clinic, mail code SD32. JSC Form 270 is available on the JSC Homepage. The request must include:

   - Your name, social security number, birth date, job description, and phone number (your title and the building you normally work in would also be helpful)
   - Your supervisor's name, and supervisor's mail code
   - Justification for the examination; identification of the toxic material you will work with, and the requirement that says you must have the examination
   - What kind of physical examination you need from paragraph 14 of this chapter

b. Wait for the Clinic to call to schedule the examination. The Clinic will do this after the Occupational Health Branch authorizes the proper physical examination protocol and sends your request to the Clinic.

c. Report to the Clinic for your examination. Fill out work history and exam questionnaires for the kind of physical examination you need. It is important that you fill out all forms completely to allow the doctor to properly perform the examination. You may pick up the forms in advance and complete them before your examination if reading or writing in English is difficult for you.

17. Requirements for physical examinations

The following table lists the requirements for exams by job or duty. The Occupational Health Branch reviews the medical surveillance program periodically and may change the frequency of physical examinations for certain job descriptions based on current medical recommendations or changes to regulatory requirements.

This table doesn't list all work areas and jobs that may require medical surveillance. Medical surveillance requirements change because of the age of the employee, changes in work procedures that reduce exposure to chemicals or hazards, or changes in regulations.

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Job or Duty	*Baseline Exam Reqd?*	*Periodic Exam Reqd?*	*Term Exam Reqd?*	*How often?*
Test subject engaged in Level I or II tests (mandated by the Institutional Review Board); for example KC-135 flyers and CTSD chambers	yes	yes	yes	yearly *
Underwater facility safety and utility divers	yes	yes	yes	yearly *
Lock observers	yes	yes	yes	yearly *
SCAPE operators, closeout crew	yes	yes	yes	yearly *
Rescue personnel	yes	yes	yes	yearly
Test subjects not engaged in Level I or II tests	yes	yes	yes	every 3 years *
Pressure suit engineer or technician	yes	yes	yes	every 3 years *
KC-135 test conductors and guests	yes	yes	yes	every 3 years *
Underwater facility test conductors and guest divers	yes	yes	yes	yearly *
Underwater facility suited divers	yes	yes	yes	yearly *
Chamber directors, operators, and conductors	yes	yes	yes	every 3 years *
Underwater facility camera divers (video and still)	yes	yes	yes	yearly *
Crane operator for critical lifts and cab or pulpit mounted cranes	yes	yes	yes	age less than 40, every 3 years and yearly thereafter
Firefighters	yes	yes	yes	yearly
Propellant handlers	yes	yes	yes	yearly
Pesticide and herbicide handlers	yes	yes	yes	yearly
Insulators	yes	yes	yes	yearly
Asbestos workers**	yes	yes	yes	yearly
Solderers for flight or ground support equipment	yes	yes	yes	yearly
Hazardous material emergency responders	yes	yes	yes	yearly
Painters	yes	yes	yes	yearly
Plating shop workers or metal finishers	yes	yes	yes	yearly
Plumbers	yes	yes	yes	yearly
Food handler	yes	yes	yes	yearly
Welders	yes	yes	yes	yearly

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Job or Duty	*Baseline Exam Reqd?*	*Periodic Exam Reqd?*	*Term Exam Reqd?*	*How often?*
Metal workers: lead, cadmium, etc.	yes	hazard based	yes	***
Fuel cell operator	yes	yes	yes	yearly
Clean room worker	yes	yes	yes	yearly
Primary contact	yes	yes	yes	yearly
Flight controllers	yes	yes	yes	age less than 40 every 2 years and yearly thereafter
Primary contact (food depot)	yes	yes	yes	every 6 months
Sheet metal workers	yes	hazard based	yes	***
Class 3b and 4 laser users or workers	yes	no	yes	***
Respirator users	yes	yes	yes	****
Roofers	yes	yes	yes	yearly
Handling any other chemical, physical, or biological agent	***	hazard-based	***	***
Working in high noise areas	yes	yes	yes	yearly
International Travel	No	No	No	Before travel
Hypervelocity Gun Operators	yes	yes	yes	yearly

* Pre-test physical examination given as necessary by test requirements.
** Someone who does class I, II, or III asbestos work (as defined in 29 CFR 1926.1101) for more than 30 days per year, where a "day" is more than 1 hour of work. Those who do asbestos work for less than 30 "days" a year are considered respirator users for medical surveillance.
*** The Occupational Health Branch will decide.
**** Age less than 35, every 5 years. Age between 35 and 45, every 2 years. Yearly thereafter.

18. Responsibilities for occupational health care

Responsibilities for occupational health care are as follows:

a. If you are a ***line manager***, you must:

- Train your employees in JSC's Clinic First policy.
- Make sure your employees know where and how to get medical treatment.
- Make sure your employees report all injuries or illnesses on the job to you.
- Make sure injured or ill employees go to the Clinic.
- Make sure your employees know what to do when they see their own doctor or go to

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a hospital for a work-related injury or illness.

- Consult with the Occupational Health Officer if you think you need first aid kits for your employees.
- Make sure those employees who use first aid kits have first aid and bloodbourne pathogens training.
- Make sure your employees have the required baseline medical examination before assigning them to a work area or job task.
- Make sure all your employees are current on all required medical examinations.
- Contact the Occupational Health Branch before starting any new process or changing existing processes so that medical surveillance requirements can be addressed.

b. The ***Occupational Health Branch*** must:

- Oversee JSC's Medical Clinic.
- Determine fitness for duty of injured or ill employees as described in paragraph 12.
- Report all injuries and illnesses (JSC Form 340) thought to be work related to the Safety and Test Operations Division.
- Investigate suspected work related illnesses and exposures.
- Tell the Safety and Test Operations Division if an injury or illness will prevent an employee from doing his or her job and when an employee may return to work without restrictions.
- Provide physical examinations as required for on-site civil servant and contractor personnel.
- Conduct industrial hygiene evaluations of work areas to determine if hazard-based work-related physical examinations are necessary.
- Make recommendations on the need for medical surveillance for new jobs.
- Provide trained emergency medical paramedics and ambulance services as First Responders. Backup up assistance is though a Mutual Aid arrangement with the Houston Fire Department.

c. The ***JSC Medical Clinic*** must:

- Assess and treat anyone with a job-related illness or injury. Assess and treat any medical emergency that happens on site whether it is job-related or not.
- Support Flight Medicine.
- Support human tests with emergency response and ambulance services.

Verify this is the correct version before you use it by checking the on-line version.

19. Safety and health records

The following records document occupational health care:

a. Center-level – the JSC Medical Clinic must keep treatment and exam records. The Clinic must protect employee medical files under the Privacy Act of 1974 and consider them privileged information.

b. Organizational-level – line managers must keep a current roster of employees requiring enrollment in medical surveillance and medical screening programs.

Verify this is the correct version before you use it by checking the on-line version.

Chapter 3.7
Disciplinary system

1. Who must follow this chapter

You must follow this chapter if you are a JSC Team Member.

2. Description of Sub-Element 3.7

JSC line managers must equitably enforce hazard controls and safety and health rules through a clearly communicated written disciplinary system. The system must include procedures for disciplinary action or reorientation of line managers and non-supervisory employees who break or disregard safety rules, safe work practices, proper materials handling, or emergency procedures.

3. Requirements

You must always do your job safely. If you are a JSC civil service employee, you can face disciplinary action for not doing your job safely. If you are a contractor employee, you can face disciplinary action under your company's policies.

JSC's disciplinary system for civil service employees is described in the JSC Personnel Handbook, Part 7, Subpart 3, "Discipline and Adverse Actions."

4. Responsibilities

JSC line managers are responsible for consistently enforcing safe work practices through equitable discipline that is intended to correct unsafe behavior rather than to punish.

5. Safety and health records

Organizational-level – you must maintain records of disciplinary action as specified in the JSC Personnel Handbook, Part 7, Subpart 3.

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Chapter 3.8
Emergency preparedness

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site. If you are a line manager, facility manager, fire warden, or director, paragraph 17 of this chapter lists your responsibilities.

2. Description of Sub-Element 3.8

JSC must have procedures for response to emergencies on all shifts. These procedures must:

a. Be written.

b. Be communicated to all employees.

c. List requirements for personal protective equipment, first aid, medical care, and emergency escape.

d. Include provisions for emergency telephone numbers and exit routes.

e. Include provisions for training drills including, at a minimum, annual evacuation drills.

3. Emergency preparedness

The emergencies you are most likely to experience at JSC are fire, medical, or weather emergencies. Certain work area may have the potential for other emergencies such as chemical spills. Planning for major emergencies is covered under JSC 05900, "JSC Emergency Preparedness Plan." Emergency preparedness at JSC involves:

a. Emergency action – defining actions to take for common emergencies such as fire and medical. Attachment 3.8A of Appendix 3B lists protective measures you must take in certain emergency situations that may prevent or limit injury.

b. Emergency planning – specific plans for buildings or work areas.

Emergency action

4. Reporting emergencies

You must report any emergency that you see or become aware of. This includes any fire, no matter how small. Report fires that have been extinguished. They may still be smoldering and could reignite.

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You must call your emergency number if you see an emergency.

Remember your emergency numbers:

x33333 at JSC and SCTF
x44444 at Ellington Field
911 at any off-site location
x5911 at White Sands Test Facility.

You must keep the emergency scene as undisturbed as possible. If you don't, valuable evidence for the investigators could be destroyed.

5. Notification of an emergency?

You could be told of an emergency in two ways:

a. A building fire alarm.

b. Someone telling you or shouting in the vicinity to alert you.

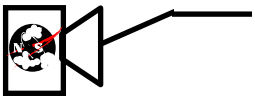
c. At the JSC main site, the employee alarm system will be activated to alert people in exposed area (outside) of potential danger. See the diagram in Attachment 3.8A of Appendix 3B for more information.

JSC Employee Alarm System

Whoop (low to high siren) - Seek shelter and get more information

3-5 minute Wavering Tone - Attack Warning (nuclear or conventional) (air raid warning)

Wail (single, constant tone) - All Clear



Short Wail (like a noon whistle) - Periodic System Test (1st Thursday of every month at noon)

Verify this is the correct version before you use it by checking the on-line version.

6. Fire wardens

Fire wardens are an important part of JSC's fire response. JSC's building fire warden program provides at least one fire warden per building to oversee building fire safety. The following requirements apply:

a. Each building at JSC and JSC field sites must have a chief fire warden, an alternate fire warden, and as many floor fire wardens as needed. You must be able to evacuate the building at a rate of no more than one minute per floor. Fire warden coverage must include as a minimum:

- One fire warden per floor.
- One fire warden per shift in buildings occupied for more than one shift per day.
- Covering each cypher lock area with a fire warden who has access to the area.
- Covering each hazardous work area or lab with a dedicated fire warden.

b. The facility manager will serve as building's chief fire warden and the alternate facility manager as the alternate chief fire warden if they work in the building or if the building is unoccupied.

c. As a fire warden, you:

- Have the authority to cross organizational lines to enforce fire safety rules and make sure everyone follows the building emergency plan in your assigned areas.
- Must inspect your assigned areas monthly and keep records of your inspections. File the originals of you records and send copies to your facility manager.

d. Fire wardens must have fire warden training that covers fire warden responsibilities, recognizing and correcting fire hazards, fire extinguishers, evacuation techniques, as well as other training deemed necessary. To get this training, contact the Safety and Test Operations Division. At White Sands Test Facility, contact the fire chief.

7. Actions if you hear a fire alarm

If you hear a fire alarm you must evacuate the building immediately and follow directions from the fire wardens or emergency and security personnel. You must assume that all fire alarms are real. JSC doesn't hold fire drills during bad weather. If you hear an alarm during bad weather, it is a real emergency and you must evacuate. Attachment 3.8A of Appendix 3B lists specific actions you must take if you hear a fire alarm.

If you don't evacuate, facility managers and fire wardens will be clearing each floor during the evacuation and will ask you to leave. If you still choose not to evacuate, you will be reported to your Director for appropriate action.

8. If you need help evacuating a building

You must follow these procedures:

Verify this is the correct version before you use it by checking the on-line version.

a. Notify your supervisor before an emergency that you need help during an evacuation. You and your supervisor must jointly decide whether you require help evacuating. Examples of physical conditions (temporary or permanent) that may hinder your evacuation are:

- Use of wheelchair, crutches, or walkers
- Hearing or visual impairments
- Pregnancy
- Heart or lung conditions
- Disabilities hindering mobility
- Temporary injuries

b. Have your supervisor arrange for a "buddy" to help you in an evacuation and notify the Facility Manger of the "buddy arrangement." The buddy should have enough physical strength to help you.

c. When an alarm sounds, evacuate the building through areas free from smoke or fire with your buddy. If you are on an upper floor, you must:

- Go to the primary AREA OF RESCUE ASSISTANCE with your buddy and wait for emergency personnel. Move to a secondary AREA OF RESCUE ASSISTANCE if smoke, heat, or fire become apparent.

Areas of Rescue Assistance are located near elevator lobbies or stairwells, are marked with distinctive signs, and can be found on Facility Evacuation Plans. These areas have been selected to protect you from heat and smoke.

- Make sure someone notifies the fire warden or emergency personnel of your location.
- DON'T use the elevator without emergency personnel; you could become trapped.
- Obey directions from fire wardens or emergency personnel.

d. If you visit another building, become familiar with that building's Area of Rescue Assistance. If you hear an alarm, tell other employees in that building that you need a buddy to evacuate. If you can't find a buddy, let the facility manager and fire wardens know you need help when they come to clear the floor.

e. You must get your supervisor's permission to work off-hours. If you can't physically activate a pull box or use a telephone, you will not be allowed to work off-hours. You must also inform the Emergency Operations Center (EOC) when and where you will be working during off-hours.

9. Using fire extinguishers

Don't try to fight fire that you can't safely put out with a hand held fire extinguisher unless you are a member of a trained fire brigade or fire department.

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Fire extinguishers are installed in JSC facilities regardless of the fire control measures. You may use a fire extinguisher if:

a. You or someone else has first called the emergency number and started an evacuation. Don't depend on the fire extinguisher alone to put out the fire.

b. The fire is small enough for the extinguisher to be effective.

c. You are trained to use a portable fire extinguisher. Otherwise, you could put yourself in danger by using the wrong extinguisher or using it improperly.

d. The extinguisher is nearby, in good working order, and the proper type of extinguisher for the class fire that occurs. See the glossary for "classes of fire" definitions.

e. There is no risk to your safety and the fire isn't between you and an exit. Always keep a clear path to an exit.

f. You know you can safely put out the fire.

10. Emergency response at JSC

JSC and JSC field sites must provide adequate emergency response personnel and equipment to deal with all potential emergencies. These personnel and equipment may be provided by civil servants, a contractor, or local fire departments through mutual aid agreements. All emergency response personnel must be trained to do their jobs safely and effectively. At JSC, the following organizations or individuals are available to respond to emergencies:

a. Houston Fire Department and mutual aid agreements with other surrounding communities on-site at JSC

b. Ellington Fire Department at Ellington Field

c. Fire protection specialists from the Safety and Test Operations Division who act as liaisons with local fire departments

d. Emergency medical technicians from the JSC Clinic

e. Spill response teams from the Environmental Services Office

f. Security

If you work at a JSC field site, see your site emergency planning personnel for information on emergency response.

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Emergency planning

11. What you must know about emergency planning as a JSC employee

As a JSC employee, you must:

a. Know the hazards in your work place and how to recognize them.

b. Be trained in how to protect yourself if you are in danger.

c. Know the exit routes you must take to evacuate safely.

d. Know any special emergency procedures for your work area if you are assigned to “safe” the area or systems before evacuating.

e. Know where you can find the emergency action plan for your work area.

f. Follow those procedures if an emergency happens.

12. Emergency planning

JSC and JSC field sites must:

a. Identify all hazards that could happen in the workplace and how to respond to them.

b. Have a site-wide emergency plan. JSC 05900, "JSC Emergency Preparedness Plan," describes JSC’s overall emergency response plans.

c. Have the Houston Fire Department or local fire department review the emergency plan.

d. Review the emergency plan yearly or after each major emergency.

e. Have a site-wide emergency drill yearly.

f. Evaluate the site emergency plan after each yearly drill or after each major emergency. Update the plan if necessary.

g. Have a fire drill for each occupied building yearly.

13. Facility evacuation plans

A facility evacuation plan (FEP) is a schematic drawing showing you how to evacuate a building. All JSC buildings must have an FEP except small single-story buildings or buildings with fewer than ten occupants. A building is considered “small” if you can walk out of your office or workstation and see two exit doors. The FEP must:

a. Be based on the floor plan and show the preferred and secondary exit routes from all occupied areas of the building. Usually, the following conventions apply:

- A solid red line marks the primary exit routes and a dashed red line marks the secondary.

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- Red boxes mark manual pull stations.
- Yellow triangles indicate locations for fire department standpipe connections that usually house fire extinguishers.
- Include “EXIT,” “YOU ARE HERE,” triangles, and box stickers.
- Firefighter-operated elevators for the physically impaired are outlined in red.
- Show Automatic External Defibrillator locations
- Show Areas of Rescue Assistance

b. Include details on evacuating disabled persons.

c. Be posted on the wall, usually at the elevator on each floor. The building’s complexity will determine where the plans must be posted. Recommended conventions to follow are posted on north walls where north is up on the drawings or on west walls where west is to the right on the drawing.

You can get an FEP from the Facility Engineering Division.

14. Emergency action plans

Each facility at JSC must have an emergency action plan to protect employees and property if an emergency happens. An emergency action plan must tell you what to do in an emergency. An emergency action plan must:

a. Cover the following:

- Emergency escape procedures and routes
- Procedures for employees who stay behind to do critical tasks before they evacuate
- Procedures to account for employees after evacuation
- Rescue and medical duties for those who perform them
- How to report emergencies
- Who to contact for more information

b. Establish the following:

- The employee alarm (warning) system
- The type of evacuation to be used in emergency circumstances
- Training of a sufficient number of persons to carry out the plan

Have the emergency action plan available during fire drills to allow the Fire Protection Specialists to you have it an upgrade their records.

To get a copy of “Tips for Writing an Emergency Action Plan,” contact either the Emergency Operations Center Office, the Safety and Test Operations Division, or your building's facility manager. This document gives you guidelines for writing an emergency action plan and an

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outline of an emergency action plan.

15. Planning for critical or hazardous areas inside or around JSC facilities

Critical or hazardous areas within or around JSC facilities must have a more detailed emergency action plan. Critical areas are locations where an emergency could require a unique response from workers in the area, safety, security, firefighters, or emergency medical personnel.

These critical or hazardous areas include:

a. Areas with essential electronic equipment
b. Aircraft hangars
c. Areas with transformers
d. Routes used to transport hazardous materials
e. Any area that stores vital records
f. Any area that uses or stores hazardous materials
g. Test areas that involve human subjects

Emergency action plans must be written separately for these unique areas and contain essentially the same information as building emergency action plans described above.

Read the individual chapters that apply to your work area for more details on emergency actions you must take in your work area.

For help, contact the Emergency Operations Center Office at JSC or your site's emergency planners. They will give you advice and review your emergency action plan.

16. For more information on emergency planning

You can find more information on emergency planning in these documents:

a. 29 CFR 1910.38, "Employee Emergency Plans and Fire Protection Plans"
b. NPD 8710.1, "NASA Emergency Preparedness Program"
c. NPR 8715.2, "NASA Emergency Preparedness Plan Procedures and Guidelines"
d. NPR 8715.3, "NASA Safety Manual," Chapter 9
e. NASA-STD-8719.11, "Safety Standard for Fire Protection"
f. JSC 05900, "JSC Emergency Preparedness Plan," including all annexes
g. National Fire Protection Association Standard 101, "Life Safety Code"

Verify this is the correct version before you use it by checking the on-line version.

Check with your community city hall for information in developing a personal emergency action plan to protect your family and loved ones.

Responsibilities, records, and measurement

17. Responsibilities for emergency preparedness

a. If you are a ***line manager***, you must:

- Encourage your employees to participate in emergency planning.
- Train your employees in your emergency action plan.
- Designate a specific outside gathering point for your employees, located at the building assembly area.
- Account for your employees after an evacuation.
- Make sure your employees follow the emergency action plan including evacuation.
- Make sure your employees follow instructions from fire wardens and emergency response personnel during an emergency.
- Be aware of your employees' current physical conditions and whether or not they may have trouble evacuating the building as described in paragraph 8 above. Contact your facility manager to discuss evacuation details. Make arrangements for any of your employees who will need help exiting their building. They must have a "buddy" and must not be left unattended.
- Train newly assigned or employed disabled persons in the general emergency evacuation procedures from JSC buildings.
- Support your building fire warden program and evacuation plans as required. This includes supporting requests from your facility managers for fire wardens to cover your floor as described in paragraph 6 of this chapter.
- Hold a safety meeting with employees after each drill or emergency to verify whether the emergency action plan worked well. Solicit employee recommendations to improve the emergency action plan and report them to the Facility Manager for updates. Retrain all employees in the revised procedures to make sure they understand.
- Review the EAP and evacuation procedures with employees who were absent during the drill.
- Document employee participation in emergency drills and make-up training.

b. If you are a ***facility manager***, you must:

- Make sure each of your buildings has an emergency action plan. Review your emergency action plan each year and forward a copy to the Emergency Operations Center office for review.

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- Make sure each floor of your building has an evacuation plan as described in paragraph 13 of this chapter.
- Be aware of any special hazards in your building. Make sure any critical or hazardous areas listed in paragraph 14 above have separate emergency action plans.
- Make sure your building occupants have copies of and are trained on your emergency action plan for their workplace.
- Know the evacuation routes in your facility and make sure they are kept clear.
- Be aware of employees in your facility who will need help exiting the building. Make sure they have made arrangements with their supervisors.
- Work with your building fire wardens and line managers to develop an employee protection team for rapid, safe evacuations, and quick employee accountability.
- Report to responding emergency personnel to brief them on the situation at your facility and tell them if anyone needs to be rescued. Stay at the emergency command post to help emergency responders and act as liaison between the emergency personnel and facility employees who may need more information.
- Have a sign-in and sign-out sheet for maintenance personnel working in locked areas. Pick up the sheet when exiting during an emergency and carry it with you outside so you will know who is behind locked areas. Report that information to the Fire Protection Specialist or security officer.
- Report any missing employees who may be in danger in the evacuated facility to arriving emergency personnel, preferably to the Fire Protection Specialist or a security officer.

c. If you are a ***chief fire warden***, you must:

- Delegate fire warden responsibilities to someone who works in the building if you aren't resident in the building. You may delegate these responsibilities to a JSC contractor if no civil service employees work in the building.
- Appoint as many floor fire wardens as you need to carry out the building emergency evacuation plan and other fire warden duties and that meet the minimum requirements of subparagraph 6.a above. This includes keeping documentation that shows fire warden responsibilities in your building.
- Assign a designated area for the fire wardens to report to you during an evacuation.
- Make sure your fire wardens are trained on fire extinguishers and building emergency evacuation plans. The Safety and Test Operations Division will train selected individuals from each floor at your discretion.
- Make sure your fire wardens and safety representatives are familiar with the location of fire equipment such as fire extinguishers and fire alarm boxes.
- Critique each fire drill in your building within 3 working days after each drill or evacuation to review the good or bad points of the drill or evacuation. Update your emergency plan as needed.

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- Hold meetings with your floor wardens throughout the year to discuss fire drill critiques and other fire safety issues.

d. If you are a ***fire warden***, you must:

- Gather at elevators or other specified areas to determine which other floor wardens are present.
- Canvas your assigned areas. Knock on the mechanical room and restroom doors and remind anyone inside to evacuate the building.
- Indicate to other floor fire wardens that their area(s) have been cleared and you all can leave the floor (using voice or hand signals).
- Report to the chief fire warden or facility manager when exiting the building at the designated area. Give them an "all clear" or tell them of any problems encountered such as people waiting in Area of Rescue Assistance or people not evacuating.

e. As a ***contracting officer***, you must concur on the delegation of fire warden responsibilities to any contractor employees on your contracts. Make sure contractor managers meet their fire safety responsibilities.

f. If you are an ***organizational director*** at JSC, you must:

- Make sure that your facilities have emergency action plans.
- Make sure your facility managers are trained in emergency action and planning.
- Make sure your employees are trained about all possible hazards in the workplace and how to protect themselves for each possible emergency.

g. The ***Safety and Test Operations Division*** must monitor the building fire warden program and provide initial and refresher fire warden training.

18. Safety and health records

The following records document emergency preparedness:

a. Center-level – JSC 05900, "JSC Emergency Preparedness Plan," including all annexes, which is the responsibility of the Emergency Operations Center Office.

b. Organizational-level:

- Facility emergency action plans, which are the responsibility of the facility manager.
- Work area emergency action plans, which are the responsibility of the manager for areas mentioned in paragraph 15 above.

19. Measurement

JSC will measure emergency preparedness by whether or not each facility and critical or hazardous work area has an emergency action plan that is reviewed yearly.

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Appendix 3A

Forms

The following forms listed in this appendix are available electronically via form search at the following web address: http://forms.jsc.nasa.gov/

JSC Form 270	JSC Job-Related Physicals
JSC Form 1240	JSC Notice of Safety or Health Hazard and Action Plan
NASA Form 1584	Safety and Health Hazard Abatement Plan

The following forms are not available electronically. Contact Forms (Supply and Distribution) at extension 36164 unless otherwise stated below to get a copy, or copy one out of this appendix:

JSC Form 340	JSC Report of Occupational Injury or Illness (available at the JSC Clinic)

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Appendix 3B

Miscellaneous guidelines and instructions

This appendix contains the following attachments:

3.6A Workers' Compensation for Civil Service Employees

3.8A Emergency Actions

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Attachment 3.6A
Workers' compensation for civil service employees

1. Workers' compensation

This Appendix tells you how to apply for workers' compensation benefits as a civil service employee. The Federal Employee Compensation Act (FECA) provides workers' compensation benefits for civil service employees who are injured or become ill on the job. It also provides benefits to the survivors of those who die from job-related injuries or illnesses.

If you are a contractor employee, follow your company's process to apply for workers' compensation benefits.

2. Applying for workers' compensation as a civil service employee

To apply for workers' compensation, you must:

a. Tell your supervisor and go to the JSC Clinic if you have a job-related injury or illness.

b. Complete a JSC Form 340, "Report of Occupational Injury or Illness."

c. Call the compensation specialist at (281) 483-7792 to discuss your benefits and request a Form CA-1. Complete the Form CA-1, have your supervisor sign it, and send it to the Occupational Health and Human Test Support Office as soon as possible.

If you are injured, you must file a written notice of your injury on a Form CA-1 within 30 days of the injury to qualify for continuation of pay.

f. Get prior authorization from the compensation claims specialist before you seek private medical care. If it is an emergency, you may get private medical care without authorization. You must contact the compensation claims officer or specialist during the next working day.

g. Provide all information required to process your claim.

h. Submit to a medical examination if required to determine if you are medically disabled. If you don't submit to a medical examination, your claim may be denied.

i. Return to your job if you are found fit for full duty.

j. Accept a light duty assignment if you are partially disabled. Your attending doctor will determine your workload and length of time on light duty.

3. What to do in an emergency

If an employee is injured in an emergency:

a. Call your emergency number. The ambulance personnel will decide if the injured employee should go to the clinic or to a hospital.

b. If you are the employee's supervisor, you should go with the employee or send a coworker with the employee to the hospital.

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c. If you go with an injured employee to the hospital, contact the compensation claims specialist when you arrive. The compensation claims specialist will authorize medical treatment at that time.

d. If you are the employee's supervisor, you should contact the compensation claims specialist immediately after the ambulance personnel begin treating the injured employee and report the following:

- Name of the employee
- Whether the employee is a civil servant or contractor
- The nature of injury
- When, where, and how it happened
- The names of any witnesses
- Where the employee was taken

Remember, your emergency numbers are: x33333 at JSC and SCTF, x44444 at Ellington Field, 911 at any off-site location, and x5911 at White Sands Test Facility.

4. The compensation claims officer or specialist

The compensation claims officer or specialist will:

a. Counsel you and your supervisor about your responsibilities and benefits you have after an on-the-job injury or illness.

b. Help you and your supervisor complete the necessary forms, process the necessary forms he or she must complete, and submit the forms as soon as possible to the Office of Workers' Compensation Programs.

c. Help you and your management find and correct the cause of your injury or illness.

d. Monitor your claim and your medical information after it is approved to determine when you may return to work.

e. Authorize a clinic medical officer, your own doctor, or a hospital of your choice, to treat you.

f. Work with your supervisor, the Human Resources Office, and other management officials to provide you light duty assignments and make reasonable accommodations if you are partially disabled by job-related injuries.

g. Contact the Office of Workers' Compensation Program, to get the status of your claim, payment for compensation, and medical care.

h. Advise your supervisor, the Safety and Test Operations Division, and the Payroll Office how to charge lost time.

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i. Monitor all claims to verify all requirements are followed and only valid claims are paid. Submit necessary medical reports to the Office of Workers' Compensation Programs.

5. For more information on workers' compensation

You can find more information in NPD 1840.1, "NASA Workers Compensation Program."

6. Responsibilities for workers' compensation

a. As ***line manager***, you must:

- Make sure that your employees know and fulfill their responsibilities in paragraph 3 above.
- Fulfill your responsibilities in paragraphs 3 and 4 above.
- Help an injured or ill employee complete workers' compensation forms.
- Make sure lost time for injured employees is correctly charged. Contact the compensation claims specialist or Payroll Office for help.
- Contact compensation claims officer or specialist if you have valid proof that a claim should be denied as soon as possible.
- Support the investigation of mishaps that results in a workers' compensation claims.
- Take action to prevent such mishaps from happening again.

b. ***Site clinics*** must:

- Provide emergency or first-aid care for job-related injuries or illnesses.
- Document job-related injuries or illnesses.
- Give the compensation claims specialist any medical information required to support or deny a claim.

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Attachment 3.8A
Emergency actions

You must take the following actions in the following situations as described in the table below.

If you . . .	*Then . . .*
Hear a building fire alarm	• Leave the building immediately using the exit routes shown on the facility evacuation diagram on your floor. • DON'T use elevators to evacuate – ONLY emergency personnel involved in rescue operations are allowed to use the elevators. • If you need Rescue Assistance or are a designated "buddy" for a person needing rescue assistance, you should follow the procedures established for your building by the Facility Manager. See paragraph 8 of Chapter 3.8. • Help others evacuate the facility as needed without delaying your own evacuation or jeopardizing your safety. Use an alternate route if you can't use the primary exit route. • Shut down hazardous operations and secure classified material if you have time. • Go to a "safe area" designated by your supervisor or as stated in the Emergency Action Plan so he or she can account for you. Do not congregate in parking lots, since you may interfere with arriving fire fighting vehicles • Move your group to another area if the "safe area," isn't safe. • Remain at least 75 feet from the building in the assembly area until you get further instructions. • NEVER re-enter an evacuated area until declared safe by Safety personnel on the scene or the ALL CLEAR siren is sounded. • Never use vehicle parking areas as a "safe area" for assembly.
See a fire	• Evacuate people from the building by pulling the lever on a fire alarm pull box. This will ring the building fire alarm bells and signal the dispatcher. • Call your emergency phone number from a safe location to make sure the dispatcher got the alarm signal. • Say, "I am calling to report a fire..." • Tell the dispatcher where the fire is (building and room number), how big the fire is, and what type of fire it is (such as chemical, electrical, or paper). • Stay on the line until the dispatcher says you may hang up. The dispatcher may put your call on hold briefly while emergency units are dispatched. • Give the dispatcher any information you think would help the emergency personnel find the fire. • Tell the dispatcher your name and the extension you are calling from. • Meet the facility manager or emergency personnel near the building entrance if possible to relay vital information. • Go to a safe area designated by your supervisor so he or she can account for you. • NEVER re-enter an evacuated area until declared safe by Safety personnel on the scene or the ALL CLEAR siren is sounded.

Table continues on next page.

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Attachment 3.8A
Emergency actions
(cont.)

If you . . .	*Then . . .*
Smell smoke Smoke may come from many sources such as: • Fluorescent light ballast • Appliances such as coffee makers and stoves • Jammed paper in a copy machine • Electronics • Welding or cutting	• Try to find the source of the smoke as soon as possible if it is only a faint odor. • If you can't find the source of the smoke, call your emergency number to ask for help. • If the smell gets stronger, you see flames, or you see large amounts of smoke, evacuate people from the building by pulling the lever on a fire alarm pull box. • Call your emergency phone number from a safe location to make sure the dispatcher got the alarm signal. • Say, "I am calling to report that I smell smoke..." • Tell the dispatcher where you smelled the smoke (building and room number). • Stay on the line until the dispatcher says you may hang up. The dispatcher may put your call on hold briefly while emergency units are dispatched. • Give the dispatcher any information you think would help the emergency personnel find the smoke. • Tell the dispatcher your name and the extension you are calling from. • Meet the facility manager or emergency personnel near the building entrance if possible to relay vital information. • Go to a safe area designated by your supervisor so he or she can account for you. • NEVER re-enter an evacuated area until declared safe by Safety personnel on the scene or the ALL CLEAR siren is sounded.
See or are involved in a medical emergency on your site – even if it isn't work-related	• Call your emergency phone number from a safe location. • Say "I am calling to report a medical emergency. Please send an ambulance to..." • Tell the dispatcher where the emergency is (building and room number) and who the injured person is, if you know. • Stay on the line until the dispatcher says you may hang up. The dispatcher may put your call on hold briefly while emergency units are dispatched. • Tell the dispatcher what and how bad the injury is, whether it seems life-threatening, and whether the person is conscious or breathing. • Give the dispatcher any information you think would help the emergency personnel find the injured person. • Tell the dispatcher your name and the extension you are calling from. • Have someone meet the emergency personnel near the building entrance if possible. • Don't move the injured person unless he or she is clearly in a life-threatening situation. • Stay with the injured person until medical help arrives. • Make sure blood is cleaned up only by trained personnel.

Table continues on next page.

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Attachment 3.8A
Emergency actions
(cont.)

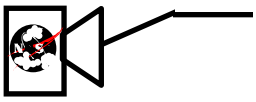
If you . . .	*Then . . .*
See an explosion, leaking gas, or a chemical spill	• Call your emergency phone number from a safe location. • Don't activate any fire alarms or evacuate any buildings. • Tell the dispatcher what you saw. • Tell the dispatcher what materials are involved, if you know. • Tell the dispatcher where the emergency is and how big the spill, leak, or explosion is. • Stay on the line until the dispatcher says you may hang up. The dispatcher may put your call on hold briefly while emergency units are dispatched. • Give the dispatcher any information you think would help the emergency personnel find the emergency. • Tell the dispatcher your name and the extension you are calling from. • Stay on the line until the dispatcher says you may hang up. • Stay in your safe location until you get further instructions.

JSC Employee Alarm System

Whoop (low to high siren) - Seek shelter and get more information

3-5 minute Wavering Tone - Attack Warning (nuclear or conventional) (air raid warning)

Wail (single, constant tone) - All Clear



Short Wail (like a noon whistle) - Periodic System Test (1st Thursday of every month at noon)

If you hear the employee warning system:

- Get inside a building as soon possible and warn others to stay inside.
- Close all doors and windows.
- Tell your facility manager, supervisor, or Safety Officer.
- Turn off the air handlers (call x33061 or x32028 for help at JSC).
- Call your emergency number if you have important information about the emergency.
- Move cross-wind to any chemical clouds.
- Stay inside until you get further instructions over the employee warning system.

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Part 4
Safety and health training

1. Description of Element 4

Part 4 describes Major Element 4 of the JSC Safety and Health Program, "Safety and Health Training." Training is necessary to reinforce and complement management's commitment to prevent exposure to hazards. All employees must understand the hazards to which they may be exposed and how to prevent harm to themselves and others from those hazards. Effective training enables employees to accept and follow established safety and health procedures.

Element 4 covers the following categories as sub-elements:

4.1 Program Description

4.2 Supervisor Training

4.3 Employee Training

4.4 Emergency Training

4.5 Personal Protective Equipment Training

4.6 Manager Training

The requirements, processes, and responsibilities for Element 4 are defined in the chapters for sub-elements.

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Chapter 4.1
Program description

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site. Paragraph 9 of this chapter lists the responsibilities of line managers, the Safety and Test Operations Division, Occupational Health Services, and the Human Resources Office.

2. Description of Sub-Element 4.1

JSC must have an effective program for safety and health training that makes sure employees understand the hazards they are exposed to and how to protect themselves and others from injury or illness. The program must include:

a. Requirements and schedules for safety and health training.

b. Tracking systems to ensure employees are current.

3. Reason for safety and health training

You must have safety and health training so that you:

a. Understand the hazards you may be exposed to and how to protect yourself and others.

b. Know safe and healthful work habits and have the skills to put them into practice.

c. Know and are able to carry out your safety and health responsibilities.

4. Training plans

Each directorate must maintain training plans that identify the safety and health training requirements for each position description. You may include these requirements in a general training plan for the employee's job. This plan must:

a. Be based on lower-level training plans or on the hazards each employee will face in his or her job.

b. Be reviewed yearly along with training records to:

- Make sure every employee and manager is up-to-date on training.
- See if the training plans need to be revised.

5. Other requirements you must follow for safety and health training

In addition to the requirements in this chapter, you must follow these standards as they apply to the work you do.

For . . .	*Follow . . .*

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Safety and health training for individual jobs	Individual chapters in this Handbook 29 CFR 1910, "Occupational Safety and Health Standards, General Industry" 29 CFR 1926, "Occupational Safety and Health Standards, Construction Industry" Chapter 6 of NPR 8715.1, "NASA Safety and Health Handbook Occupational Safety and Health Programs" Chapter 4 of NPR 8715.3, "NASA Safety Manual"
Certification requirements	Chapter 5.8, "Hazardous operations: safe practices and certification," of this Handbook Paragraph 4.4 of NPR 8715.3

6. Sources for safety and health training

The Safety and Test Operations Division and Occupational Health Services provide safety and health training through the JSC Safety Learning Center and Occupational Health Services. Some training is also available on computer-based moduleson the JSC Web or through the NASA HQ Site for On-line Learning and Resources (SOLAR) website https://solar.msfc.nasa.gov/solar/delivery/public/html/newindex.htm. You must register and get a password to use SOLAR.

a. If you are a civil service employee, you must take the training you need at the Safety Learning Center, throught the SOLAR website, or at Occupational Health Services if it is offered. If the training you need for your job isn't offered, your supervisor must provide training by any of the following means:

- Classes or briefings your organization or other JSC organizations develop
- Training from sources outside JSC

b. If you are a contractor, your company must provide training by any of the following means:

- Safety Learning Center or Occupational Health Services classes
- Classes or briefings your company or other JSC organizations develop
- Training from sources outside JSC

c. If you develop your own safety or health training classes or courses as a JSC organization, or contractor, you must:

- Have the Safety and Test Operations Division review outlines for safety-related training.
- Have the Occupational Health Branch review outlines for health-related training.

d. For more information on training schedules, check the Safety and Total Health Homepage (http://www4.jsc.nasa.gov/safety/Training/). You may also contact the Safety Learning Center at (281) 483-6369 if you need help finding safety training or Occupational Health Services at (281) 483-6726 if you need help finding health-related

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training.

7. Conducting safety and health training

JSC uses many methods for conducting safety and health training. These methods could range from formal classroom training to informal briefings in the work area. Safety and health trainers must know their subjects and provide high-quality training. Safety and health training must:

a. Apply to the student's jobs.

b. Be interesting.

c. Use different training aids and the latest technology.

d. Involve the students.

e. Include student feedback through course evaluations.

f. Include necessary safety and health information.

8. Awareness and motivation for safety and health

JSC provides awareness and motivation for safety and health through:

a. JSC's Unified Safety and Health Awareness Campaign (USHAC). See the Safety and Total Health Home Page at http://www4.jsc.nasa.gov/safety/index.htm, for more information.

b. Other awareness campaigns that use such things as:

- Posters and videos.
- The Safety and Total Health Newsletter.
- Alerts and flyers.
- Articles in the Space News Roundup.

c. Rewards for good safety and health performance; awards programs will follow Paragraph 1.14 and Appendix C of NPR 8715.3, "NASA Safety Manual"

d. Contests

e. Special events

9. Responsibilities for training, awareness, and motivation for safety and health

Responsibilities for safety and health training, motivation, and awareness are as follows:

a. As a ***line manager*** at any level, you must:

- Identify training requirements and maintain training plans for your employees or managers.

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- Make sure your employees and managers complete the courses indentified in their training plans.
- Review your training requirements yearly to make sure they are still valid.
- Analyze the hazards of each job your employees do to help you identify what safety and health training they need.
- Keep your employees and managers up-to-date on any required refresher training.
- Keep records on training you conduct or training from sources outside JSC as described in Paragraph 10 of this chapter.
- Promote Safety Learning Center and Occupational Health Services classes that would benefit your organization and encourage attendance by your employees and managers as applicable.

b. The ***Safety and Test Operations Division and Occupational Health Branch*** must:

- Identify JSC's overall training needs in consultation with the JSC Human Resources Office and provide training such as classes, videos, or self-study programs to fulfill those needs.
- Make sure training follows federal regulations, NASA, and JSC requirements.
- Develop training schedules for the Safety Learning Center and Occupational Health Services. Promote Safety Learning Center and Occupational Health Services classes. Post training schedules on the Safety Homepage at http://www4.jsc.nasa.gov/safety/Training/
- Keep records of Safety Learning Center and Occupational Health Services training as described in Paragraph 10 of this chapter.
- Review the contents of training courses conducted by NASA and contractor organizations.
- Help NASA and contractor organizations to prepare, update, and evaluate their training programs.
- Evaluate training effectiveness with employees and managers. Act on these evaluations to improve training.
- Keep Safety Learning Center and Occupational Health Services classes up-to-date.
- Involve employees in training activities such as identifying training needs, developing classes, and teaching classes.

c. The ***Human Resources Office*** will:

- Help fund safety and health training from outside sources.
- Make sure training from the Safety Learning Center or Occupational Health Services is entered in civil service employee training records.
- Integrate safety and health training into core training requirements for civil service

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employees and managers.

10. Safety and health records

Training records are required to document that employees attend training. At the Center level, the Safety Learning Center and Occupational Health Services keep attendance records on their classes. Even though the Safety Learning Center and Occupational Health Services keep attendance records, you may also keep your own records to show that you are current on any refresher training.

Organizational-level – if you as a line manager or JSC contractor:

a. Develop your own training, you must keep records of:
   - Who took the training and when (date and time).
   - What the training covered. For this, you may attach outlines or lesson plans.

b. Get training from outside the Safety Learning Center and Occupational Health Services, you must keep:
   - Proof that your employees took the training and when.
   - Handouts or course material.
   - Any other useful information such as who conducted the training.

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Chapter 4.2
Supervisor Training

1. Who must follow this chapter

You must follow this chapter if you are a line manager at JSC or a JSC field site.

2. Description of Sub-Element 4.2

Safety and health training for first line supervisors must follow the requirements of Chatper 4.1, "Program Description." The training must ensure that supervisors:

a. Understand their safety and health responsibilities and are able to carry them out effectively.

b. Are aware of hazards, how to recognize hazardous conditions, and the signs and symptoms of workplace-related illnesses.

c. Know safe work procedures to follow to protect themselves and their employees from hazards.

3. General training or awareness in safety and health

As a first line supervisor, civil service or contractor, you must:

a. Be aware of federal regulations and NASA requirements, including:

- The Occupational Safety and Health Act and Executive Order 12196, "Occupational Safety and Health Programs for Federal Employees."
- OSHA requirements in 29 CFR 1910, "Occupational Safety and Health Standards, General Industry," and 29 CFR 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters," for civil service employees.
- NASA's and JSC's safety and health programs.
- Copies of the above documents must be available to you.

b. Be aware of available training opportunities.

c. Take core safety and health training listed at http://hro.jsc.nasa.gov/training/plan/core_trng.htm and:

- Basic hazard communication and emergency response training when you first report to work and then every year.
- Other manager safety training as required.

d. Know how to recognize hazards.

e. Be aware of JSC's involvement with OSHA's Voluntary Protection Program.

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f. Have safety and health training for your job and your employee's jobs such as:

- What safety and health requirements apply to your job or your employees' jobs.
- What hazards you and your employees face on the job.
- How to protect yourself and your employees from injury or illness on the job.
- What protective equipment you or your employees need, how to use it, and how to care for it.
- How to report hazards, close calls, and mishaps.
- How to fulfill your safety and health responsibilities.
- Hazard-specific training that is required for activities such as those involving: asbestos, lasers, confined space, and lock out/tag out. See other chapters in this Handbook for specific requirements.

4. Other safety and health training

If you fulfill any of the other duties listed in the table below, you must take the required training listed.

If you are . . .	***Then you must have . . .***
A responder to hazardous material releases	Training in emergency response to the level of response you will provide in an emergency as described in 29 CFR 1910.120(q)
A Fire Warden	Fire Warden training
Identified as a "technical expert"	Mishap Investigation Training
A facility manager	Facility manager with facility manager fire certification course Lockout/Tagout course

To find the training required for your employees' jobs, see the chapters in this Handbook that apply to their jobs. Also see 29 CFR 1910.

5. Responsibilities

Chapter 4.1 lists the responsibilities for safety and health training.

6. Safety and health records

Chapter 4.1 lists the records required for safety and health training.

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Chapter 4.3
Employee Training

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site.

2. Description of Sub-Element 4.3

Employee training must follow the requirements in Element 4.1, "Program Description." Safety and health training for employees must ensure that employees:

a. Are aware of hazards, how to recognize hazardous conditions, and the signs and symptoms of workplace-related illnesses.

b. Know safe work procedures they must follow to protect themselves from hazards, through training provided at the same time they are taught to do a job and through reinforcement.

3. General training or awareness in safety and health

As a JSC civil service or contractor employee, you must:

a. Be aware of federal regulations and NASA requirements, including:

- The Occupational Safety and Health Act and Executive Order 12196, "Occupational Safety and Health Programs for Federal Employees."
- OSHA requirements in 29 CFR 1910, "Occupational Safety and Health Standards, General Industry," and 29 CFR 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters," for civil service employees.
- NASA's and JSC's safety and health programs.
- Copies of the above documents must be available to you.

b. Be aware of available training opportunities.

c. Take core safety and health training listed at http://hro.jsc.nasa.gov/training/plan/core_trng.htm and basic hazard communication and emergency response training when you first report to work and then every year.

d. Know how to recognize hazards.

e. Be aware of JSC's involvement with OSHA's Voluntary Protection Program.

f. Have safety and health training for your job and your employee's jobs such as:

- What safety and health requirements apply to your job or your employees' jobs.
- What hazards you and your employees face on the job.

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- How to protect yourself and your employees from injury or illness on the job.
- What protective equipment you or your employees need, how to use it, and how to care for it.
- How to report hazards, close calls, and mishaps.
- How to fulfill your safety and health responsibilities.
- Hazard-specific training that is required for activities such as those involving: asbestos, lasers, confined space, and lock out/tag out. See other chapters in this Handbook for specific requirements.

4. Other safety and health training

If you fulfill any of the duties below you must take the training listed in the table. If you think you don't have the right safety and health training, tell your supervisor.

If you are . . .	***Then you must have . . .***
A responder to hazardous material releases	Training in emergency response to the level of response you will provide in an emergency as described in 29 CFR 1910.120(q)
A Fire Warden	Fire Warden training
Identified as a "technical expert"	Mishap Investigation Training
A facility manager	Facility manager with facility manager fire certification course Lockout/Tagout course

To find the training required for your employees' jobs, see the chapters in this Handbook that apply to their jobs. Also see 29 CFR 1910.

5. Responsibilities

Chapter 4.1 lists the responsibilities for safety and health training.

6. Safety and health records

Chapter 4.1 lists the records required for safety and health training.

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Chapter 4.4
Emergency training

1. Who must follow this chapter

You must follow this chapter if you work at or visit JSC or a JSC field site.

2. Description of Sub-Element 4.4

JSC line managers, non-supervisory employees (including contractor employees), and visitors on site must understand what to do in emergency situations.

3. Fire drills

The emergency you are most likely to encounter at JSC is a fire in your building. Training for fire evacuation includes a yearly fire drill for your building. If you are in the building during a fire alarm, you must evacuate the building as described in Chapter 3.8. Whether this is a drill or a real alarm, it will count as an evacuation drill. The following requirements apply:

a. The building's chief fire warden will receive notice stating the date and time of the drill. If the drill cannot be conducted when scheduled, it must be rescheduled. It will be a surprise to the building occupants.

b. Floor fire wardens are responsible for all persons involved in a fire drill and for seeing that drill procedures are followed.

c. When everyone has evacuated the building and is accounted for, a uniformed Fire Protection Specialist from the Safety and Test Operations Division will declare the drill terminated and notify building occupants to return to the building.

d. Any actual evacuation caused by a fire protection system, whether real or due to a malfunction, will count as an annual drill.

4. Make up fire drills and fire evacuation training

If you are out of the building during a fire drill, your supervisor must provide evacuation training, which includes:

a. A review of the evacuation route and procedures and any lessons learned from the fire drill, plus special considerations if you are physically challenged.

b. Walking you through an evacuation to the designated assembly area.

Make-up fire drills and fire evacuation training are only required once a year, regardless of how many times the alarm sounds in the building.

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5. Other emergency training

Certain buildings or work areas have potential emergencies beyond fire evacuation. If you work in one of these buildings or areas, you must:

a. Receive training in emergency procedures for your building or work area.

b. Participate in emergency drills to reinforce the training at least once a year or more frequently if required.

6. Visitor training

All visitors must view the videotape at Building 110 and review the information on the visitor badge card before coming on site.

If you are escorting visitors in your work area, you must inform them of any special emergency procedures and make sure they follow those procedures if an emergency occurs.

7. Responsibilities

Responsibilities for emergency training are as follows:

a. As a ***line manager,*** you must make sure your employees:

- Participate in a fire drill or receive fire evacuation training at least once a year. Document the participation or training on JSC Form 2150.
- Are aware of other emergencies that could happen in their work areas and the procedures to respond to those emergencies. This may include formal training as necessary.
- Participate in any other emergency drills required for their work areas.

b. The ***Security Branch*** is responsible for providing safety and health information to visitors via the visitor badge card.

c. If you escort visitors, you are responsible for making sure the visitors understand what to do in any emergency that could occur in their work areas.

7. Safety and health records

As a line manager, you must maintain the following Organizational-level records to document your emergency training:

a. JSC Form 2150, “Building Evacuation Accountability Record,” to document fire evacuation training or participation in fire drills for your employees at least once each fiscal year.

b. Records of other required emergency training or emergency drills in your work areas.

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Chapter 4.5
Personal protective equipment training

1. Who must follow this chapter

You must follow this chapter if you or your employees use personal protective equipment (PPE).

2. Description of Sub-Element 4.5

Where PPE is required, employees must use it properly. The training must be specific to the PPE the employees will be using and cover the following:

a. When it is required and what PPE is necessary.

b. Why it is required.

c. Its limitations.

d. How to use it properly.

e. How to properly care for and maintain it.

3. PPE training

PPE training must follow the requirements in Chapter 4.1 and cover the items mentioned in Paragraph 2 above.

4. Responsibilities

As a ***line manager***, you are responsible for making sure your employees have the necessary PPE training if PPE is required in their work areas.

5. Safety and health records

Organizational-level records of PPE training must follow the requirements for training records in Chapter 4.1.

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Chapter 4.6
Manager Training

1. Who must follow this chapter

You must follow this chapter if you are a manager at any level above first line supervisor.

2. Description of Sub-Element 4.6

Safety and health training for managers at all levels above first line supervisors training must follow the requirements in Element 4.1, "Program Description." The training must ensure that these managers:

a. Understand their safety and health responsibilities and are able to carry them out effectively.

b. Are aware of hazards, how to recognize hazardous conditions, and the signs and symptoms of workplace-related illnesses.

c. Know safe work procedures to follow to protect themselves and their employees from hazards.

3. General training or awareness in safety and health

As a manager above the first-line supervisor level, you must:

a. Be aware of federal regulations and NASA requirements, including:

- The Occupational Safety and Health Act and Executive Order 12196, "Occupational Safety and Health Programs for Federal Employees."
- OSHA requirements in 29 CFR 1910, "Occupational Safety and Health Standards, General Industry," and 29 CFR 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters," for civil service employees.
- NASA's and JSC's safety and health programs.
- Copies of the above documents must be available to you.

b. Be aware of available training opportunities.

c. Take core safety and health training listed at http://hro.jsc.nasa.gov/training/plan/core_trng.htm and:

- Basic hazard communication and emergency response training when you first report to work and then every year.
- Other manager safety training as required.

d. Know how to recognize hazards.

e. Be aware of JSC's involvement with OSHA's Voluntary Protection Program.

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f. Be trained to fulfill your safety and health responsibilities.

4. Other safety and health training

If you fulfill any of the other duties listed in the table below, you must take the required training listed.

If you are . . .	***Then you must have . . .***
A responder to hazardous material releases	Training in emergency response to the level of response you will provide in an emergency as described in 29 CFR 1910.120(q)
A Fire Warden	Fire Warden training
Identified as a "technical expert"	Mishap Investigation Training
A facility manager	Facility manager with facility manager fire certification course Lockout/Tagout course

To find the training required for your employees' jobs, see the chapters in this Handbook that apply to their jobs. Also see 29 CFR 1910.

5. Responsibilities

Chapter 4.1 lists the responsibilities for safety and health training.

6. Safety and health records

Chapter 4.1 lists the records required for safety and health training.

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Part 5
Safety and health practices for everyone

This could be you . . .

A bookcase that was stacked on an office table fell and almost hit someone.

An employee fell and strained his back when he backed into a box in the aisle.

1. Who must follow Part 5

You must follow Part 5 if you work at JSC or a JSC field site. The following table tells you which chapters from Part 5 apply to what jobs.

If you . . .	***Then you must follow . . .***
Work in any area at JSC or JSC field sites	• Chapter 5.1, "Fire safety" • Chapter 5.2, "Office and general work area safety" • Chapter 5.4, "Indoor air quality requirements" • Chapter 5.5, "Ergonomic requirements" • Chapter 5.7, "Asbestos in the workplace"
Drive, walk, or bicycle at JSC, Ellington Field, or the Sonny Carter Training Facility	• Chapter 5.3, "Driving, walking, and bicycling safely"
Use any personal protective equipment, even if you only use ear plugs, safety glasses, or hardhats occasionally	• Chapter 5.6, "Using and maintaining personal protective equipment"
Do any work in an area that contains asbestos, such as a ceiling	• Chapter 5.7, "Asbestos in the workplace"
Do any hazardous operations	• Chapter 5.8, "Hazardous Operations, Safe Practices and Certification"

2. How to use Part 5

Part 5 provides you with safe work practices that apply to most JSC employees. Read and follow the requirements that apply to your job. Keep in mind, even though you may work in an office, you may visit hazardous areas occasionally. If you do, make sure you find out what requirements you must follow in those areas and what personal protective equipment you will need such as safety glasses, ear plugs, or hard hats.

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Chapter 5.1
Fire safety

This could be you . . .

An office employee allowed an excessive amount of paper to accumulate around his work area. When a short developed in an electrical outlet, a fire quickly destroyed the office contents before it was extinguished.

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site. Paragraph 21 lists the responsibilities of Organizational Directors, Facility Managers, JSC's Center Director, and the Safety and Test Operations Division.

2. What this chapter covers

This chapter describes JSC's fire safety program and covers the actions that you must take in your daily work activities to recognize possible fire risks, conditions that could cause a fire to develop and grow, and conditions that can interfere with safe and orderly evacuation in case of a fire.

You can find additional fire protection requirements in NASA's "Safety Standard For Fire Protection," NASA-STD-8719.11.

Fire safety program

3. JSC's fire safety program

JSC's fire safety program seeks to apply recognized standards to protect life and property from fire. It also provides standard procedures for evacuating buildings in case of a fire. A strong fire safety program also increases awareness of fire safety and fire hazards so that you can maintain a safe and healthy workplace and reduce the chance of death, injury, or property damage from fire.

JSC's fire safety program covers four areas of fire protection: education, prevention, detection, and suppression. It provides consistent, comprehensive methods for JSC to prevent fires and deal with them if they happen. The program covers:

a. Fire prevention which includes:

- Management supporting and following fire rules, regulations, and codes.
- Education, training, and motivation of all employees in the causes and prevention of

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fires.

- Building fire warden program.
- Inspections of all work areas and other facilities to identify possible fire risks.
- Fire risk assessments of mission operations, test configurations, laboratory equipment, storage areas, flight hardware, essential data and records, and high value or mission critical equipment.
- Design and construction of buildings that limit the spread of fire and smoke.
- Fire drills, emergency evacuation plans, and emergency action plans.

b. Fire detection which includes:

- Installing and maintaining smoke and heat detectors throughout buildings.
- Installing manual pull stations near outside exits and entrances to stairwells.
- Installing and maintaining alarms throughout buildings to notify occupants of a fire.

c. Fire suppression includes:

- Installing and maintaining sprinkler, Halon, clean agent, and carbon dioxide systems
- Inspecting monthly and maintaining portable fire extinguishers
- Training building fire wardens and their assistants to use fire extinguishers

4. What you need to know about the JSC fire safety program

As a JSC employee, you must take measures to prevent fires in your work area and react properly if a fire occurs. You must be familiar with the requirements in this chapter. Other chapters in this Handbook cover parts of JSC's fire safety program as follows:

a. Fire inspections and surveys – Chapter 2.5, "Routine Inspections."

b. Fire wardens – Chapter 3.8, "Emergency Preparedness."

c. Fire drills – Chapter 4.4, "Emergency Training."

5. Fire prevention plans

Each JSC building must have a fire prevention plan that includes:

a. A list of the major workplace fire hazards and procedures for properly handling and storing flammable or combustible materials.

b. Potential ignition sources (such as welding, smoking, and others).

c. Procedures for controlling the hazards and ignition sources to include the kinds of fire protection equipment or systems available in the building.

d. Names or regular job titles of those personnel responsible for maintaining equipment and

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systems installed to prevent or control ignitions or fires.

e. Names or regular job titles of those personnel responsible for controlling fuel source hazards.

f. Housekeeping procedures to control accumulations of flammable and combustible waste materials and residues so that they do not contribute to a fire emergency.

6. Facility design, fire detection, and fire suppression

See Chapter 10.1, "General safety and health requirements for facility design, construction, and operation," for fire safety requirements involving facility design, fire detection, and fire suppression.

Fire safety practices

7. Precautions you should follow to prevent fires

You must follow good fire prevention practices to reduce the chance of a fire or to allow JSC to deal with a fire. The following table describes many of these precautions and practices.

For . . .	***Follow this precaution . . .***
Access to buildings and emergency equipment	• Keep at least one-half the width, but not less than 16 feet (14 feet for existing buildings), of a service driveway open at all times to allow access by fire trucks. • Never park in areas marked with a yellow or red curb. • Never place or store any items of stock, furniture, equipment, recycle bins, janitor equipment, interior decoration, vehicles, debris, or other substantial physical object in any exit routes such as a corridor, exit door, stairwell, or exit without the approval of the Safety and Test Operations Division. • Never place objects in locations which restrict ready access to or use of fire protection equipment such as fire extinguishers, alarm pull stations, hydrants, fire hose outlets, Siamese connections, fire alarm panels, or sprinkler riser valves. • Indicate the location of any fire extinguisher not readily visible, using a sign with the lettering "Fire Extinguisher" above the fire extinguishers. Existing painted red squares are acceptable. Remove or paint over signs or red squares if the fire equipment is relocated or taken out of service. • Fire extinguisher signs located in corridors must be visible from the ends of the corridor. • Put signs denoting "Fire Alarm" over fire alarm pull boxes when they are not readily visible from a distance.

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For . . .	*Follow this precaution . . .*
Hot work such as open flames, burning, cutting, or welding	• Never have open flames in your work area without following the hot work requirements in Chapter 5.8, "Hazardous operations: safe practices and certification," of this handbook. The exception to this requirement is open flames or hot work in areas designed for it such as Bunsen burners in laboratories or designate hot work areas. Keep combustible and flammable materials away from all open flames and hot work. • Follow Chapter 8.4, "Welding, cutting, and brazing safely," of this handbook.
Fire safety in construction areas, maintenance areas, work areas, and janitorial areas (includes offices and storage areas)	• Keep at least an 18-inch clearance between the deflectors of sprinkler heads and materials or furniture below. This doesn't apply to cabinets or shelving placed against a wall unless the shelving is directly under a sprinkler head. • Never use flammable liquids in janitorial operations. All janitorial supplies must be stored in a safe manner such as in closets or cabinets specifically designed for this purpose.

8. Smoking at JSC

Smoking is strictly prohibited inside all government-owned or government-leased facilities. You may smoke in outdoor areas unless the area is posted as "no smoking" due to nearby hazardous activities or storage. Dispose of cigarette butts in ashtrays and make sure they are out. Limit smoking to ground level locations to avoid the potential of cigarette butts falling from an outside balcony. Do not place paper or other combustibles in ashtrays or other cigarette receptacles.

9. Widths for exit routes

You must arrange your work area to maintain the exit widths shown on the diagram in Attachment 5.1A, Appendix 5. Report any violations of the exit widths that you cannot control, such as doors or hallways, to your supervisor or facility manger. These are the minimum acceptable widths based on the Life Safety Code, NFPA 101. The JSC Furniture Office may require wider exit widths to allow them to move furniture easily.

10. Maximum number of people permitted in a conference room or other assembly area to allow a safe exit in case of a fire

If there are too many people in a room or area, they may have problems evacuating safely if a fire occurs. As a facility manager, you must calculate and post the maximum number of people allowed in each conference room or assembly area in your building. You may set the maximum posted occupant load at less than the load you calculate below. A fire protection engineer is available from the Safety and Test Operations Division to help you, if needed. Use these requirements to calculate and post the maximum occupant load:

Post occupant loads at the entrance to all conference rooms and other assembly areas with an occupant load of 50 or more persons. For rooms or assembly areas with occupant loads of

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fewer than 50 persons, you may list the occupant load on table tents or signs inside the room in the assembly area.

Calculate the maximum occupant load using all of the following steps. Normally, the load will be the number you calculate in steps a or b, but you may have to reduce the number based on your checks in step c:

a. If the room has fixed seats (permanently attached to the floor), then the maximum occupant load is the number of fixed seats unless you must reduce the load based on your checks in subparagraph c below. Allow no one to sit or stand in the aisles.

b. If the room doesn't have fixed seats:

- Find the net area of the room by calculating the area of the floor and deducting the square footage of any partitions, cabinets, conference tables, or other furniture which are not normally moveable. Do not deduct the square footage occupied by moveable chairs or other moveable furniture or equipment.
- Divide the net square footage of the room you calculated above by 12 square feet for a square room and 11.5 square feet for a rectangular-shaped room. This is the maximum occupant load of the room unless you must reduce the load based on your checks in subparagraph c below.

c. Check all of the following to see if you must reduce the maximum occupant load you calculated in a or b above:

- If the exit doors have latches not operated by panic bars, the maximum occupant load is 99 persons or the number you calculated in a or b above, whichever is less.
- If the room only has one exit or if **any** exit doors swing into the room, the maximum occupant load is 49 persons or the number you calculated in a or b above, whichever is less.
- Divide the sum of the clear widths in inches of all exit doors in the room by 0.2 inches per person. Clear width is the width of the opening through the fully open doorway, not the width of the door frame. This step usually applies only to large rooms. The maximum occupant load will be the lesser of this number or the number you calculated in any of the above steps.
- The Facility Manager must report changes to occupancy capacities to the JSC Facility Manager Coordinator yearly for updating the conference room capacity directory in the phone book and on line.

11. Controlling the maximum occupant load

Facility managers, those who reserve conference rooms, and those sponsoring or chairing meetings all have a role in making sure occupant loads aren't exceeded:

a. If you are a facility manager, you must remove excess chairs in conference rooms to meet occupancy loads. Chairs may be added up to the maximum calculated occupant load.

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b. If you take reservations for conference rooms, you must provide information or documentation about the occupant load responsibilities to those who use rooms. This information is available from the facility manager.

c. If you sponsor or chair a meeting in an assembly room or area, you must make sure that the posted occupancy load isn't exceeded. In the event of an emergency, you are responsible for safely evacuating the meeting attendees.

d. Meeting attendees may be seated or standing as long as the occupant load isn't exceeded. Exceptions to this rule are:

- You must include physically challenged individuals in wheelchairs who cannot use fixed seating in the occupant load count.
- Don't include event fire marshals in the occupancy count, in large areas such as Building 2 auditorium, Building 30A auditorium, or the Gilruth Center.
- Persons are not allowed to stand in the aisles in a room with fixed seating. See Paragraph 10a, above.

e. The Safety and Test Operations Division will monitor compliance with these requirements.

12. Fire extinguishers

You must know that:

a. You must never try to put out fires unless you have had fire extinguisher training.

b. Fire extinguishers are installed in JSC facilities regardless of the fire control measures.

c. If you see smoke or a fire, call your emergency number and start an evacuation BEFORE using an extinguisher. Don't depend on the fire extinguisher alone to put out the fire.

d. Portable fire extinguishers are designed to put out small fires when they first start. To use one successfully you must have:

- An extinguisher nearby and in good working order.
- The proper type of extinguisher for the class fire that occurs. See the glossary for "classes of fire" definitions.
- A small enough fire for the extinguisher to be effective.

e. If you elect to use a fire extinguisher, always maintain a clear path to an exit.

f. You must not move fire extinguishers in buildings to another location without coordinating with the on-site Fire Protection Emergency Services Coordinator, extension 35324.

g. Forklifts, other powered industrial trucks, and digging equipment must be equipped with a fire extinguisher in good working order. The equipment operators must inspect the

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extinguishers monthly. Mount fire extinguishers horizontally on this equipment to minimize the affects of settling of the extinguishing powder.

h. Fire extinguishers located in buildings must be mounted on a wall with the bottom at least 4 inches off the floor.

13. Fire safety practices

Good housekeeping is an effective way to prevent fires and allow quick evacuations and access to emergency equipment. Follow these practices:

a. Keep all offices, workplaces, passageways, storerooms, break rooms, and service rooms free from items that could restrict an orderly evacuation or block access to emergency equipment if a fire occurs. Avoid excessive paper and other combustibles in your work area as that can increase the fire load. Note: a messy desk isn't necessarily an increased fire load, but large stacks of paper in an office or other area is. See additional information in Chapter 5.2.

b. Provide containers to separate waste, trash, oily rags, used rags, and other refuse if necessary. Use covered metal containers for garbage, oily wastes, flammable wastes, or hazardous wastes such as caustics, acids, and harmful dust.

c. Provide metal cans with tight-fitting, self-closing lids where cloth rags or paper towels saturated with oil, paint, ink, or other combustible or flammable liquid are found. These areas could include vehicle and aircraft repair shops, paint shops, printing or reproduction areas, and essential electronic equipment areas. These cans must be emptied at the end of each work shift.

d. Store all loose rags, whether used or unused, in a self-closing, approved metal container.

e. Never store anything in mechanical and boiler rooms, electrical equipment rooms, halls or corridors, utility tunnels, and stairwells. Never store anything under stairs.

f. Never use wooden waste containers near electrical equipment or other ignition sources. NOTE: Small wooden wastebaskets found in offices are allowed.

g. Use only metal trash cans with self-extinguishing or garbage can type lids in computer rooms.

h. Keep the wall space above coffee pots, microwaves, and other ignition sources clear of paper, posters, and other combustible material.

i. Do not overload receptacle circuits with too many coffee pots, microwaves, refrigerators, and other appliances.

j. Keep combustible trash and debris from accumulating by:

- Doing a periodic (at least yearly) housecleaning to remove things that no longer serve a useful purpose. This is especially important in offices and research laboratories where large amounts of publications, files, and loose paper may be found.
- Putting trash and rubbish in approved containers daily.

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- Removing waste from buildings daily or often enough to prevent an excessive accumulation of waste.
- Doing a daily housecleaning in areas that generate a large quantity of combustible trash and debris such as woodworking shops or building construction sites. Remove all refuse from the area or deposit it in appropriate receptacles.
- Providing enough waste cans in all areas.

k. Do not allow paper or other combustible materials to fall or rest on power strips, tombstones, or other electrical devices.

l. Keep at least a 44-inch path open in corridors, stairs, and major hallways. Keep at least a 36-inch path open for other passageways you use to reach an exit such as your work area, aisles, stairs, ramps, and doors. Stairs may be 36 inches wide where the total occupant load off all stories served by the stairs is fewer than 50 people. See Paragraph 9 of this Chapter.

a.

Requirements for flammable materials

14. How to store, handle, or transport flammable materials

To store, handle, or transport flammable materials, you must follow these requirements:

a. For compressed gases, follow the requirements in Compressed Gas Association Pamphlet CGA P-1-2000, "Safe Handling of Compressed Gases in Containers," as found in 29 CFR 1910.101(b), “Compressed Gas Cylinders.”

b. For flammable and combustible liquids, follow NFPA Standard 30, "Flammable and Combustible Liquids Code," NASA-STD-8719.11, “Safety Standard for Fire Protection,” and this chapter which, in some cases, is more stringent. Combustible liquids must meet the same requirements as flammable liquids when they are heated to or above their flash points.

c. This chapter applies only to storing and handling of ordinary flammable and combustible liquids, such as gasoline, alcohol, and kerosene. You may have to follow additional requirements to safely store and use liquids that:

- Have unusual burning characteristics.
- Could self-ignite when exposed to air.
- Are highly reactive with other substances.
- Are subject to explosive decomposition.
- Have other special properties that require greater safeguards than this chapter requires.

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d. Never use flammable liquids for cleaning purposes other than in dip tanks that meet NFPA 30 standards.

e. Identify and label all containers of flammable and combustible liquids as described in Chapter 9.2, "Hazard communication," of this Handbook. You may use the NFPA's segmented diamond symbol (NFPA Standard 704) to show the health hazard, flammability, and reactivity of the liquid on the container.

15. Flammable and combustible liquids

As defined by the most recent version of NFPA 30, the "Flammable and Combustible Liquids Code":

a. Flammable liquids have a closed cup flash point below 100°F (37.8°C) and have a vapor pressure at or below 40 psia (2068 mm Hg) at 100°F (37.8°C). They are known as Class I liquids.

b. Combustible liquids have a closed cup flash point at or above 100°F (37.8°C). They are known as Class II and III liquids.

c. The following table gives the basic criteria for the classes.

Type	***Class***	***Flash point***	***Boiling point***
Flammable	IA	Below 73°F (22.8°C)	Below 100°F (37.8°C)
Flammable	IB	Below 73°F (22.8°C)	At or above 100°F (37.8°C)
Flammable	IC	At or above 73°F (22.8°C) & below 100°F (37.8°C)	N/A
Combustible	II	At or above 100°F (37.8°C) & below 140°F (60°C)	N/A
Combustible	IIIA	At or above 140°F (60°C) & below 200°F (93°C)	N/A
Combustible	IIIB	At or above 200°F (93°C)	N/A

16. Safely storing flammable or combustible liquids outdoors

You must follow these requirements, as described in NFPA 30 (2000), Subsection 4.7:

a. You may store flammable or combustible liquids contained in flammable liquid storage cabinets next to a building. Paragraph 16, except Subparagraph 16.d, below, applies.

b. Locate flammable or combustible liquids stored in a hazardous materials storage locker a minimum of 20 feet from the nearest building. Refer to NFPA 30 (2000), Subsection 4.6.

c. For flammable or combustible liquids stored in closed containers, but outside approved flammable liquid cabinets or lockers, maintain the following distances from adjacent buildings:

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Class	*Maximum Quantity, gallons*	*Distance From Building, feet*	*Distance to Street, feet*
IA	1100	50	10
IB	2200	50	10
IC	4400	50	10
II	8800	25	5
III	22000	10	5

- If the total quantity stored does not exceed 50 percent of the maximum quantity listed in the above table, the distances can be reduced 50 percent, but not less than 3 feet.
- When two or more classes are stored together, the most stringent requirements apply.
- If the adjacent building meets the construction requirements of NFPA 30 (2000), Subsection 4.7.2, the closed container can be placed next to the building.

d. Clear all dry grass, weeds, and other combustibles around the storage area for a minimum distance of 50 feet from any container storage.

e. For assistance, contact the Safety and Test Operations Division..

17. Safely storing flammable or combustible liquids indoors

If you store flammable or combustible liquids indoors, you must:

a. Store flammable liquids in approved flammable liquid storage cabinets, as described in NFPA 30 (2000), Subsection 4.3.

b. Mark cabinets with conspicuous lettering: FLAMMABLE - KEEP FIRE AWAY.

c. Never store more than 120 gallons of Class I, Class II, and Class IIIA liquids in one storage cabinet. Never include more than 60 gallons of Class I and Class II liquids in the 120-gallon total.

d. Never have more than three such cabinets in a single fire area. In an industrial occupancy fire area, you may have additional cabinets in the same fire area if:

- You keep them in groups of no more than 3.
- You have at least 100 feet between each group of cabinets.

e. Make sure the manufacturer’s bungs are in place if cabinets aren’t vented to the outside of the building.

f. Never store cylinders of propane or other flammable gases in flammable liquid storage cabinets.

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g. Venting of flammable liquid storage cabinets is not recommended for fire protection purposes. However, if the cabinet is required to be vented by the Occupational Health and Human Test Support Office, you must vent the cabinet directly to the outdoors. Vent systems must not decrease the ability of the cabinet to protect the contents in a fire. A fire protection engineer in the Safety and Test Operations Division must review and approve proposed vent designs before installation.

18. Other indoor storage facilities you must use

If larger quantities of flammable or combustible liquids than allowed in Paragraph 16 are required to be stored inside, the room requirements are based on the liquid quantities and type room involved. Contact a fire protection engineer in the Safety and Test Operations Division for assistance.

a. All electrical equipment in inside rooms used for storing Class I liquids must meet the requirements for Class I, Division 2, locations as defined in Articles 500 - 501 of NFPA 70, "National Electrical Code." Ordinary electrical equipment is acceptable in areas that store Class II and III liquids if you never store Class I liquids in that area.

b. Storage limitations and guidelines for inside storage rooms must follow NFPA 30 (2000), Subsection 404.

c. Inside storage rooms where liquids are dispensed have special storage limitations. See NFPA 30 (2000), subsection 404.

19. Storing small quantities of flammable or combustible liquids in an office or wet laboratory environment

a. In an office or business environment, you must follow NFPA 30, "Flammable and Combustible Liquids Code." You must also limit the quantities to the amount required for operation of office equipment, maintenance, demonstration, and laboratory work, with the following limits:

- Approved metal or plastic containers of flammable liquids that are stored outside of a flammable liquid storage cabinet must not exceed a capacity of 1 gallon. When stored in approved safety cans, the maximum amount is 2 gallons.
- You may store no more than 1 pint of Class 1A liquid and no more than 1 quart of Class 1B liquid in glass containers outside of a flammable liquid storage cabinet.
- You may store no more than 5 gallons of flammable and combustible liquids, combined in a single fire area outside of flammable liquid storage cabinets. When stored in approved safety cans, the maximum amount is 25 gallons.

b. Storage of flammable and combustible liquids in areas considered to be wet chemical laboratories must meet NFPA 45, "Standard on Fire Protection for Laboratories Using Chemicals." This standard has different requirements for storing flammable and combustible liquids than NFPA 30, "Flammable and Combustible Liquids Code." A

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"wet chemical" laboratory is one whose primary activity is mixing and using liquid chemicals.

c. See the following table for the combined quantities (gallons) of flammable and combustible liquids you may store in a wet chemical laboratory

	Excluding Quantities in Storage Cabinets or Safety Cans		**Including Quantities in Storage Cabinets or Safety Cans**	
	Max. Quantity per 100 ft^2 of Laboratory Unit (gallons)	Max. Quantity per Laboratory Unit (gallons)	Max. Quantity per 100 ft^2 of Laboratory Unit (gallons)	Max. Quantity per Laboratory Unit (gallons)
Sprinklered	1.1	75	2	150
Non-sprinklered	1.1	37	2	75

Note: A "laboratory unit" is laboratory space separated from other parts of the building by fire resistant construction. Without any separation, the entire building becomes the "laboratory unit". Contact a fire protection engineer in the Safety and Test Operations Division if you need help.

20. Handling large quantities of flammable or combustible liquids

Follow these requirements for handling large quantities:

a. You must transfer, dispense of, or mix Class I or Class II liquids in quantities larger than 5 gallons only in facilities specifically designed and constructed for such operations. The Safety and Test Operations Division must approve plans and specifications for such buildings.

b. Never fuel vehicles in a building unless you are authorized to do so in writing by the Safety and Test Operations Division. Vehicles in facilities must have full fuel tanks.

c. Store flammable liquids that require refrigeration in explosion-proof refrigerators or freezers.

d. Refer to NFPA 30 (2000), 4.5.2, for requirements for storing flammable or combustible liquids in warehouses.

21. Responsibilities under JSC's fire safety program

The following individuals and organizations have responsibilities under the fire safety program:

a. As an ***organizational director***, you must:

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- Carry out JSC's fire safety program described in this chapter.
- Evaluate your operations and valuable inventories to make sure that no undue fire risks exist. A fire protection engineer from the Occupational Safety and Quality Assurance Branch can help you do risk assessments or help you by providing technical assistance and fire code interpretations.

b. As a ***facility manager***, you must manage the fire safety program in your facility with the help from the line managers, contract project managers, and assistant fire wardens. This includes the following:

- Make sure everyone in your building follows facility fire rules, regulations, and fire codes. This is done through education and training in the causes and prevention of fires.
- Be aware of all maintenance or construction work that takes place in your facility and the associated fire risk it may create.

c. JSC's ***Center Director*** must appoint in writing a safety or fire protection professional as the "Authority Having Jurisdiction" for fire protection at JSC.

d. The ***Safety and Test Operations Division*** must:

- Oversee the fire safety program with emphasis on facility fire protection.
- Direct the technical aspects of the JSC fire protection activity, including the provision of adequate fire fighting and rescue capabilities.

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Chapter 5.2
Office and General Work Area Safety

This could be you . . .

Two employees were burned by candles on their desks.

One employee was hurt when an over-loaded bookcase fell.

An employee slipped and fell on a freshly waxed floor, resulting in a lost time case.

1. Who must follow this chapter

You must follow this Chapter if you work at JSC or JSC field site.

2. What this chapter covers

This Chapter covers the basic controls for common hazards and safe work practices in offices and general work areas. The requirements and recommendations in this Chapter stem from JSC's mishap and close call data as well as federal regulations.

3. What you need to do to be safe in your office

To increase your safety in the office or other work area, follow the requirements in this Chapter and think about consequences before taking action.

4. Doors, aisles, and hallways

Follow these rules to stay safe in doors, aisles, and hallways:

a. Keep required fire doors closed at all times. You may leave fire doors open if they have automatic releases and self-closing hardware, but don't block them with anything that would interfere with their operation.

b. If you see yellow stripes on the floor in front of a door and an OPEN DOOR SLOWLY sign, open the door with care. It opens into the flow of traffic, and you could hit someone.

c. Don't store anything in aisles and hallways. Keep aisles and passageways clear and in good repair. Remove or mark anything that blocks or sticks into an aisle or passageway. Maintain the minimum widths for exit routes shown in the diagram in Attachment 5.1A, Appendix 5. Also, see Chapter 5.1, Paragraphs 9 and 13. These are the minimum acceptable widths based on the Life Safety Code, NFPA 101. The JSC Furniture Office may require wider exit widths to allow them to move furniture easily.

d. Cover sharp or pointed objects that block or stick into an aisle or passageway to prevent someone from being cut or stabbed.

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e. If you spill something or see a spill, stop what you are doing and clean it up. You will prevent JSC's most common mishap: slips, trips, and falls.

f. Make sure there is enough safe clearance when you use mechanical handling equipment such as pallet jacks or forklifts.

5. Walking and working surfaces

Follow these practices in your work area and building:

a. Keep floors and working surfaces as clean and dry as possible.

b. Maintain good drainage in areas with wet processes such as washing areas. Provide dry places to stand with false floors, platforms, mats, or other means.

c. Protect floor openings, open pits, tanks, vats, or ditches with covers or guardrails. If you can't protect them yourself, report them to your supervisor. Make sure others don't fall into any of these openings by using signs, using cones, or posting a guard.

d. Keep outside walking and working surfaces free of ice, snow, mud, grease, or other stuff that may make them unsafe. You may use sand, cinders, or other approved material to reduce slip hazards. Report any areas you can't clear, cover, or block off to Work Control, x32038.

6. Telephones and electrical equipment

Electrical equipment and telephones cause many office mishaps. Here's what to do to stay safe:

a. Cover all floor telephone jacks and electrical outlets (commonly known as tombstones) by desks, tables, and other equipment so they are not a tripping hazard.

b. Don't place telephone or electrical cords across aisles unless you cover the cords with rubber channels designed for this purpose.

c. Use only personal equipment that is listed by Underwriters Laboratories (UL, Factory Mutual [FM]), or other recognized testing laboratories and that is in good working condition, such as coffee makers, radios, or lamps at work.

d. You may use UL-rated forced air space heaters only if they have a tip over cutoff switch. Never use a radiant space heater. Note: the Center Operations Directorate may restrict the use of space heaters for other reasons, such as energy conservation. When space heaters are allowed, they must follow the requirements above.

e. Occasionally check all of your electrical cords, plugs, and outlets for damage or frayed points. Replace any that show signs of excessive wear.

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7. Power strips and extension cords

Don't connect power strips together since you risk overloading the circuit. You may only use extension cords under certain circumstances. Follow the rules below:

a. You may use extension cords only under the following circumstances:

- Temporary work such as buffing floors, remodeling, or construction.
- To provide power for temporary decorations or special events. This is limited to 90 days or less.
- Development projects or experiments. You must remove the extension cords at the end of the project.

b. Power strips and extension cords must meet the following:

- Use only UL listed, double insulated cords or power strips that are rated for the current they will carry.
- Never run the cords through walls or ceilings.
- Try to avoid running cords behind furniture such as filing cabinets or bookcases where they could be pinched or damaged. If this is necessary, leave a space behind the furniture for the cord.

8. Computer workstations

Computers cause many small injuries that get worse if not corrected right away. Here's what to do:

a. Your furniture must be ergonomically designed so that you have no discomfort when working at your computer. See Chapter 5.5, "Ergonomics," for more ergonomic recommendations. Here are some general ones:

- Place your keyboard and monitor directly in front of you.
- Adjust your chair to fit you and make sure it has firm back support.
- Use soft wrist rests at the keyboard and mouse.
- Place your monitor screen so you see no glare.
- Secure your overhead hutch to the desk or table it sits on.

b. To clean the monitor, spray cleaning solution onto a cloth, then wipe the monitor. JSC has had several small fires and electrical shorts from cleaners sprayed directly onto screens.

9. Office supplies and equipment

Knowing what office supplies are in your office and how to store them properly is the key in this area. Follow these rules:

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a. Don't store office supplies, equipment, or anything else in any building's mechanical rooms. Many fires begin in mechanical rooms, so it's best to never store anything, especially anything that burns, in these areas.

b. Store all office supplies in cabinets or on shelves in areas designed for storage.

c. Keep only small quantities of flammable or combustible fluids such as cleaning supplies or printer toners and inks. Store quantities greater than 5 gallons in fireproof cabinets or bulk storage areas.

d. Maintain material safety data sheets on all spray paints and any hazardous office supplies (for example, liquid paper, copier toner) used in greater than home-use quantities. You can download Material Safety Data Sheets from the Total Health Home Page http://www4.jsc.nasa.gov/scripts/org/sd/msds/msdssearchform.cfm. Direct questions about hazardous materials to Occupational Health Services at (281) 483-7512. See Part 9, "Safety and health practices for hazardous materials," of this handbook for more information on hazardous materials.

e. Keep combustible materials such as wall-mounted combustible materials, paper, tapes, and wood to a minimum.

f. Don't have open flames such as candles in your office; they could burn you or start a fire.

g. Don't hang anything from the ceiling. It could stress the ceiling or dislodge a ceiling tile.

h. Don't use halogen lamps. The bulbs get extremely hot and could easily start a fire.

10. Office furniture

Defective or improperly placed furniture has injured some people at JSC. Follow these prevention guidelines:

a. Periodically inspect your office furniture for worn, cracked, or loose parts.

b. Don't put anything on top of bookcases, storage cabinets, and large equipment that could fall and injure you. Small personal items such as pictures or plants, if stable, are allowed. You must secure books on top of furniture with bookends.

c. Keep at least an 18-inch clearance between the deflectors of sprinkler heads and materials or furniture below. This doesn't apply to cabinets or shelving placed against a wall unless the shelving is directly under a sprinkler head. Shelves or equipment against a wall or mounted to a wall may penetrate the 18-inch clearance unless it is directly below a sprinkler head. In that case, the 18-inch clearance applies.

d. Leave adequate space for proper activation and maintenance around heat or smoke detectors.

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e. For stackable bookshelves:

If your bookshelves are located . . .	***Then you may stack . . .***
Against a wall, furniture, or secured panel	4 shelves
Free-standing	3 shelves

f. Multi-shelf, single-unit (non-stackable) bookcases are acceptable if they are against a wall, furniture, or secured panel.

g. Remember that while new file cabinets generally have satisfactory safety features, older units, which are prevalent on site, do not. Follow these practices for file cabinets:

- To prevent file cabinets from tipping over secure them to the floor if possible, or at a minimum, weigh them down at the lowest drawer.
- Open only one drawer at a time, and be certain to latch closed drawers which are not in use. If more than one drawer is open, the unit can become unstable and tip.
- Never switch drawers between cabinets. This can render safety devices, including drawer stops and latches, inactive if they don't match between the cabinet and drawer. The drawer may seem to fit, but may not be properly secured and could potentially cause injury.

11. If you have a disability

Contact the Equal Opportunity Programs Office at (281) 483-4831. JSC makes every effort to accommodate employees according to the Americans with Disabilities Act.

12. If you visit other work areas

If you visit other work areas, the occupants of that area must tell you what the safety rules are and you must follow them. For example, if you visit a warehouse, you must know and follow the requirements in Chapter 6.3, "Warehouse Safety And Health," of this handbook. See the table of contents of this handbook for a complete listing of safety and health rules for various areas and operations.

13. Jewelry in other work areas

If you do any maintenance or troubleshooting on any electrical or mechanical system or subsystem, you must first remove all rings, watches, jewelry, or other metallic objects that are electrical conductors or that could be caught on sharp objects or corners.

Verify this is the correct version before you use it by checking the online version.

Chapter 5.3
Driving, walking, and bicycling safely

This could be you . . .

At least two pedestrians have been hit by cars at JSC and several have almost been hit.

A truck went straight from a left-turn-only lane at JSC and almost caused an accident.

1. Who must follow this chapter

You must follow this chapter if you work at JSC, Ellington Field, or Sonny Carter Training Facility. If you work at a field site, see your site traffic rules. Note: Ellington Field may include additional traffic rules.

2. Operating a motor vehicle at JSC

You must follow these requirements whenever you operate a private or government motor vehicle such as a car, truck, van, motorcycle, or forklift.

a. Follow the JSC Vehicle Code, which you can find at: http://www4.jsc.nasa.gov/org/ja/ja14/external/docs/Vehcode.doc.

b. Wear a lap or shoulder belt as a driver or passenger. This includes operating rental vehicles while on Government business..

c. Use a ground guide to help you back up if you can't see out the back of the vehicle.

d. Yield to pedestrians crossing streets:

- Stop for pedestrians in or pedestrians approaching crosswalks.
- Don't pass a vehicle that is stopped at a crosswalk.
- Be courteous to each other. Remember, you are both a driver and a pedestrian at one time or another.

If you are driving an emergency vehicle such as an ambulance or fire truck, you have the right-of-way, but you still have to drive with due caution.

Pedestrians at JSC have the right-of-way when they cross streets after they stop and look both ways to make sure it is safe to cross. They must respect the vehicles' presence because drivers may not see them or may not have time to react and stop. Pedestrians must yield to emergency vehicles.

f. Follow these traffic regulations:

- Observe JSC's 25-mile-per-hour (mph) speed limit unless another limit is posted.
- Comply with all traffic signs, barriers, or cones.

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- Observe a 15-mph speed limit in parking lots and through all gates.
- Report all traffic accidents immediately to JSC Security, (281) 483-3333 or (281) 483-4658.
- Follow the JSC Vehicle Code.
- Follow local, state, and federal traffic laws at all times.

g. Never, while driving on NASA business, exceed:

- 10 hours of continuous driving, including personal driving
- 12 hours of combined work and driving in a 24-hour period

without at least 8 continuous hours of rest.

3. Carrying passengers

Follow these requirements when you carry passengers:

a. Come to a complete stop before you load or unload passengers.

b. Don’t put the vehicle in motion until everyone in the vehicle is properly seated, has his or her lap or shoulder belt on, and all doors are closed.

c. Don’t carry people in the backs of trucks unless:

- The truck has sides.
- Everyone is seated in a seat with seatbelts that meets 49 CFR 571.207.
- The load will not shift during an emergency maneuver injuring passengers.
- Everyone keeps his or her arms and legs completely inside the bed.
- You close the tailgate.
- You drive no faster than 25 mph.

d. Don’t carry anyone on a trailer or on an attachment to a vehicle.

Verify this is the correct version before you use it by checking the on-line version.

4. Walking or crossing streets

You must follow these practices when walking or crossing streets:

a. Cross streets at marked crosswalks whenever possible.

b. Follow Paragraph 12, table 6, of the JSC Vehicle Code.

c. Even though a vehicle should yield the right-of-way to a pedestrian, don't stake your life on a driver whose attention may be elsewhere. Don't cross unless the vehicles give you the right-of-way. Remember, a crosswalk isn't an extension of the sidewalk. It is an intrusion into the traffic and requires caution on your part. You must:

- Stay on the sidewalk until you look both ways to make sure it's safe to cross the street. Also remember, it's hard for Space Center Houston Trams to stop quickly. Give them an extra margin of safety.
- Remember, emergency vehicles always have the right-of-way. Yield to them.
- Be courteous to each other. Remember, you are both a driver and a pedestrian at one time or another.

d. Sidewalks and crosswalks may be slick when wet or in the winter. Walk carefully. Flat-soled shoes are the best footwear when you walk outside in wet or icy conditions.

5. Bicycles and motorcycles

If you ride a private or government bicycle or a motorcycle, you must follow these requirements in addition to the traffic rules in Paragraph 2 of this chapter:

a. Follow Paragraph 12, table 7, of the JSC Vehicle Code.

b. Wear a helmet when riding a motorcycle.

c. Observe these practices when riding bicycles:

- Follow all state and local traffic rules and laws for bicycle riders.
- Stop at pedestrian crosswalks, stop signs, and red lights.
- Avoid riding on sidewalks if possible.
- Limit your speed.
- Yield to pedestrians at all times. Warn pedestrians before you pass them.

6. Protective equipment for bicycles

Organizations with government bikes must:

- Provide helmets to bicycle riders on request.
- Install handlebar bells or other warning devices.

Verify this is the correct version before you use it by checking the on-line version.

7. Other requirements for government vehicles

If you operate any motorized government vehicle, you must follow these requirements apply in addition to those in Paragraphs 2 and 3 of this chapter:

a. Be trained to operate the vehicle effectively and safely. Your training will depend on the kind of vehicle you operate:

- You must have an initial briefing from your supervisor to orient you to the vehicle and introduce you to the peculiarities of the vehicle, as needed.
- If the vehicle requires special skills, you may need formal classroom training and road testing. Contact the JSC Transportation Officer for more details.
- Continued operation of a Government vehicle requires safe and sensible driving on your part.

b. Display a "slow moving vehicle emblem" on any vehicle with a maximum speed of 25 mph or less as described in Section 139B of the Texas Traffic Laws.

c. Make sure the vehicle is inspected yearly under the JSC transportation preventive maintenance program if it is licensed for road use. Government vehicles used off site must have a current state inspection sticker. The Transportation Branch must keep maintenance records.

d. Check the vehicle daily or before each use to make sure safety devices are in good condition. If you find any defective safety devices on the vehicle, report the problems to the Transportation Branch and don't use the vehicle until it is repaired. Check the following:

- Tires and brakes
- Head lamps, tail lamps, stop lights, and turn signal lights
- Windshield wipers
- Horn
- Steering
- Lap and shoulder belts or harnesses
- Fuel, cooling, and oil systems
- Backup warning devices
- Rearview mirror

8. Carry hazardous materials

If you carry hazardous materials in your vehicle, you must follow the requirements in Chapter 9.1, "Hazardous materials safety and health," of this handbook.

Verify this is the correct version before you use it by checking the on-line version.

9. Other requirements and regulations you must follow for transportation

In addition to the above requirements, JSC must follow these traffic and transportation requirements and regulations:

a. Everyone must follow the JSC Vehicle Code. Contact the Security Branch.

b. JSC's Security Branch must escort any vehicle that:

- Has a WIDE LOAD sign.
- Is wider than a traffic lane even if it doesn't have a WIDE LOAD sign.

c. JSC's Transportation Branch must escort cranes and other equipment it is responsible for.

d. Traffic control devices or road markings must follow American National Standards Institute (ANSI) D6.1, "Manual on Uniform Traffic Control Devices."

e. Vehicle operation and transportation must follow:

- DOT requirements that apply.
- Other federal, state, and local requirements and regulations that may apply.

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Chapter 5.4
Indoor air quality

This could be you . . .

An engineer began getting headaches late in the day after moving to another building. Air samples showed there were vapors in the air because a coworker had used acetone to clean the office furniture. Makeup air was increased to eliminate the vapor buildup. Workers were cautioned to use less toxic cleaners whenever possible.

1. Who must follow this chapter

You must follow this chapter if you work in or maintain an indoor workspace.

2. What this chapter covers

This chapter describes the steps to take if you suspect an indoor air quality problem. It doesn't cover:

a. Confined spaces (see Chapter 6.10, "Entering confined spaces").

b. Ventilation (see Chapters 6., "Laboratory safety and health," and 10.1 "Safety and health requirements for designing, constructing, and operating facilities").

c. Indoor work processes such as welding (see Chapter 8.4, "Welding, cutting, and brazing safety").

d. Soldering (see Chapter 9.4, "Materials that contain lead: how to work with them safely").

e. Using solvents (see Chapter 9.1, "Hazardous materials safety and health").

f. Asbestos abatement (see Part 12 of this Handbook, "Asbestos Control Requirements").

g. Other asbestos concerns (see Chapter 5.7, "Asbestos in the workplace").

3. Indoor air quality

Indoor air quality involves maintaining building ventilation systems, controlling airborne contaminant levels, and ensuring acceptable temperature and relative humidity in buildings.

4. How to know when you might have a problem

The most common perceptions of poor indoor air quality are stuffiness and uncomfortable temperature. While some people may also experience headaches or allergy-like symptoms, these symptoms could also be related to other causes.

Verify this is the correct version before you use it by checking the on-line version.

5. Who to call if you suspect a problem

Call Occupational Health Services at (281) 483-6726 if you suspect poor indoor air quality. They will send out an inspector to interview you and investigate the problem. They will report back to your facility manager in writing their findings and recommendations.

6. Fixing an indoor air quality problem

When you request an indoor air study, the results are sent to the Mechanical Operations Branch as well as to you. They will do everything in their power to correct the problem if it lies with the building utilities. Contact your supervisor if the problem lies with an operation such as model building or construction. Schedule all cleaning activities that introduce strong odors or contaminants when few workers will be in the area.

7. Where you can get more information on indoor air quality

You can find these documents at Occupational Health Services:

a. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), *2000 HVAC Systems and Equipment Handbook*, *1999 HVAC Applications Handbook*; and *1999 Fundamentals Handbook*

b. ASHRAE STD 62-2001, “ASHRAE Standard: Ventilation for Acceptable Indoor Air Quality,” 2001

c. ASHRAE STD 55-1992, “Thermal Environmental Conditions for Human Occupancy,” 1992

d. “Building Air Quality: A Guide for Building Owners and Facility Managers”; Environmental Protection Agency (EPA)/National Institute for Occupational Safety and Health, 1991

e. EPA 40 CFR 50, “National Primary and Secondary Ambient Air Quality Standards,” as amended July 1, 1987

f. EPA/600/6-88/009 A and B, “Indoor Air Quality in Public Buildings”; Vol. I and II; U.S. EPA, Office of Acid Disposition, Environmental Monitoring and Quality Assurance, Office of Research and Development, 1988

g. “Indoor Air Quality and Work Environment Study," EPA Headquarters Building, Results of Indoor Air Environmental Monitoring Study; Vol. II and Supplement to Vol. II; U.S. EPA, Office of Administration and Resources Management, May 1990

h. American Industrial Hygiene Association, “Do I Work in a Sick Building?” February, 1995

i. Other agencies with more information, including:

- The American Industrial Hygiene Association, (703) 849-8888
- The American Lung Association, (212) 315-8700
- The American Medical Association (312) 464-4541

Verify this is the correct version before you use it by checking the on-line version.

- U. S. Consumer Product Safety Commission, 1-800-638-2772

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Chapter 5.5
Ergonomics

This could be you . . .

A supervisor began having pain in his wrist when using his computer. He took the Computer Ergonomics class, followed the suggestions made in the class and has been pain-free ever since.

An employee began having neck pain after moving into a smaller office. An ergonomic assessment showed that her neck pain was due to twisting, which was caused by her computer monitor not being lined up with the keyboard or her body.

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site.

2. What this chapter covers

This chapter covers JSC's ergonomics program. Although there is currently no Occupational Safety and Health Administration (OSHA) ergonomics standard, JSC is committed to eliminating injuries and illnesses caused by improper ergonomics.

3. Why ergonomics is important

Ergonomics is the science of fitting jobs to people. Ergonomic design is applying this body of knowledge about physical abilities, limitations, and other human characteristics to the design of the workplace (i.e., work tasks, equipment, environment) for safe and efficient use by workers. It is principally based on preventing musculoskeletal disorders (MSDs) such as carpal tunnel syndrome and other work-related disorders caused by improper job, tool, and workstation design. MSDs account for an increasingly large percentage of worker's compensation costs and they represent nearly half of the occupational illnesses reported in the annual Bureau of Labor Statistics survey.

4. Elements of a complete ergonomics program

A full "ergonomics" program consists of these five program elements:

a. ***Management Leadership***, as demonstrated by an effective MSD reporting system, prompt responses to reports, clear program responsibilities, and regular communication with employees about the program

b. ***Employee Participation***, as demonstrated by the early reporting of MSDs and active involvement by employees and their representatives in the implementation, evaluation, and future development of the ergonomics program

Verify this is the correct version before you use it by checking the on-line version.

c. ***Job Hazard Analysis and Control***, as demonstrated by a process that identifies, analyzes, and uses feasible engineering, work practice, and administrative controls to control MSD hazards or to reduce MSD hazards to the extent feasible, and evaluates controls to ensure that these measures are effective

d. ***Training*** of managers, supervisors, and employees in the ergonomics program and their role in it, the identification of MSD hazards in jobs, and the methods to control them

e. ***Ergonomics Program Evaluation***, as demonstrated by regular reviews of the elements of the program and of the effectiveness of the program as a whole, using such measures as reducing the number and severity of MSDs, increasing the number of jobs in which MSD hazards have been controlled, or reducing the number of jobs posing MSD hazards, and correcting identified deficiencies in the program.

5. Who must be involved in JSC's ergonomic program

a. If you are a ***manager***, you must be committed to eliminating ergonomic hazards as part of your commitment to maintaining a safe and healthful workplace. Once a problem has been found, take all actions necessary to fix it within the bounds of operational requirements and budget. You must:

- Assign a person to track ergonomic concerns and solutions in your area if applicable. Ergonomic evaluation teams may also be necessary for your area.
- Ensure that your policies and practices encourage and do not discourage both early reporting of MSDs, their signs and symptoms, and MSD hazards; and employee participation in the ergonomics program.
- Communicate periodically with employees about the effectiveness of the ergonomics program and their concerns.
- Refer employees suffering from MSD symptoms to the JSC Clinic for evaluation and medical follow-up.
- Ensure recommendations made during an employee ergonomic evaluation are implemented and are effective in solving the employee's concerns.

b. If you are an ***employee*** at JSC, you must participate to make the ergonomics program a success. You can participate by:

- Learning the signs and symptoms of MSDs and reporting any that you notice to your supervisor.
- Practicing good posture and work habits to reduce ergonomic injury.
- Bringing your ergonomic concerns to management.
- Attending training so that you may serve on an ergonomic evaluation team, learning and using skills to identify and analyze jobs for ergonomic hazards, and making recommendations to correct them.

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- Practicing good ergonomics off the job.

6. How to know if you have ergonomic hazards

a. Analyze your own job and workspace by using the checklist on the Compaq Comfort Guide (http://www6.compaq.com.comfortguide.com) or the OSHA-related checklist that can be found on the Total Health Homepage (http://www4.jsc.nasa.gov/org/totalhealth/)

b. Take the Computer Ergonomics course or the Occupational Ergonomics course from the Occupational Health Branch or from your company. Call (281) 483-6726 to register for JSC courses.

c. Look for things that increase MSD risk:

- Frequency - the rate at which you repeat specific physical motions or exertions.
- Force - physical exertion by or pressure applied to any part of the body.
- Duration - the length of any period of work activity which poses a MSD risk.
- Posture - the position of any part of your body during a work activity, especially awkward or static postures.
- Exposure to localized or whole-body vibration.
- Exposure of hands and feet to cold temperatures that cause discomfort.

d. Go to the JSC Clinic to report any discomfort. They will notify the Occupational Health Services Office to perform an ergonomic evaluation of your workstation.

7. How to correct ergonomic hazards

JSC prefers to prevent ergonomic injuries by making engineering changes to workstations and job procedures. The idea is to fit the job to the person; not make the person fit the job. Specifically you can:

a. Change your workstation to fit your body correctly by:

- Placing your keyboard and monitor directly in front of you.
- Placing the keyboard close to your body and the mouse close to the keyboard.
- Adjusting your chair so your forearms are parallel to the floor when using keyboard. Make sure the chair has firm back support. Lumbar supports are available in government stock. Note: A lumbar support cushion may not be comfortable if you have long legs or if your chair has a short seat pan.
- Using soft wrist rests at the keyboard and mouse.
- Placing your monitor screen so you see no glare, usually at a 90 angle to any window and not tilted. You may also adjust window shades or blinds to control glare.

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- Placing your screen so the top line of type is at or slightly below eye level. Place your screen slightly lower than that if you wear bifocals.
- Using a document holder if you often type from hard copies.
- Keep yourself about 18-30 inches from your monitor. This is usually about arm's length. The larger the monitor, the farther away you should be.

b. Have your eyes checked by an optometrist if you are having eyestrain. Be sure to tell him or her that you work with a computer.

c. Get up and move around often. Take a 1-3-minute micro-break about every hour.

d. Clean your monitor weekly to prevent dust buildup on the screen.

e. Check with your area Organization Administrative Representative to get furniture that fits your body size and space constraints. **NOTE:** Furniture (including chairs) will only be replaced when determined to be necessary by ergonomic evaluation and the Organization Administrative Representative (see paragraph 12 below).

f. Call JSC Furniture Repair (x36661) for repair of any broken furniture.

g. Avoid awkward positions, repetitive motions, and excessive force in your job.

h. Adjust the lighting and noise levels to comfortable levels. Adjust the temperature to a comfortable level within the guidelines of JSC's Energy Conservation policy (76 degrees or higher in the summer or 70 degrees or lower in the winter).

i. Select tools and handles that are comfortable and reduce strain and vibration in your hands and arms.

j. Make sure the tools you use (including your keyboard and mouse) are in good working order and have been properly maintained.

k. Analyze the tasks you do. Try to find an easier or more comfortable way to get the job done.

8. Administrative controls for ergonomic hazards

Administrative controls reduce your exposure to ergonomic hazards. A person who has had a MSD will likely need more attention. As an employee or manager, you can:

a. Reduce the number of repeated motions for each employee and limit overtime work.

b. Allow yourself or your workers time to get used to a job.

c. Take short rest breaks to relieve tired muscles and tendons.

d. Increase the number of employees assigned to a task to lighten the load on everyone (especially in lifting heavy objects).

e. Rotate jobs to reduce fatigue and stress on a particular muscle group.

f. Provide standby or relief personnel to compensate for busy times on the job.

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g. Reduce repeated motions by combining quick jobs.

h. Develop realistic goals and timelines. Try not to wait until the last minute to schedule a job.

i. Sign up for an exercise class at the Gilruth Health Fitness Center to improve physical fitness.

9. Training to reduce ergonomic hazards

Ergonomic training is an effective way to reduce ergonomic injuries. Training is available to inform you about the ergonomic hazards you may be exposed to. This training is available when you are trained on how to do your job and at least every three years thereafter. It also covers any protective measures you must use , such as personal protective equipment or special procedures, to eliminate or reduce the hazards present. Contractors may take their own company's ergonomic training course in lieu of the JSC course if available. If you are:

a. A new employee or one that has been reassigned, an initial orientation and hands-on training are available before being placed in a full-production job. This training includes:

- Properly arranging your workstation.
- Caring for, using, and handling any equipment.
- Using special tools and devices associated with individual workstations.
- Using proper lifting techniques.
- How to recognize MSD signs and symptoms.
- How to report MSD signs and symptoms, and the importance of early reporting.
- Your role in the JSC ergonomics program and in evaluating the effectiveness of ergonomic controls.
- Provisions of any applicable existing standards

b. A supervisor or manager, your training is similar to your employees' training and includes:

- Recognizing early signs and symptoms of MSDs and hazardous work practices.
- Effectively managing the ergonomic hazards in your areas of responsibility.
- Evaluating the effectiveness of the ergonomics program in your area.

c. As plant engineer or maintenance person, your training covers how to prevent and correct ergonomic hazards through job and workstation design and proper maintenance.

Verify this is the correct version before you use it by checking the on-line version.

10. Responsibility for the JSC ergonomics program

The Occupational Health Branch has responsibility for the formal ergonomics program. This office will help other organizations perform evaluations, develop job-specific programs, and train employees.

11. What to do if you have problems from ergonomic hazards

If you have concerns about ergonomic issues or hazards please follow the flowchart below (Figure 5.5-1) to start an investigation, do an evaluation, resolve a concern, or receive a medical evaluation.

If you have any of the following symptoms of ergonomic hazards, report them to your supervisor and go to the JSC Clinic. Watch for persisting or recurring:

a. Pain from exertion, pressure, or exposure to cold or vibration, except when the pain is due to an acute injury such as a burn, abrasion, splinter, slip, or fall.

b. Skin color becoming blue, abnormally white, or red on exposure to cold or vibration.

c. Numbness or tingling in an arm, leg, hand, or foot.

d. Decreased grip strength.

e. Decreased range of joint movement.

f. Swelling of a joint or part of an arm, leg, or digit.

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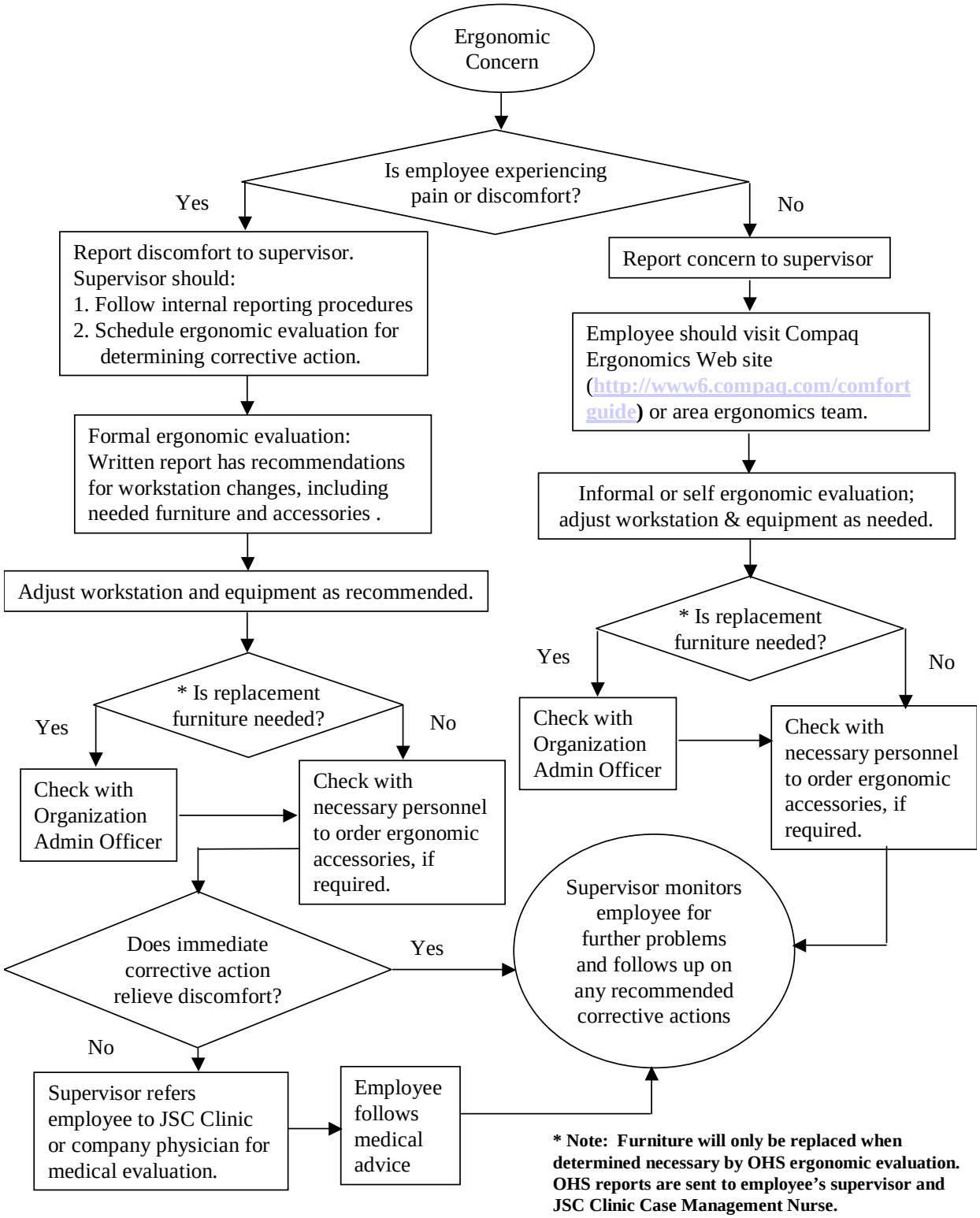

Figure 5.5-1: Flowchart for dealing with ergonomic concerns

Verify this is the correct version before you use it by checking the on-line version.

12. Priorities for providing different furniture or accessories for computer workstations

a. The JSC Furniture Department, classifies furniture requests as follows:

- Class A - employee is in pain and has reported this discomfort to the JSC Clinic, his or her company physician, or a private physician.
- Class B - employee is in pain but has not reported the discomfort to the JSC Clinic or to a physician
- Class C - employee does not have a chair or a desk
- Class D - employee is currently experiencing no pain or discomfort

b. Class A and B requests are filled first, followed by Class C. If supplies permit, Class D requests are filled.

c. When the JSC Furniture Department Inventory does not allow filling requests in a timely manner, contractors may provide chairs and other necessary furniture for their on-site employees. Clearly mark this furniture with the contractor's name to prevent confusion of ownership. The JSC Furniture department will not support contractor owned furniture for repair or replacement.

d. The employee's management is responsible for providing ergonomic accessories; such as, foot rests, document holders, telephone headsets, trackballs, mouse rests or pads, ergonomic keyboards, and monitor risers.

13. Follow-up on recommendations made during an ergonomic evaluation

a. Your supervisor must follow-up to ensure that recommendations for arranging your workstation and changes in furniture were effective and have not caused additional discomfort.

b. Case management personnel from the JSC Clinic or your employer may follow-up on ergonomic evaluations due to pain or discomfort.

c. You may be asked to fill out a follow-up worksheet.

d. For furniture priorities Class A and B, if you do not receive your recommended furniture within 4-6 weeks, contact the center furniture personnel at JB9 (extension 36661) for follow-up information.

e. Occupational Health Services will follow-up when necessary at the request of employees, supervisors, or case managers.

14. For more information on ergonomics

You can find more information on ergonomics in these documents that can be found in the Science and Technology Information Center:

Verify this is the correct version before you use it by checking the on-line version.

a. "Ergonomics Program Management Guidelines for Meatpacking Plants," U.S. Department of Labor, OSHA, 1990

b. "Technical Report, Work Practices Guide for Manual Lifting," National Institute for Occupational Safety and Health (NIOSH) Pub. #81-122, DHHS, March 1981

c. Revisions in NIOSH Guide to Manual Lifting, Puts-Anderson, V. & T. Waters, University of Michigan, Ann Arbor, Michigan, April 1991

d. Cumulative Trauma Disorders, Edited by Vern Putz-Anderson

e. American National Standards Institute (ANSI) Standard on Control of Work-Related Musculoskeletal Disorders

f. ANSI/HFS 100-1988, "American National Standard For Human Factors Engineering Of Visual Display Terminal Workstations"

g. OSHA 3125, "Ergonomics: The Study of Work," U. S. Department of Labor, OSHA, 1991

h. Repealed OSHA Ergonomics Standard: http://www.osha-slc.gov/ergonomics-standard/index.html

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Chapter 5.6
Personal protective equipment

This could be you . . .

An employee accidentally cut into a chemical line and some of the chemical splashed on the particulate respirator he was wearing. He suffered throat irritation and coughing because the particulate respirator wasn't designed to protect against the chemical.

An employee who wasn't wearing a hard hat hit his head on a pipe and fell to the floor.

1. Who must follow this chapter

You must follow this chapter if you use personal protective equipment (PPE) in your work.

2. What this chapter covers

This chapter covers the selection, use, and maintenance of PPE. You can find specific requirements for respirators, hearing conservation, and asbestos in Chapter 7.2, "Respiratory protection"; Chapter 7.1, "Hearing protection"; and Part 12 of this Handbook, "Asbestos Control Requirements."

3. When you need PPE

You need to use PPE when you work in hazardous situations where engineering controls, management controls, or other corrective actions do not reduce the hazard to an acceptable level. The Safety and Test Operations Division and the Occupational Health Branch along with your supervisor will determine the need for and selection of PPE based on the hazards in your work area.

Your supervisor or company must do a hazard assessment on your need for PPE and verify the assessment in writing. Include this assessment in your facility's safety and health documentation. The written verification must state that it certifies that the assessment has been done and include the following:

a. Workplace location

b. The date of the hazard assessment (Job Hazard Analysis)

c. The person who certifies that the evaluation has been done

Verify this is the correct version before you use it by checking the on-line version.

4. How you get PPE

Your supervisor (for civil service employees) or company (for contractor employees) is responsible for providing PPE. The following chart shows how to obtain PPE:

If you are . . .	*Your PPE comes from . . .*
A civil service employee or on-site contractor	• The JSC Supply Branch or Procurement for all PPE except rigid frame prescription safety glasses • The Occupational Health Branch for rigid frame prescription safety glasses
A transient or visitor	• Your host organization
An off-site contractor employee	• Your company

Obtain rigid frame prescription safety spectacles by sending a letter to the Occupational Health Branch. In the letter, state that you work in an eye hazard area and list your duties and specific hazards that require safety glasses. Have the letter approved by your supervisor. Include a completed prescription if you request prescription glasses. You must pay for any eye exams.

5. Providing and using your own PPE

You must only use PPE recommended and provided by your employer.

6. How to select PPE

Select PPE based on a hazard assessment (Job Hazard Analysis) your supervisor performs. He or she will let you know what hazards are found and what PPE is required. You must select PPE that will fit you properly. PPE selection factors include:

a. Exposure potential to hazard, including frequency and length of contact.

b. Potential effects of skin contact with the hazard.

c. The body part that could be exposed such as hands, face, chest, arms, etc.

d. The protection factor of the PPE.

e. Other safety hazards present such as falling, slipping, falling objects, electrical shock, etc., and the hazards that may be induced by wearing the PPE.

f. Limitations caused by the PPE such as reduction in sight, hearing, touch.

g. Work area conditions such as temperature, humidity, abrasion, and cutting or tearing potential.

h. Characteristics and limitations of the PPE such as resistance to degradation, size, comfort and dexterity.

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i. Anticipated use (single use vs. routine use, duration of use).

j. Regulatory requirements. Use only PPE that is approved.

k. PPE service life and cost.

Help in selecting PPE is available from the Safety and Test Operations Division for potentially hazardous physical or mechanical hazards, and from the Occupational Health Branch for potentially hazardous chemical and biological agents.

7. Precautions you must take when working around physical hazards

Observe the following requirements when working around physical hazards:

a. Wear flame-retardant clothing when operations involve the possibility of explosion or fire.

b. Wear protective gloves made of strong durable material when operations include handling sharp-edged or abrasive objects.

c. Wear gloves made of thermal protective material when handling hot or cryogenic substances.

d. Wear gloves made of rubber or other nonconductive material that conform to the OSHA standard for dielectric strength when operations include potential exposure to electrical current.

e. Wear hearing protection in hazardous noise areas.

f. Wear hard hats when there is a potential for injury to the head from falling objects.

g. Wear eye and face protection when there is a potential for injury from flying particles, chemicals, or laser radiation.

8. Precautions you must take when working around chemical and biological hazards

Wear protective clothing when working with hazardous chemical and biological agents and when required by the Environmental Protection Agency, Centers for Disease Control, or the Occupational Safety and Health Administration (OSHA) standards.

Base the selection of protective clothing on the environment where it will be used. The section of the material safety data sheet marked “Exposure Controls and/or Personal Protective Equipment” will give you specific instructions on PPE for the material you’re using. Use the following key points when selecting protective clothing:

a. All chemicals pass or permeate through protective barriers sooner or later, with or without any visible evidence or change in the protective materials.

b. A material may protect against one chemical very well but perform poorly against another. Each chemical and material combination must be considered. No single protective material is an absolute barrier against all chemicals.

Verify this is the correct version before you use it by checking the on-line version.

c. Protective gloves and other chemical protective clothing may all look alike. Make sure that the clothing you select is the right one for the job you are doing.

d. When a chemical is absorbed by protective clothing material, it will continue to pass through the material.

e. Chapter 7.4 provides information on PPE and precautions to be used when handling biohazards.

9. Precautions you must take when working where head protection is required

Observe the following requirements if you are exposed to head hazards:

a. Wear a well-fitting hard hat that meets 29 CFR 1910.135, "Head Protection," and American National Standards Institute (ANSI) specifications in ANSI Z89.1, "Industrial Workers Protective Headwear."

b. Sanitize the shell and replace or sterilize the cradle and sweatband before giving your hard hat to another worker.

c. Replace the cradle and sweatband to maintain the effectiveness of the hard hat. Replace them on a regular schedule that is recommended by the manufacturer.

d. Clean the shells with a mild soap and water. Never use solvents or abrasives.

e. Wear a class A or class B hard hat around electrical hazards.

f. Store hard hats away from ultraviolet rays.

g. Don't drill holes in your hard hat to attach things unless your hard hat is designed to accommodate holes.

10. Precautions you must take when working where eye protection is required

Observe the following requirements when working in eye hazard areas:

a. Wear side shields on your safety glasses when there is a hazard from flying objects.

b. If you wear corrective lenses in spectacles, use one of the following types of eye protection:

- Goggles worn over the protective lenses
- ANSI-approved safety eyewear

c. Never wear contact lenses in any area where you are exposed to irritant fumes, corrosive gases, or a dusty atmosphere.

d. Wear goggles when handling corrosive liquids, such as acids and caustics. Make sure the goggles:

- Have soft, non-flammable eyecups.
- Are flexible enough to fit your face readily.

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- Are made so that no splashing liquid can get in your eyes through the ventilation openings.

e. Wear goggles when exposed to vapors or fumes that could cause injury or discomfort to your eyes. Make sure the goggles have eyecups that fit your face snugly and have no ventilation openings.

f. Wear goggles, helmets, and shields with a filter lens that meets ANSI-Z87.1, "Occupational and Educational Eye and Face Protection," when doing arc welding, oxy-acetylene welding, furnace work, or any operation where your eyes are exposed to glare.

g. Wear face masks and shields to protect your face from light impacts, sparks, or chemical splashes. Make sure the mask or shield has a nonflammable transparent visor free from scratches or other flaws.

h. Always wear safety glasses or goggles under face shields. Face shields are designed to protect the face and not as primary protection for the eyes.

i. Sanitize goggles and glasses before giving them to another worker. Replace any parts such as elastic headbands that can't be sterilized.

j. When not in use, keep goggles, glasses, and face shields in containers to protect them from damage or scratches and from contamination by oil, grease, or other materials.

11. Precautions you must take when working where foot protection is required

Observe the following requirements when working where foot protection is required:

a. Wear steel toed safety shoes that meet the requirements of ANSI Z41.1 where your feet are exposed to the falling of heavy materials, such as in a materials warehouse or machine shop.

b. Wear footwear made of rubber, specially treated leather, wood, or other suitable corrosion-resisting materials when you handle corrosive liquids such as acids and caustics.

c. Wear snug footwear when handling molten metals or hot or corrosive liquids. Make sure your footwear has no laces that would allow liquids to reach your foot.

d. Wear nonmetallic footwear when working with electricity.

e. Wear high-top leather footwear when working with cryogenics.

12. Precautions you must take when working where fall protection is required

Use appropriate fall protection devices when working in any area that is 4 feet or more above adjoining surfaces and is unprotected by guardrails. Follow the guidelines below:

a. Use a full body harness whenever practical.

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b. Use lifelines, drop lines, lanyards, safety belts, and harnesses only for safeguarding workers. Don't use them for any other purpose. A lifeline must be able to support a minimum dead weight of 5400 lb (2450 kg) per person applied to the center of the lifeline.

c. Don't reuse a drop line, lanyard, belt, or harness that has been stressed by a worker falling.

d. Securely buckle all harnesses and belts and wear them tight enough to prevent yourself from slipping out.

e. Secure drop lines and lifelines to fixed anchorages; make sure they are long enough to reach the ground; and use pads over sharp corners. A fixed anchorage must be able to support a minimum dead weight of 5400 lb (2450 kg) per person.

f. Keep lanyard length as short as the work allows. If possible, don't attach to the lifeline below your waist.

g. Use a body harness and shock-absorbing device in the lanyard system if a long free fall is possible.

h. Make sure you are securely attached to a secondary restraint system when using a boson's chair suspension belt.

13. Precautions you must take when inspecting fall protection equipment

a. Don't use safety belts, harnesses, and lanyards that have been impact- or load-tested for safety purposes.

b. Use only sample belts and worn belts or those of doubtful quality for testing. Test them to destruction, if possible, or at least to a 4:1 safety factor of the anticipated load. Keep belts that were used for testing only as samples to help judge the safety of other belts.

c. Observe the following guidelines to inspect fall protection equipment:

- Inspect all safety equipment such as belts, harnesses, lanyards, and lines before use.
- Follow your employer's inspection program. Inspect all safety equipment at least every 6 months and document the date on the equipment.
- Many safety equipment manufacturers and vendors publish detailed inspection and maintenance procedures. Use them as a guide.

d. Do all preventive maintenance on schedule. This keeps the equipment ready for use and extends the life of the equipment.

e. Notify your supervisor if you find defective PPE and don't use it.

14. Precautions to take when working in a confined space

Follow the requirements in Chapter 6.10, "Entering confined spaces," of this handbook.

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15. Using and maintaining PPE

Use the guidelines below to get the most from your PPE:

a. Inspect your PPE before putting it on. Look for:

- Imperfect seams and poor closures.
- Non-uniform coatings and scratches.
- Pinholes, tears, and cracks.
- Stiffness and discoloration.

b. Don't use PPE that fails inspection. Put it aside and notify your supervisor.

c. Put your PPE on and inspect it to make sure you have it closed correctly and that it fits snugly but doesn't bind.

d. Inspect your PPE every so often while you work and make sure it is still protecting you. Stop work if your PPE fails. Stop work if you get too hot when wearing chemical protective clothing.

e. Clean and decontaminate your PPE before taking it off. Take off your PPE before leaving the work area.

f. Take off your PPE and store or dispose of it properly. Call the Environmental Services Office if you need more information on or help with disposing of your used PPE. Store your PPE separately from your regular clothing.

g. Make sure you understand the chemical properties of any chemical clothing you reuse so that permeation doesn't occur in storage and you decontaminate it after every use.

h. If you reuse damaged PPE, make sure it is fixed to manufacturer's specifications.

i. Maintain your PPE according to manufacturer's schedule or to your organization's schedule. Minimize field repairs.

j. Account for PPE as described in NPR 4200.1, "NASA Equipment Management Manual."

16. Training for PPE?

See Chapter 4.5, "Personal Protective Equipment Training," of this Handbook.

17. Where you can get more information on PPE

You can find more information on personal protective equipment in these documents:

a. 29 CFR 1910.132, "Personal Protective Equipment"

b. "Accident Prevention Manual for *Business and Industry: Administration and Programs, 12th Edition,*" National Safety Council, Washington, DC, 2000

Verify this is the correct version before you use it by checking the on-line version.

c. *"Accident Prevention Manual for Business and Industry: Engineering and Technology, 12th Edition,"* National Safety Council, Washington, DC, 2000

d. American Industrial Hygiene Association, *Chemical Protective Clothing*, J. S. Johnson, ed., Akron, Ohio, 1990

e. ANSI Z41.1 - 1991 "Personal Protection—Protective Footwear"

f. ANSI Z87.1 - 1989 "ANSI Standard for Occupational and Educational Eye and Face Protection"

g. ANSI Z89.1 - 1986 "ANSI Standard on Protective Headwear for Industrial Workers"

18. Responsibilities for PPE

a. As a ***supervisor***, you must:

- Survey, identify, and document all actual and potentially hazardous work areas, job operations, and working conditions where PPE is required.
- Obtain the required PPE after review by the Occupational Health Branch and the Safety and Test Operations Division.
- Make sure everyone is aware of the specific PPE required for his or her work assignment.
- Make sure your operating procedures reflect PPE requirements.
- Make sure everyone uses the equipment as directed and maintains it in good condition.

b. As a ***procurement coordinator***, you must:

- Process all requests for PPE.
- Verify PPE approvals with the Occupational Health Branch for chemical and biological hazards and the Safety and Test Operations Division for physical and mechanical hazards.

c. The ***Occupational Health Branch and the Safety and Test Operations Division*** must:

- Help supervisors to determine hazards and the need for PPE.
- Help in selecting and approving PPE.
- Review and monitor JSC's respiratory protection program.
- Fit-test, train, and consult with on-site respirator users.
- Provide general training on PPE.

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Chapter 5.7
Asbestos in the workplace

This could be you . . .

A worker may have released asbestos fibers while drilling through some floor tile to install bolts. No one sampled the tile ahead of time and it was later found that the tile contained asbestos. The worker took no measures to prevent asbestos exposure. The work area had to be decontaminated, which delayed the job.

An office employee may have released asbestos fibers when he climbed into a drop ceiling on a ladder to run a cable from a computer to a printer across the room. The area above the ceiling contained asbestos and entry into the ceiling space was a Class III asbestos activity. The worker wasn't trained in asbestos control techniques, and wasn't using the proper personal protective equipment (respirator and disposable Tyvek® clothing) and other items (ground cover, barricades, and warning signs). The asbestos spill response team had to be called out to clean up the area.

1. Who must follow this chapter

You must follow this chapter if you work at JSC, even if you don't do any asbestos work. If you work at White Sands Test Facility (WSTF), you must follow WSTF requirements that meet the intent of this chapter.

2. What this chapter covers

This chapter provides you basic information on asbestos in your work area and on what you must do to avoid exposing yourself to it. Many JSC buildings contain asbestos. Even if you don't work in one of them, you will visit one occasionally.

If you work with asbestos-containing materials (ACMs) or in areas with asbestos, this chapter is only a starting point. You must follow other requirements such as those found in Part 12 of this Handbook.

3. JSC's policy about asbestos

JSC's policy is to maintain currently existing ACMs in place and to use procedures that will prevent the release of ACM and prevent exposures to workers and building occupants. JSC will remove or abate ACM as necessary to protect the health of all employees.

JSC will follow all federal, state, and local regulations and guidelines that apply to control any hazards with asbestos on JSC property.

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Asbestos in your work area

4. How to know if your building contains asbestos

You will see a sign at each entrance to your building informing you that:

a. The asbestos materials aren't hazardous under ambient conditions.
b. You must never disturb ACM without the proper training, notification, and procedures found in Part 12 of this Handbook.

You can check the Asbestos Locations Database on the JSC Total Health home page [http://ks.jsc.nasa.gov/thh/asbestoslink.htm]. You can also ask your facility manager, supervisor, or the Occupational Health Services if your building contains asbestos.

5. What you must know about asbestos in your building

If you work in an office and don't disturb building materials there are a few things you still must know:

a. Installed asbestos products aren't hazardous as long as they remain in good condition and you don't disturb them and release fibers.
b. You must never do anything to damage building materials or create dust.
c. Many JSC buildings have spray-applied insulation (SAI) that contains asbestos above suspended ceilings. It is a fluffy beige material. Don't disturb ceiling tiles or go into the ceiling in a building with SAI unless you have met all the requirements to conduct asbestos activities.
d. If you find SAI or any beige fluffy insulation that has fallen from the ceiling, it may contain asbestos. Call Occupational Health Services at (281) 483-6726 to assess the situation and the JSC asbestos spill response team at (281) 483-2038. Never attempt to clean it up yourself.
e. Many buildings also have ceiling tiles that contain asbestos. Some buildings have attached ceiling tiles to the walls. Never disturb or touch a ceiling tile or a wall in any building unless you know that it doesn't contain asbestos.
f. If a material is falling from the ceiling and you think or know it is ACM, notify any coworkers in the immediate area and leave. Then call Occupational Health Services.
g. If you are a custodial worker, see Paragraph 12 of this chapter for training requirements.

6. Prohibited activities

To reduce the chance for exposure to asbestos, all uncontrolled activities that may damage ACM or cause the release of airborne fibers are prohibited. You must never:

a. Cut or drill holes in any ACM.
b. Install hangers or fasteners in any ACM.
c. Sand or grind any ACM, including floor tile that contains asbestos.
d. Damage ACM while moving equipment or furniture.
e. Install curtains, drapes, or dividers in such a manner that they will damage ACM.

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f. Sweep or use compressed air to clean up ACM. Use only a vacuum equipped with a high-efficiency particulate air filter.
g. Disturb or remove ceiling tiles without following the procedures in the asbestos control manual.
h. Damage any pipe or mechanical system insulation that contains or could contain asbestos. Materials such as Styrofoam, foam rubber, foam glass, and fiberglass don't contain asbestos. However, asbestos-containing mud may exist at the joints and fittings. If in doubt, contact Occupational Health Services ((281) 483-6726) or the Asbestos Program Manager (APM) before conducting activities that may disturb or damage these materials or follow the job performance requirement in Part 12 of this Handbook.
i. Leave waste- or asbestos-labeled disposal bags in mechanical rooms. Call Work Control at (281) 483-2038 for disposal bags and asbestos waste pickup. It is your responsibility to ensure any asbestos waste is promptly removed by the Center Operating Support Services contractor.

Requirements for working with ACM or in asbestos areas

7. If you are planning any operations, maintenance, or construction

Paragraphs 8 and 9 outline general requirements for asbestos activities that you must know. See Part 12 of this Handbook for the specific details. If you are planning any work that could disturb ACM, you must:

a. Establish the job requirements.
b. Identify the asbestos hazard, if known. Treat all building materials at JSC as if they contain asbestos until sampling and analysis or other information shows that they don't.
c. Determine if the work area is in the JSC asbestos database as an area that contains asbestos.
d. Check with the APM ((281) 483-3021), with his or her designee, or with Occupational Health Services ((281) 483-6726) if the work area is not in the database. They will determine if there is evidence of asbestos in the area and if bulk sampling needs to be done.
e. Proceed with the job as normal non-asbestos work if there is no ACM or evidence of asbestos. If any work area is in the database or bulk sampling results indicate the presence of ACM, you must plan an asbestos activity using Part 12 of this Handbook and you must also meet all OSHA asbestos requirements in 29 CFR 1926.1101 and 29 CFR 1910.1001.

8. If your work could expose you to asbestos

If any work area is in the database or bulk sampling results indicate the presence of ACM, you must follow these steps:

a. Review the job requirements against the requirements in Part 12 of this Handbook. Develop a work plan to integrate the two requirements.

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b. Develop and follow alternate procedures if no specific asbestos work requirements exist for the job. Follow Part 12 of this Handbook for developing your procedures.
c. Complete the Job Procedure Requirements Permit and Notification Form found in Part 12 of this Handbook to make sure all requirements have been met.
d. Use the form to document coordination with or notification of certain JSC offices as required by Part 12 of this Handbook.
e. Have a competent person, as defined and required by Occupational Safety and Health Administration (OSHA). Make sure you follow proper work practices to protect yourself and any others in the area.
f. Give the completed Job Procedure Requirements Permit and Notification Form to the workers assigned to the task. The form must be at the work site at all times and available for inspection by the APM or safety and health personnel. It serves as a work permit to enter an asbestos area such as inside ceilings.
g. Ensure all workers assigned to the task have all of the following:
   - Cards or credentials documenting proper training for the class of asbestos work they are doing.
   - Documentation of a current medical evaluation.
   - Documentation of a current respirator fit test and training.
h. Proceed with the job.
i. Do on-site inspections and monitoring during the job as required by Part 12 of this Handbook.
j. Have Occupational Health Services do a clearance inspection and air monitoring after the job is done, if required by Part 12 of this Handbook.
k. Upon satisfactory clearance inspection and air monitoring results, the originator will reestablish and release the work area for general occupancy, and prepare and submit any documentation required by Part 12 of this Handbook.

9. If you will control or manage ACM

If you supervise personnel or oversee contracts engaged in activities that involve controlling or managing ACM, you must ensure that those whom you oversee follow the requirements detailed in Part 12 of this Handbook. Call the APM or the Occupational Health Officer if you have questions about these requirements. This includes developing work plans and specifications for the job.

10. If you fail to follow asbestos requirements

Any failure to adhere to this chapter or the procedures in Part 12 of this Handbook will be reported to the supervisor in charge or a contract official and to the APM. Appropriate disciplinary action will be taken.

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11. Training to work with ACM or in asbestos areas

Before you are assigned to do any work that could disturb asbestos, a "competent person," as defined by OSHA and Part 12 of this Handbook, must certify that you have met all requirements. The following table tells you what training you must have for your particular job.

If you . . .	***Then you must have training in . . .***
Work in a building that contains asbestos	• The fact that your building has asbestos • How to recognize asbestos-containing materials • What to do if you suspect an asbestos release in your work area
Are a custodial worker	• Identifying asbestos in the JSC workplace • What to do and who to call if you suspect you find asbestos debris • Proper methods for housekeeping in areas with asbestos • Caring for floor materials that contain asbestos • As detailed in Part 12 of this Handbook
Do any work that could disturb asbestos	• The specific class of asbestos work you will be doing as detailed in Part 12 of this Handbook • How to use a respirator, which includes a fit test and medical surveillance
Are a "competent person" as defined by OSHA	• The subjects required by OSHA to be a "competent person" • As detailed in Part 12 of this Handbook

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Chapter 5.8
Hazardous operations: safe practices and certification

This could be you . . .

An employee was working on a water tower base without using the buddy system or checking the air quality and was overcome due to an oxygen deficiency.

Another employee was dispensing a chemical through a liquid sprayer, which he had done numerous times before, based on his training. Unfortunately he failed to read the current MSDS, which indicated, there had been a change in the chemical make-up, which resulted in an allergic reaction to the new chemical composition.

Contaminated solder was used in a Space Shuttle component because there were no requirements to certify solder technicians.

1. Who must follow this chapter

You must follow this chapter if you do or oversee any hazardous operations at JSC or JSC field sites. Paragraph 19 lists the responsibilities of supervisors, line managers, safety representatives, certified confined space supervisors, contracting officers, the Safety and Test Operations Division, the Occupational Health Branch, and the Employee Development Branch.

2. Hazardous operations

A hazardous operation is a job that involves hazardous materials, conditions, or equipment that could result in injury or property damage if you don't follow special precautions.

Requirements for hazardous operations

3. Requirements for any hazardous operation

If you do or oversee hazardous operations, you must:

a. Decide which category—I, II, III, or IV—your operation belongs in. See Paragraphs 4, 5, 6, and 7 of this chapter.

b. Inform your organizational director of the risks involved in any new or non-routine hazardous operation with the potential for death, serious injury, or loss of critical high dollar value hardware before you start.

c. Make sure, as a supervisor, that everyone follows any requirements that apply to the operation or that are listed on the permit.

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d. Use the "buddy system" with at least one standby person in one of these ways:

- One of you does the job and the other watches from the immediate area of the job to make sure the "worker" is safe.
- Two of you do the job and you keep in constant contact with a standby person electronically, mechanically, or visually. The standby person must remain in the immediate area where you are working.
- Two of you do the job and you keep in contact with a standby person by coded lifeline signals even though you may be out of sight of the standby person. The responsible safety representative will decide how many worker and standby person combinations there must be.

e. Take extra care, as a supervisor, to recognize and respond to dangerous situations when:

- Your employees work in hazardous areas they aren't normally assigned to.
- Your employees are working near public access areas.

4. Requirements for category I hazardous operations

Category I jobs involve operations that are likely to either cause death or serious injury or high-dollar property damage for JSC.

For category I jobs, you must have at least the following:

a. Classroom or on-the-job training or both for initial certification and then as needed.

b. Written examination or experience review by line management. Many chapters in the handbook and other requirements list training requirements for certain operations.

c. Annual retraining that will include review of emergency response and first aid procedures.

d. Recertification as required or as necessary.

e. Permits (Hazardous Operations, Hot Work, or Confined Space) or physiological training if necessary.

f. Physical examination if required by the Occupational Health Branch. See Chapter 3.6, "Occupational Healthcare Program," of this handbook for more details on physical examinations. Physiological training may also be required.

Category I jobs include, but are not limited to, those listed in the following table. Chapter numbers given are for chapters in this handbook.

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For these personnel or operations . . .	*Permit reqd . . .*	*Physio trng reqd?*	*Med. exam reqd?*	*Follow requirements in . . .*
Working on an aircrew	none	yes	yes	n/a
Operating aircraft engine test cells (T-38 aircraft sound suppression facility)	none	no	yes	n/a
Operating a crane	HOP*, for heavy lifts	no	some, see Chapter 3.6	Chapter 8.5
Handling explosives or pyrotechnics (ordnance category)	HOP*	no	no	Chapter 9.5
Handling propellants	HOP*	no	yes	Chapter 9.5
Rescue personnel	none	yes	yes	n/a
SCAPE (Self-Contained Acid-Proof Equipment) operators	none	no	yes	n/a
Scuba diving and operating neutral buoyancy tanks	HOP*	no	yes	Chapter 6.6
Handling pesticides, insecticides, or herbicides	HOP*	no	yes	Chapter 9.3
Test directors, conductors, engineers, and subjects (including flights with and without human subjects)	none	yes**	yes	Chapter 6.9
Washing windows on multistoried buildings	none	no	no	Chapter 8.7
Handling lithium cells or batteries	none	no	no	Chapter 6.1
Working in confined spaces	CSE***	no	no	Chapter 6.10

* HOP – Hazardous operations permit
** Required for human occupied hyperbaric and hypobaric activities only.
*** CSE -- Confined space entry permit

5. Requirements for category II hazardous operations

Category II jobs involve operations that, if not done correctly, could create a severe hazard to the operator or user, other personnel, or property.

The requirements for category II jobs are similar to those for category I jobs. You may reduce the levels of physical examination, training, and testing because of the lower hazard levels. Your organization must determine the certification and recertification requirements with the concurrence of the Safety and Test Operations Division or the Occupational Health Branch.

Category II jobs include, but are not limited to, those listed in this table. Chapter numbers given are for chapters in this handbook.

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For these personnel or operations . . .	*Permit reqd . . .*	*Physio trng reqd?*	*Med. exam reqd?*	*Follow requirements in . . .*
Operating altitude chambers	HOP*	yes	yes	Chapter 6.9
Operating heavy equipment and rigging loads	none	no	yes	Chapter 8.5 and equipment manuals
Operating high-pressure liquid, vapor, or gas systems	none	no	no	n/a
Working with high-voltage electricity	HOP*	no	no	Chapters 8.1 and 8.2
Servicing and maintaining equipment with hazardous energy	none	no	no	Chapter 8.2
Operating hyperbaric chamber	HOP*	yes	yes	Chapter 6.9
Operating powder-actuated tool	HOP*	no	noise only	Chapter 8.6
Using radioactive materials or radiation-producing equipment (ionizing and nonionizing)	HOP*	no	no	Chapter 7.3
Operating boiler plants	none	no	noise only	n/a
Operating aerial baskets and truck platforms	HOP*	no	no	Chapter 8.7
Working with insulation	none	no	yes	n/a
Operating Class 3B & 4 lasers or solar simulators	HOP*	no	yes	Chapter 6.2 (laser only)
Handling cryogenics	HOP*	no	no	Chapter 6.5
Pressure suit technicians	none	yes	yes	n/a
Welding (fusion) on flight ground-support equipment	HWP**	no	no	8.4 & JSC 18323
Hand or automated wire wrapping	none	no	no	MIL-STD-130b
Hand soldering for flight and ground-support equipment	none	no	yes	NASA-STD 8739.3
OSHA Class I, II, or III asbestos work	Yes	No	Yes	Chapter 5.7 and Part 12

* HOP – Hazardous operations permit
** HWP – Hot work permit

6. Requirements for category III hazardous operations

Category III jobs involve handling, transporting, and packaging of hazardous materials that do not disturb the integrity of the basic shipping container. Operations that involve the reduction of palletized or otherwise combined items of packaged hazardous materials qualify

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as handling.

Category III jobs require training, certification, and a hazardous operations permit unless you have a procedure as described in Paragraph 13 of this chapter. Your organization will determine the certification period with concurrence from the Safety and Test Operations Division, or the Occupational Health Branch if none is required by state or federal laws. You must:

a. Have specific training in federal, NASA, and JSC rules for preparing, packaging, marking, and transporting the material you will handle.

b. Pass a written test to show you have the necessary knowledge and skills.

c. Get a certification card and carry it. The card must include name, date, materials you may handle, signature of certifying officer, and expiration date.

7. Requirements for category IV hazardous operations

Category IV operations require a hazardous operations permit unless you have a procedure as described in Paragraph 13 of this chapter. Medical exams are only required for certain operations. See Chapter 3.6 for more information on medical exams.

Category IV jobs include, but are not limited to, those listed in this table. Chapter numbers given are for chapters in this handbook.

For these personnel or operations . . .	***Follow requirements in . . .***
Hot work	Chapter 8.4 and 5.8.8 below
Working in acoustic and vibration chambers	Chapter 6.9
Working in acceleration facilities	Chapter 6.9
Working in impact testing facilities	Chapter 6.9
Working in oxygen-enriched or oxygen-deficient atmospheres	n/a
Demolition	29 CFR 1926.850
Using pneumatic and power actuated devices that incorporate projectiles	Chapter 8.6
Excavation	29 CFR 1926.650 and 1926.651
Proof pressure testing components or systems	n/a
Transferring, transporting, using, disposing of, or otherwise exposing personnel to cryogenic substances, explosives, radiation, etiological agents, flammable or combustible liquids or solids, propellants, poisons, corrosive or oxidizing materials, or compressed gases	Chapter 5.1 Chapter 8.5 Chapter 9.1
Transporting oversized loads or trailers that would require special permits on public roadways	Chapter 5.3
Working at heights of 20 feet or more	Chapter 8.7

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Using “heavy lift” material handling equipment	Chapter 8.5
Doing hazardous waste operations	29 CFR 1910.120 40 CFR Parts 260-279

8. Work shift limits for hazardous operations

These limits prevent dangerous situations due to fatigue. They apply to those doing hazardous activities as well as to those who are responsible for activities that could result in death, injury, or property damage:

a. If you do any hazardous operations, you must:

- Never work a shift of over 12 hours in a 24-hour period.
- Be off for at least 10 hours between shifts.

b. If you do any test support or test facility activities such as facility readiness, repairs, or maintenance, you must:

- Never work a shift of over 12 hours in a 24-hour period.
- Be off for at least 10 hours between shifts.

c. If you are involved in test team activities that directly support tests, you must:

- Never work a shift of over 12 hours for continuous testing. Normal and desired shifts are 8 hours.
- Have a qualified relief every 4 hours so you can take rest breaks.
- Be off for at least 10 hours between shifts.

d. If you are involved with hypobaric chamber activities, you must:

- Be off for at least 24 hours before the test starts if you work 12-hour shifts during the pretest phase.
- Never start a test if the combined pretest hours worked and the test hours scheduled to complete the test will exceed 12 hours. You may use a fresh test team to staff the duty stations of those whose shifts will exceed 12 hours.
- Never work more than five 12-hour shifts in a week without a day of rest right after the 60-hour workweek.
- Never work longer than 8 hours in a 24-hour period at altitude as an inside lock observer. A standard shift at altitude is 4 hours with a maximum of 6 hours. The medical monitor is responsible to notice excessive fatigue in lock observers.
- Never spend more than 6 hours in suit conditions in a hard vacuum. The medical monitor is responsible to notice excessive fatigue in crew members.

e. Have waivers to the requirements in Subparagraph a above approved by the Division Chief responsible for the facility.

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f. Have waivers to the requirements in Subparagraphs b and c above approved by the director or assistant director responsible for the facility. The request must include, as needed, the rationale for the waiver, the reason you can't fully comply, alternatives, program impact, hazard assessment, and an assessment by the Space and Life Sciences Directorate. Send a copy of the approved waiver to the Safety and Mission Assurance Directorate.

Hot Work Requirements

9. Requirements for hot work

"Hot work" is any work involving burning, welding, or similar operations that is capable of initiating fires or explosions. To do any hot work on cooling towers anechoic chambers, or mockup areas, you must first get approval from the Safety and Test Operations Division. Send that office a written statement justifying the need for the work for review and approval. You must follow these requirements for any hot work:

a. Never do any hot work outside of a designated hot work area without an approved hot work permit. See Subparagraph 12.b of this Chapter for more information on permits. See Paragraph 11 below for information on designated hot work areas.

b. To reduce the chance of a fire, notify the facility fire wardens, and remove ordinary combustibles.

c. Post a fire watch recognize fire hazards, notify appropriate responsible persons in the event of an emergency, start an orderly emergency evacuation when appropriate, and safely use a small portable fire extinguisher. The fire watch must:

- Take appropriate action if potential fire hazards are observed. This includes notifying responsible persons of the observed hazards.
- Prevent fires from occurring. For example, be aware of where falling sparks may land and prevent them from falling into any sewer system or onto combustible materials. Maintain adequate clearance between ignition sources and combustible materials.
- Maintain a close watch on any locations where hot work has been done to make sure there are no imbedded hot spots or flare-ups.
- Notify the Emergency Operations Center (x33333 at JSC and SCTF or x44444 at Ellington Field) and building occupants of a fire and start an evacuation.
- Extinguish small fires if it can be done safely.

10. Permit-required hot work areas

A permit-required area is an area that is made fire safe by removing or protecting combustibles from ignition sources. A hot work permit is required for any hot work. See

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Subparagraph 12.b of this Chapter for more information. The Safety and Test Operations Division and the Occupational Health Branch must review permit-required hot work areas during each annual safety, health, and fire protection inspection.

11. Designated hot work areas

A designated hot work area is a permanent location approved for hot work operations to be done regularly. To set up a designated hot work area, you must:

a. Form a team to review the area. The review must include an on-site survey of the area and a meeting to discuss any discrepancies or concerns. The team must consist of the following individuals as a minimum:

- Safety and Test Operations Division representative.
- Occupational Health Branch representative.
- Fire Protection engineer.
- Facility Manager.
- Contractor Safety Representative for contractor operations.
- Line manager(s) over the proposed area.

b. Meet the following requirements:

- The area must be a specific area designed or approved for hot work, such as a maintenance shop or a detached outside location.
- The structure must be made of noncombustible or fire-resistive materials, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas.
- Chapters 5.1, “Fire safety,” and 8.4, “Welding, cutting, and brazing safely,” of this Handbook.
- NSS 8719.11, “NASA Fire Protection Standard.”
- NFPA 1, “National Fire Prevention Code.”
- NFPA 51B, “Standard for Fire Prevention During Welding, Cutting and Other Hot Work.”

c. Submit a plan to the team in subparagraph a above. The plan must include as a minimum:

- A description of the welding process and related activities planned.
- Location and floor plan, indicating the location of extinguishers, pull stations, phones, emergency egress routes, nearest flammable and combustible materials, etc.
- The type of fire alarm and suppression systems in the area.
- A list of any associated hazards and controls.

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- A hazard analysis for the planned activities.
- A Job Safety Analysis for the planned activities.
- An Emergency Evacuation Plan.
- Air quality survey.
- A list of responsible individuals and contacts.

d. Attach a signature page to the plan that must include concurrence signatures of the review team members (subparagraph a above) once their concerns have been identified and addressed.

e. Present the plan, with concurrences noted on signature page, to the JSC Authority Having Jurisdiction or the Division Chief of the Occupational Safety and Quality Assurance Branch, or both for final approval.

f. Keep one copy conspicuously posted in the designated hot work area and provide another to the JSC Fire Specialists.

g. Reevaluate the area yearly.

Permits and procedures

12. Permits for hazardous operations

You must have a permit for certain hazardous operations before you may begin work. Fill out the permit form and post the completed permit at the job site until the job is over. Some operations, such as welding in a confined space, require two or more permits. Permits are only good for a limited time, such as one shift, and expire on the date and time shown on the permit. You must have one of the following permits as required and post it at the job site along with any procedures you will use:

a. A ***confined space entry permit*** any time you enter a confined space. See Chapter 6.10, "Entering confined spaces," for more details.

b. A ***hot work permit*** any time you do any work involving burning, welding, or similar operations that is capable of initiating fires or explosions outside a designated hot work area. Use JSC Form 1475, "Hot Work-Welding-Cutting Permit," Appendix 5A. Electric soldering irons, hot plates, coffee pots, and similar appliances don't require a permit. Hot work permits are valid for no longer than 1 week. The flowchart in Figure 5.8-1 describes the steps to complete a hot work permit.

   Note: as a fire warden, contractor safety representative, safety point of contact, or facility manager, you must contact the Occupational Health Branch if you suspect any exposure or health issue with the hot work.

c. A ***hazardous operations permit*** for other operations as required by Paragraphs 4 and 5 of this chapter. Use JSC Form 8, "Hazardous Operations Permit," Appendix 5A. The flowchart in Figure 5.8-2 describes the steps necessary to complete and approve a

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hazardous operations permit.

13. Exceptions to permit requirements

You don't need a hazardous operations permit if you write a detailed procedure and have it approved by the Safety and Test Operations Division. The procedure must include a statement that says, "This document contains hazardous operations." Confined space entry and hot work permits are always required. To use a procedure, you must:

a. Include the title and telephone extension of each person who would normally receive a copy of the permit with the procedure.

b. Contact those you listed under Subparagraph a above to let them know about your work, before you start.

c. Post a copy of the procedure at the job site as you would post a permit.

d. Send any revisions to the procedure to Safety and Test Operations Division for review and approval.

e. Review and update the procedures at least yearly.

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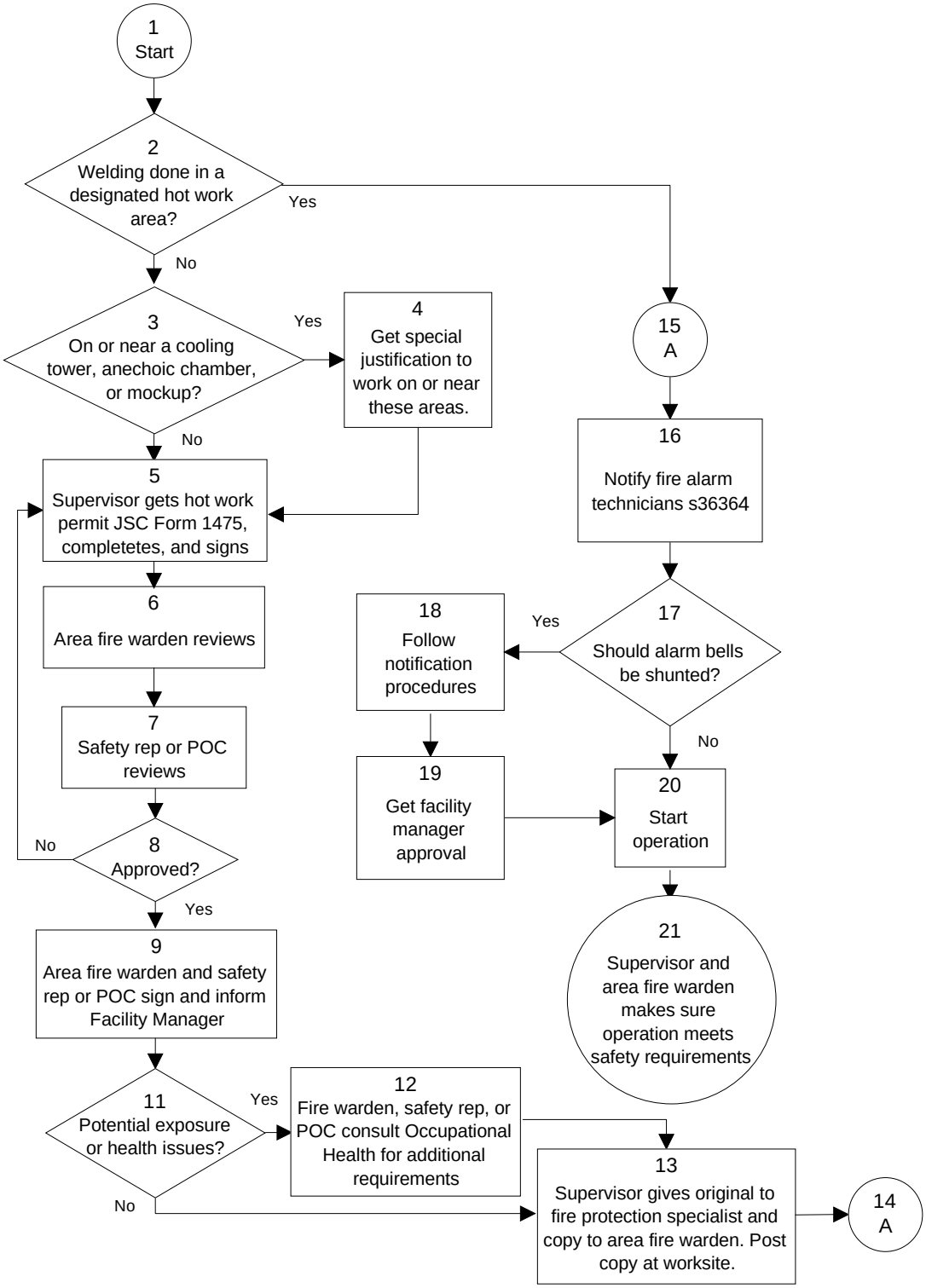

Figure 5.8-1. Hot work permit flowchart.

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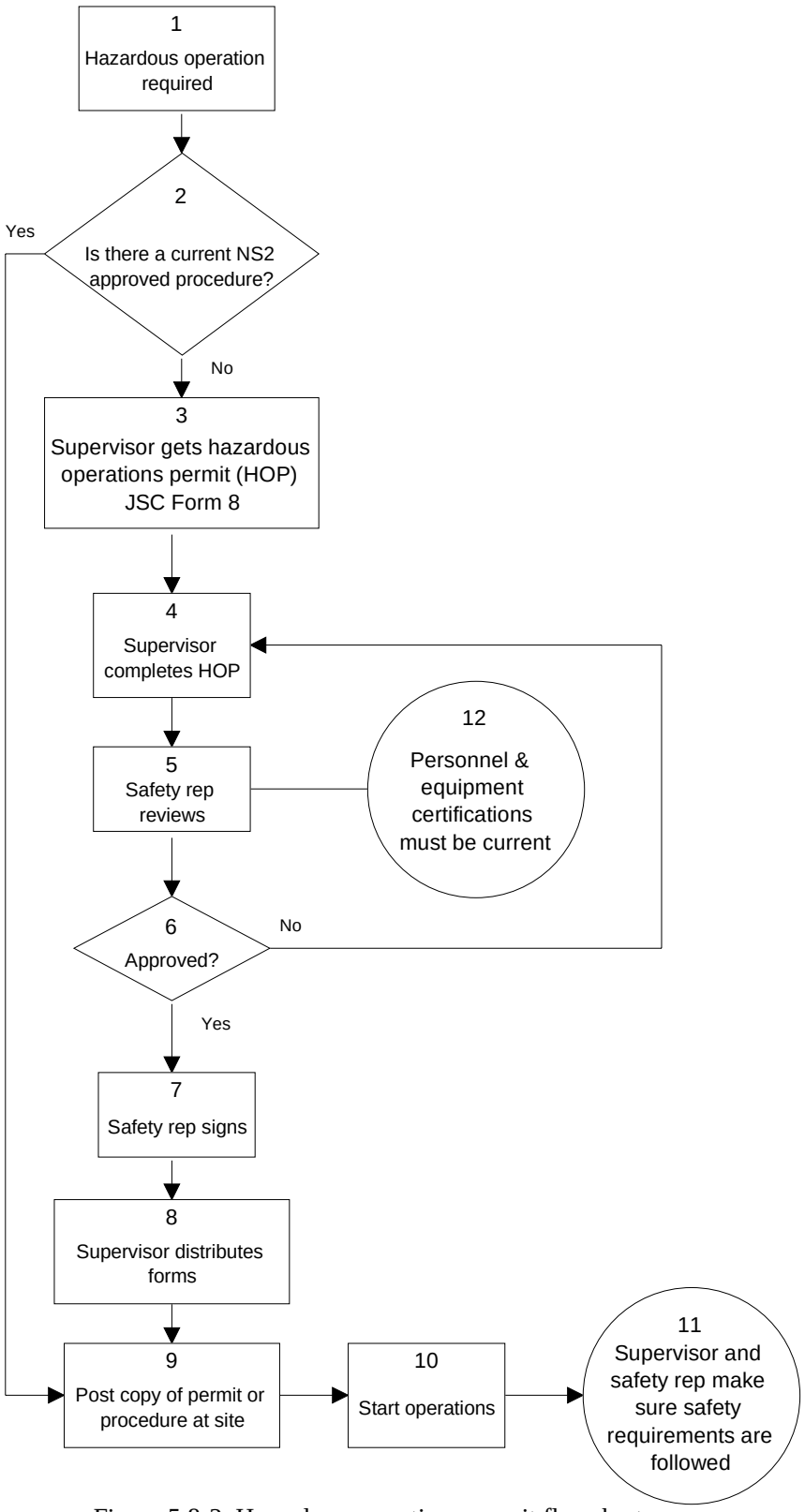

Figure 5.8-2. Hazardous operations permit flowchart.

Verify this is the correct version before you use it by checking the on-line version.

Certification for hazardous operations

14. Certification process

To be certified, you must show that you have the necessary knowledge, skills, judgment, and physical ability to do the job safely. JSC will provide and document your training and certification. Certification must follow these requirements:

a. You must be certified by your management after you:

- Complete the necessary formal or on-the-job training. Your management must at least outline the on-the-job training you must have and state the minimum number of hours required.
- Pass an oral test, written test, or experience review.
- Get a certification card when the certification examiner determines that you have the required safety knowledge and skills. The certification examiner and certifying officer must both sign the card. You may use JSC Form 353, Appendix 5A. See NPR 8715.3, Chapter 4, "Safety Training and Personnel Certification," for more information.

b. Your organization must keep a record of your certification on JSC Form 209, "Application and Record of Qualification for Personnel Certification," Appendix 5A, or a similar form.

c. Certification examiners must:

- Know the requirements of the operation they will certify.
- Be at least one organizational level higher than the employee to be certified.
- Be appointed by the Center Director or his or her designated representative to certify category I operations.
- Be appointed by directorate level official or representative from the organization responsible for the operations to certify category II or III operations.

d. Certification is good for 3 years or less if necessary. The certifying officer and your management may request that you be recertified or retested:

- Any time they question your knowledge or skills.
- When you have to do any new hazardous operation.

e. You must have a physical examination when required by Paragraphs 4 or 5 of this chapter or by the Occupational Health Branch to be certified or recertified.

15. Exceptions to the requirements in Paragraph 14 above

Certifications for operations other than the categories of hazardous operations mentioned in this chapter are exempt from the requirements of this chapter.

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16. How you could lose your certification

You will lose your certification if you:

a. Leave JSC or your company.

b. Fail the recertification exam or fail to retain the required knowledge and skills.

c. Are transferred or reassigned and no longer do the operations you are certified for.

d. Fail to pass a required medical examination.

e. Are past your recertification date.

Other requirements and responsibilities

17. Hazardous duty pay

Never use anything in this chapter to justify hazardous duty payments, environmental differential pay, or premium pay. Jobs that qualify for hazardous duty pay aren't necessarily covered by this chapter. See Part 5, Subpart 6 of the JSC Personnel Manual for information on hazardous duty pay.

18. For more information on hazardous operations

You can find more information on hazardous operations in these documents:

a. 29 CFR 1910.38, "Employee Emergency Plans and Fire Protection Plans"

b. NPR 8715.3, Chapter 6

19. Responsibilities for hazardous operations

a. As a ***supervisor***, you must:

- Get, complete, and distribute required permits.
- Monitor hazardous operations to make sure the requirements on the permit and in this Chapter are followed for any hazardous operation.
- Provide detailed safety instructions for safe operations to employees who are authorized access to hazardous areas or who do hazardous operations.
- Identify operations that could be hazardous. Analyze these operations to determine the risk to personnel, equipment, and facilities.

b. As a ***line manager*** you must:

- Make sure that hazardous operations that require certification are done only by employees with a valid certification.
- Manage a training and certification program for your organization. This includes

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providing all training and testing necessary to qualify your employees and certifying them after they show they have the necessary knowledge and skills.

- Keep a master list of: all operations that require certified personnel, employees that are certified for those operations, certification examiners, and certification officers in your organization.
- Keep completed certificates and supporting records current. Protect employee training records under NPD 1382.17 (current version), "Privacy Act - Internal NASA Direction in Furtherance of NASA Regulation."
- Recommend candidates for certification examiners.

c. As a ***safety representative, competent person,*** or ***certified confined space supervisor***, you must review each permit to make sure requirements are followed and that personnel listed on permits have valid and current certifications if required.

d. As a ***contracting officer***, you must make sure contracts contain hazardous operations requirement as necessary.

e. The ***Safety and Test Operations Division*** must:

- Review all operations being done at JSC or JSC field sites yearly to identify those that could be hazardous. Employee safety and health committees and employee representatives will help identify hazardous operations as requested.
- Monitor JSC operations to make sure that only certified personnel are assigned to tasks described in this chapter.
- Survey selected areas to determine the effectiveness of the certification program.
- Keep metrics on the waivers and mishaps related to the waivers.

f. The ***Occupational Health Branch*** must set requirements for hazardous operations involving potential health hazards, sample and monitor environmental conditions, and provide professional medical support and surveillance as needed.

g. The ***Employee Development Branch*** must provide training courses for hazardous operations as requested by line management and the Safety and Test Operations Division. These courses must qualify personnel for certification.

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Chapter 5.9
Weather Safety

This could be you . . .

An employee was struck by lightning while removing rain panels from the roof of a NASA trailer in preparation for moving the trailer to another location. After initially refusing to seek medical care, later in the day he began to feel worse and finally went to a hospital emergency center. The employee was admitted to the hospital overnight and subsequently remained off work for about two-weeks recovering from the event.

Debris from a construction site damaged several cars when a severe thunderstorm came through the JSC area. A severe thunderstorm warning and wind gust advisory had been issued about an hour before the incident.

1. Who must follow this Chapter

You must follow this Chapter if:

a. You work at JSC or a JSC field site as a civil servant or contractor employee.

b. You are a line manager, facility manager, or contractor safety representative. Paragraph 9 of this Chapter lists your responsibilities.

Paragraph 9 of this Chapter also lists the responsibilities of the Safety and Test Operations Division, contracting officers, and contracting officers' technical representatives.

2. Basic requirements for weather safety

When there is doubt about the potential for adverse weather conditions, adopt a conservative approach and assume the presence of adverse weather conditions. You must be aware of and know what specific actions are required to be taken for your immediate area when notified of adverse weather conditions. You are responsible for your own safety.

When approved site or task-specific weather safety policies conflict with this Chapter, the task or site-specific instructions take precedence. When there is no site or task-specific instruction, this chapter applies. You must coordinate any task or site-specific instructions with the Safety and Test Operations Division.

Each JSC organization must have a plan for limiting operations when weather conditions present a hazard to personnel or equipment (See Paragraph 7 of this Chapter for Group Events). The plan must:

a. Identify weather limits for safe operations based on the time required to safely terminate operations, the operation's risks, and the operation's location.

b. Designate individuals responsible for monitoring weather conditions. These individuals are responsible for:

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- Notifying the organization's members when adverse weather conditions are occurring or are expected to occur.
- Monitoring the weather at their local jobsite or contacting the Spaceflight Meteorology Group* (SMG) for guidance.

c. Provide instructions for the safe termination of operations and sheltering for personnel and special high value equipment when adverse weather conditions are anticipated.

*NOTE: The JSC SMG monitors local JSC weather weekdays from 6:30am to 6:00pm Central time(except Federal Holidays) and issues weather advisories for the specific criteria listed below. The SMG issues advisories via the JSC Emergency Notification System (JENS), which posts to the JSC internal home page and distributes global e-mails. The SMG can also assist an organization in monitoring adverse weather conditions in response to specific queries. SMG issues JSC weather advisories for the following:

- Lightning within 6 miles of JSC
- Severe Thunderstorm, Tornado, Flash Flood Watch or Warning for Harris or Galveston County
- Surface wind gusts greater than 58mph
- Freezing Temperatures or Precipitation
- Excessive Heat
- Tropical Storm or Hurricane Watch or Warning for Harris or Galveston County

Operations in Potentially Hazardous Weather Conditions

3. Lightning

Lightning is second only to floods in the number of weather related deaths that are caused each year.

Generally speaking, if you can see lightning or hear thunder, you are already at risk of a lightning strike. Lightning can strike as much as 10 miles away from the rain area in a thunderstorm. That's about the distance that you can hear thunder. High winds, rainfall, and cloud cover are often precursors to actual cloud-to-ground strikes, alerting you to take action. Many lightning casualties occur as the storm approaches or after the storm appears to have passed. Don't be fooled by sunshine or blue sky!

At JSC, you must follow this policy:

a. Consider lightning to be occurring in the JSC area if any of the following occurs:

- You observe lightning and hear the associated thunder within 30 seconds of seeing

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the lightning.

- You hear thunder but do not observe lightning.
- You receive indications from a properly operating lightning detection system that lightning is occurring within 6 miles.
- You receive an SMG issued JSC *Lightning Alert* per subparagraph b below.

b. The following apply to JSC lightening alerts that you may receive via JENS e-mail or by phone or that you see on NASA CCTV Channel 18:

- The SMG issues a JSC Lightning Alert when lightning is occurring or imminent within 6 miles of JSC.
- A SMG Lightning Alert ends 30 minutes after the last lightning strike within 6 miles of JSC is detected.
- This service is available Monday through Friday from 6:30am to 6:00pm. The service is not available on federal holidays.

c. If lightning is occurring in the JSC area, take the following steps immediately:

- Suspend all outdoor activities, including construction and landscaping work and move indoors if possible.
- Move to a protected location. JSC buildings that are occupied as daily work areas (office buildings and laboratories) can be considered to be protected safe locations during a lightning event. If you cannot safely reach an office or laboratory building, a metal enclosed vehicle with the windows rolled up will provide better protection than being outdoors.

NOTE: It is a misconception that lightning always strikes the highest object in an area. If you are walking near a building while lightning is occurring you are at just as much risk as someone working on the roof of the building.

Although your safety is significantly improved by being inside an office or laboratory building, be aware that even in these “protected locations” injuries could occur if lightning should strike.

Some areas that provide no additional lightning safety to individuals are carports, rain shelters, the pavilions at Gilruth, softball field dugouts, golf or “Cushman” carts, eaves or awnings around buildings, trees, fences, light poles, and automobiles with non-metallic tops.

- Stay out of direct contact with plumbing, piping, window frames, or other metallic objects. You may continue to use phones and computers because they are isolated. If in an automobile, stay away from any metal in the vehicle.
- Monitor weather conditions.

d. You may resume activities when any of the following criteria are met:

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- You have heard no thunder for 30 minutes. The threat of lightning continues for a much longer period than most people realize. Wait at least 30 minutes after the last clap of thunder before leaving a protected location.
- The JSC SMG cancels the *Lightning Alert.*

4. Wind Policy

You must follow these requirements during adverse wind conditions:

a. After identifying potentially adverse wind conditions, supervisors or task leaders may:

- Consult the JSC Web for JSC Bldg. 30 Weather Observations. You can find JSC Bldg. 30 weather observations including wind speed at the following web address http://www.srh.noaa.gov/smg/bldg30.htm. (Note that the JSC Bldg. 30 sensors are approximately 172 feet (52 meters) above sea level.)
- Use a hand held or crane mounted anemometer to get direct readings for their specific work site.
- Contact the SMG weather forecaster to get a more precise prediction for the specific job site. You must make prior arrangements for this service.

b. Operations may continue as long as local conditions (at the specific work site) do not exceed the adverse weather limitations as specified in the “Wind Limitations Table.”

c. As a supervisor or task leader of operations and facilities, you must stop all operations and take appropriate actions when the wind speed or direction presents a hazard to the operation or facility.

d. The following table reflects the maximum wind speed work limitations. You must never exceed the table without approval from the on site supervisor or task leader and the Safety and Test Operations Division:

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Wind limitations table

Average Wind Speed	***Wind Gusts***	***Follow these limitations . . .***
20 mph	25 mph	Don't erect work platforms or lift personnel in buckets or crane.
25 mph	28 mph	Stop all crane operations per *NASA NSS/GO-1740.9B "Safety Standard for Lifting Devices and Equipment*.
34 mph	40 mph	Stop work on roofs, unprotected areas, or outside hand rails.
40 mph	46 mph	Supervisors must immediately check their area for unsecured items.
45 mph	50 mph	Immediately secure all loose or unanchored materials and equipment.

A supervisor or task leader may decide to start or complete a lift in progress based on wind direction, high mass or low sail area of load, and wind measurements taken at the work site, but must never exceed the maximum gust limit.

When equipment manufacturers recommend lower wind limitations than this table, you must follow the manufacturer's recommended lower limits.

5. Tornados

You must follow this policy at JSC:

a. When the National Weather Service (NWS) issues a Tornado Watch for Harris or Galveston County, which indicates conditions are favorable for forming tornados, outdoor construction work may continue, however, you must secure equipment, supplies, and debris at outdoor work areas to the greatest extent possible.

b. When the NWS issues a Tornado Warning for Harris or Galveston County, which indicates tornados have been sighted or indicated by radar in the warning area, you must:

- Be prepared to take cover if a Tornado Threat to JSC is imminent.
- Close window coverings.

c. When the SMG issues a Tornado Warning for JSC, indicating a tornado is an imminent threat to JSC, you must:

- Take cover immediately.
- Stop all outdoor work immediately and take shelter in inner hallways or other safe locations in nearby buildings closing all doors.
- Stay in these safe locations until an "All Clear" is announced.

The SMG forwards all watches and warnings to employees via JENS. You will see this

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information via a JENS e-mail or the scrolling banner on the JSC CCTV Channel 18.

When the SMG issues a Tornado Warning for JSC, the JSC Emergency Operations Center activates the Emergency Warning System (EWS) and a "whoop" or high to low tone will sound. The EWS will announce an all clear as a solid "wail" sound.

6. Excessive Heat Advisories

You must follow this policy if an Excessive Heat Advisory is issued at JSC. SMG relays National Weather Service heat advisories issued for Harris County via JENS:

a. Outdoor construction work may continue. As a supervisor, you must:

- Be aware of the increased risk of heat related illness to your workers
- Make sure that adequate fluids (water, etc.) are available to employees at the outdoor location.
- Provide employees with a means to get out of the heat and reduce their accumulated heat load.
- Make every effort to schedule work during early morning hours when air temperatures are the lowest.

b. Outdoor exercise can lead to heat injuries when an Excessive Heat Advisory is in effect. If you choose to exercise outdoors during an Excessive Heat Advisory, you must be aware that:

- You are doing so at your own risk and against the advice of JSC Health and Safety offices.
- Exercising with a partner allow someone to get help if a heat injury occurs.
- Consuming adequate fluids will reduce the risk of a heat injury.
- Understanding the symptoms of heat injury will allow you to stop and cool off before a heat injury actually occurs.
- Exercising during early morning hours when air temperatures are the lowest reduces the risk of heat injury.

7. Group Events

All outdoor group events must have a Weather Safety Plan that is approved through the Occupational Safety Office. The following requirements apply for group events:

a. All plans require:

- A person to decide if the weather limits identified for the event have been exceeded and if the event must be terminated. This person must be present continuously for the event and must not consume alcoholic beverages during the event.
- A person responsible for monitoring the weather for any changes that might require

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the event to be terminated.

- A means of notifying all participants at the event of weather safety related matters in a timely fashion
- Operational weather limits for the event.
  - A procedure for safely terminating the event if the weather limits are exceeded.

b. Plans for Gilruth events must remain on file at Gilruth. Plans for events held away from Gilruth (includes Ellington, SCTF, Child Care Center, or general JSC area) must remain on file in the Safety and Test Operations Division with information available to the on-call Occupational Safety Engineer.

c. Most "routine" events held at Gilruth may use one of two templates in Appendix 5B. If you use one of these templates and turned in the plan with other paperwork when you make a reservation at Giluth, then no further approval is required.

d. Some events will be better served by developing their own plan due to the nature of the event. These plans must also meet the requirements in subparagraph a above and require approval by the Safety and Test Operations Division.

e. For events with 40 attendees or less, use the plan template in Appendix 5B, Attachment 5.9A, which must contain:

- A primary decision making official who must be assigned for the entire length of the event and remain alcohol free
- Protective areas and actions in the event of lightning or severe storms
- Planned routes to protective areas
- The specific notification process or signal to take protective measures and an ALL CLEAR notice.
- Planned sources of weather information. In addition to visual assessments (30-30 rule), weather information sources must include <u>at least two</u> of the following: Internet, All-Hazards Weather Radio, hand-held lightning detector, continuous contact with NWS or private weather service

f. For events with more that 40 attendees, use the plan template in Appendix 5B, Attachment 5.9B, which must contain:

- A primary and a back-up decision making official
- A weather watcher or reporter
- One safety warden for every 100 attendees to assure that everyone receives safety notifications and instructions from responsible officials.
- Protective areas to house all attendees and actions in the event of lightning or severe storms
- Planned routes to protective areas
- The specific notification process or signal take protective measures and an ALL CLEAR notice.
- Planned sources of weather information. In addition to visual assessments (30-30 rule), weather information sources must include <u>at least two</u> of the following:

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Internet, All-Hazards NOAA Weather Radio, hand-held lightning detector, continuous contact with NWS or private weather service

- The method of maintaining 2-way communications between the primary and backup decision makers, the weather watcher, and all safety wardens. Possible options are cell phones and hand held radios

8. Remote Operations

If you are working at remote locations (trade shows, field tests, recovery operations, etc.), you must include adverse weather safety planning into the operational plans. Before starting operations, the task lead or senior individual on site must determine the current environmental conditions for the specific area by:

a. Assessing the surrounding conditions. Look for overcast or threatening clouds, rain, or indications of high winds. Listen for thunder. If you hear thunder, follow the steps in Paragraph 3 of this Chapter.

b. Contacting the JSC Spaceflight Meteorology Group at least one day before the operation, and providing them with the exact location of the remote operation, description of work to be done, when it will be done and estimated length of the task. Then on the day of the operation, request from SMG information on existing or developing adverse weather conditions for the specific area of operations that could potentially move into the area during the operation. Request the weather forecaster's recommendation for application of JSC Lightning Alert precautions, or high wind advisory. The SMG is available to monitor weather weekdays from 6:30AM to 6:00PM Central time(except Federal holidays). You must make prior arrangements for this service.

c. If the activity is held at a remote location with access to an on-site weather organization (examples – Dryden Flight Research Center, military installations), coordinate with the remote site's forecaster at least one week in advance of the operation to arrange weather support.

d. Making the decision to proceed with the scheduled operation, and applying appropriate adverse weather precautions as directed in this Chapter.

e. Periodically reassessing conditions. Monitor weather instrumentation, monitor weather radios, and request updates from the SMG as necessary. Remember if you can hear thunder you are already at risk for a lightning strike.

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Responsibilities

9. Responsibilities for adverse weather planning

a. As **a *first level or line manager***, you must take necessary actions to:

- Make sure the requirements of this Chapter are followed in your functional areas.
- Monitor weather observations and forecasts when your organization is engaged in activities subject to increased risk during severe weather to assure safe operating limits are not exceeded.
- Make sure personnel under your supervision are trained and knowledgeable in the specific actions they are required to take when they are notified or become aware of pending or actual adverse weather conditions.
- Make sure that personnel under your supervision understand that no adverse action will be taken against them for exercising personal options relating to weather safety. Supervisors and other persons in positions of authority must never require an individual to be exposed to a potential weather hazard in order to attend meetings or to do other work.

b. As a ***contractor safety representative***, you must work with line mangers to make sure all personnel are trained and knowledgeable in the specific adverse weather actions they are required to take.

c. As a ***facility manager***, you must make sure that all new and on-going activities within the facility have appropriate adverse weather plans and that areas requiring evacuation during adverse weather are identified.

d. ***Contracting officers and technical representatives*** must make sure that JSC contractors understand and follow NASA and JSC contract requirements for adverse weather safety and planning.

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Appendix 5A

Forms

The following forms are not available electronically. Contact Forms (Supply and Distribution) at extension 36164 unless otherwise stated below to get a copy, or copy one out of this appendix:

JSC Form 1475	Hot Work-Welding-Cutting Permit
JSC Form 8	Hazardous Operation Permit
JSC Form 353	Certification/Recertification
JSC Form 209	Application and Record of Qualification for Personnel Certification

Verify this is the correct version before you use it by checking the on-line version.

JSC Form 1475
Hot Work Permit

☆GPO: 1986–662-643

HOT WORK – WELDING–CUTTING PERMIT	No. 15726

Hot Work
approval is given to (organization)

To (weld, cut, etc.)

Location (*Cooling Towers)

Work Begins	Date	Time
Work Complete	Date	Time
Permit Expires	Date	Time
Supervisor's Signature		
Responsible Safety Representative		
Area Fire Warden		

NOTIFY ALARM MAINTENANCE PRIOR TO AND AFTER COMPLETING WORK (4658 or 3744).

MAINTAIN A FIRE WATCH DURING AND FOR 1 HOUR AFTER THE COMPLETION OF HOT WORK.

REMOVE LOOSE COMBUSTIBLES, AND COVER FIXED COMBUSTIBLES WITH FIRE RESISTANCE BLANKETS.

COVER OPENINGS IN WALLS, FLOORS, OR ROOFS AND PROTECT FACILITIES AND EQUIPMENT FROM SLAGS AND SPARKS WITH FIRE RESISTANT BLANKETS.

KEEP WELDING LEADS OFF WALKWAYS.

SET UP FLASH CURTAINS TO PREVENT AREA OCCUPANTS FROM BEING EXPOSED TO ARCS.

*COOLING TOWER HOT WORK REQUIRES A WRITTEN JUSTIFICATION OF THE NEED AND A PROCEDURE FOR THE HOT WORK.

THE FOLLOWING FIRE EXTINGUISHER IS REQUIRED AT WORK LOCATIONS:

_____ WATER_____FOAM_____OTHER_____

_____ CO_2_____DRY CHEMICAL_____ SIZE_____

JSC FORM 1475 (DEC 84) **JSC SAFETY OFFICE**

Verify this is the correct version before you use it by checking the on-line version.

JSC Form 8
Hazardous Operation Permit

HAZARDOUS OPERATION PERMIT	No. 29044
APPROVAL IS GIVEN TO	
(Organization)	
TO PERFORM OPERATION DESCRIBED BELOW:	
SPECIAL PRECAUTIONS TO BE TAKEN:	

	DATE	TIME
OPERATION BEGINS		
ESTIMATED COMPLETION		

EXACT LOCATION OF OPERATION	
SUPERVISOR'S SIGNATURE	DATE
ISSUING AUTHORITY	DATE

JSC FORM 8 (JUN 64) **Safety Office**

THIS SIDE TO BE COMPLETED AT CLOSE OF HAZARDOUS OPERATION AND RETURNED TO JSC SAFETY OFFICE.		
ACTUAL COMPLETION	DATE	TIME
DESCRIBE ANY UNUSUAL CIRCUMSTANCES WHICH MAY HAVE OCCURRED DURING OPERATION.		
SUPERVISOR'S SIGNATURE		
REVIEWED BY (JSC SAFETY OFFICE)		
REMARKS:		

Verify this is the correct version before you use it by checking the on-line version.

Appendix 5A, Forms
(cont.)

JSC Form 353
Certification/Recertification

SIGNATURE OF EMPLOYEE	**NASA** **Lyndon B. Johnson Space Center** **CERTIFICATION/RECERTIFICATION**	DATE
	This is to certify that _____ (Name) Code is qualifed to perform the opeations listed hereon:	
	SIGNATURE OF CERTIFYING OFFICER	

JSC FORM 353 (REV JUL 81) **NASA-JSC**

This certificate is issued as government property and shall be surrendered to the certifying officer when:

a. leaving JSC employment
b. refused recertification
c. certification is revoked.

RECERTIFICATION

Required every _____ and signed by the cognizant certifying officer.

DATE	CERTIFYING OFFICER

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Appendix 5A, Forms
(cont.)

JSC Form 209

APPLICATION AND RECORD OF QUALIFICATION FOR PERSONNEL CERTIFICATION

SECTION I

1. TYPE OF CERTIFICATION

2. APPLICANT/TRAINEE	3. ORGANIZATION	4. DATE

5. WHERE	6. YEARS OF EXPERIENCE	7. TYPE

8. TECHNICAL TRAINING

9. APPLICANT/TRAINEE SIGNATURE	10. APPROVAL (SUPERVISOR SIGNATURE)

SECTION II—PHYSICAL EXAMINATION (If applicable)

11. EXAMINER	12. DATE

13. RESTRICTIONS

SECTION III-TRAINING EXAMINATION

14. NAME, DATE, AND LENGTH OF TRAINING

15. ORAL	16. WRITTEN	17. OPERATIONAL

18. EXAMINER/INSTRUCTOR (COMMENTS AND RECOMMENDATIONS)

19. EXAMINER/INSTRUCTOR (SIGNATURE)	20. DATE

SECTION IV

21. CERTIFYING OFFICER'S COMMENTS

22. CERTIFIED IN CATEGORY

23. NOT QUALIFIED FOR CERTIFICATION

24. REQUIRES RECERTIFICATION

25. CERTIFYING OFFICER (SIGNATURE)	26. DATE

JSC Form 209 (Rev Jul 81)

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Appendix 5B

Miscellaneous guidelines and instructions

This appendix contains the following attachments:

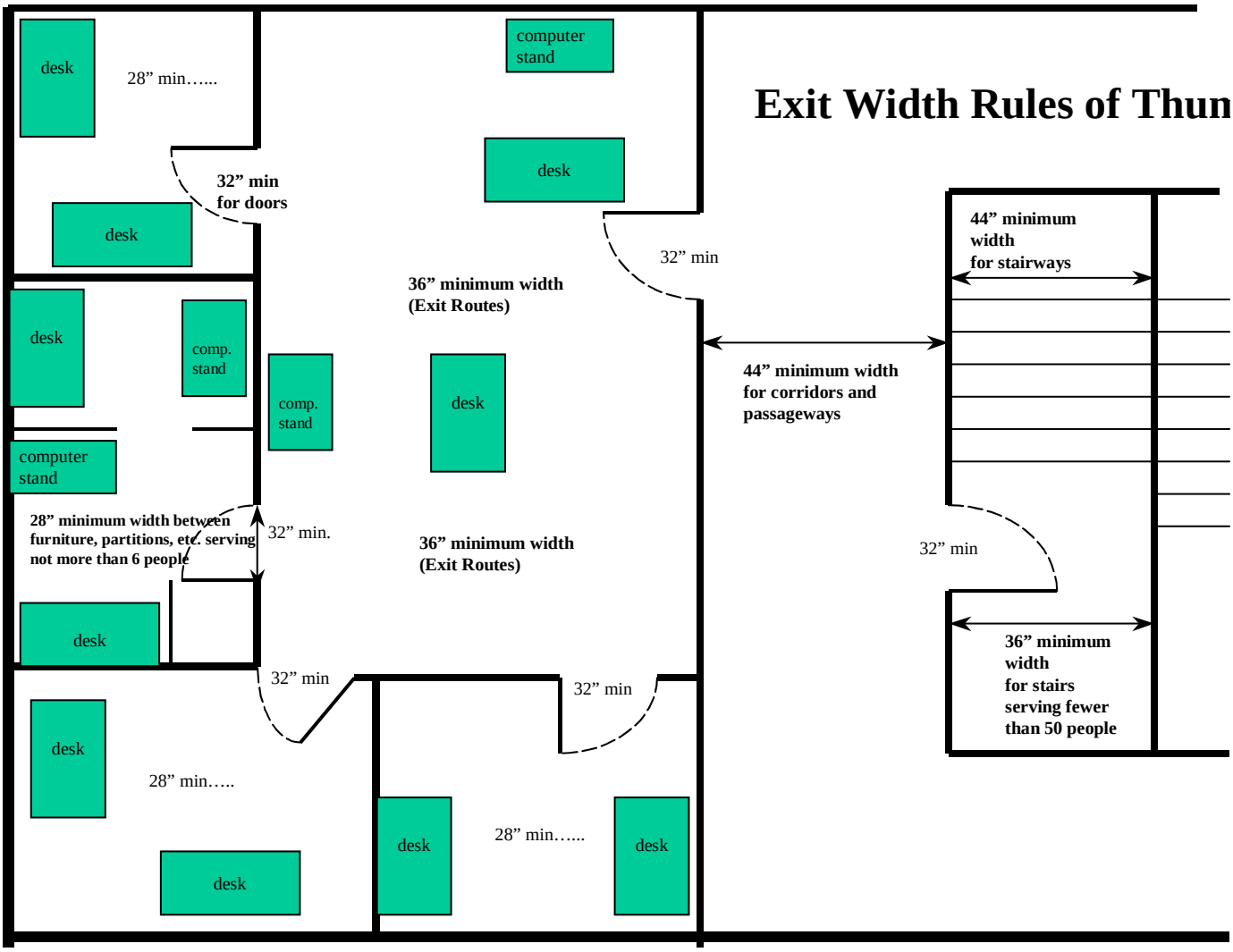
5.1A Exit width rules of thumb

5.9A Small Group Weather Safety Action Plan

5.9B Large Group Weather Safety Action Plan

Verify this is the correct version before you use it by checking the on-line version.

Attachment 5.1A
Exit width rules of thumb



Notes:

1. 32-inch door widths are “clear” width. (“Clear width” is the width of the opening through the fully open doorway, not the width of the doorframe.)
2. Minimum width of stairways is measured from wall to wall and not from handrail to handrail.

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Attachment 5.9A
Small Group Weather Safety Action Plan

The following are Weather Safety Requirements for small groups with 40 attendees or less.

1. Your severe weather safety plan must identify:

a. A decision making official that can be contacted by cell phone during the event. This person must:
   - Be assigned for the entire length of the event.
   - Remain alcohol free.

b. Protective areas and actions in the event of lightning or severe storms.

c. Planned routes to protective areas.

d. The specific notification process or signal to take protective measures and an ALL CLEAR notice.

e. Planned sources of weather information. In addition to visual assessments (30-30 rule, outlined under Weather Hazards Decision Criteria, below), weather information sources must include <u>at least two</u> of the following:
   - Internet.
   - All-Hazards NOAA Weather Radio.
   - Hand-held lightning detector.
   - Continuous contact with NWS or private weather service.

2. Use the following criteria for weather hazard decisions:

a. Base any <u>Lightning safety decisions</u> on the 30/30 rule:
   - 30 seconds or less flash - to - bang: seek safe shelter.
   - Wait at least 30 minutes from the last thunder before resuming outdoor activities.
   - If you can't assess flash-to-bang time, use the sound of thunder as the cue to seek safer shelter.

b. Base any <u>severe weather safety decisions</u> on an NWS Severe Thunderstorm or Tornado Warning for southern Harris County or northern Galveston County. Alternately, factors should include visual observations and "common sense." For example, a funnel cloud or small tornado that may be just forming, with no official NWS warning, should trigger protective measures for severe weather.

3. The following are additional recommendations for weather safety at your event:

a. Include lightning safety tips or action plan in programs, posters, flyers, etc.

b. Post lightning safety placards around the event area.

Verify this is the correct version before you use it by checking the on-line version.

Attachment 5.9A
Small Group Weather Safety Action Plan

Small Group Weather Safety Plan Template

You must complete all sections. If you need more space, continue on the back. Please print legibly.

Date of Event: _____ **Location**: ☐ Gilruth ☐ Other – Specify_____

Group Name: _____ **Estimated Number of Attendees**: _____

Decision Making Official: _____ **Phone**: _____

Specific Lighting and Shelter Location(s) for Attendees:

Evacuation route(s):

Notification Signals or Methods: Take Cover or Evacuate:_____

All-Clear: _____

Weather Monitoring Methods (two required – other than visual assessment and using 30/30 rule):

____Internet
____hand-held lightning detector
____NOAA All Hazards Weather Radio
____continuous contact with NWS or private weather service

Verify this is the correct version before you use it by checking the on-line version.

Attachment 5.9B
Large Group Weather Safety Action Plan

The following are Weather Safety Requirements for groups with more than 40 attendees:

1. Your severe weather safety plan must identify:

a. Both a primary and a back-up decision making official that can be contacted by cell phone during the event. These individuals must:
   - Be assigned for the entire length of the event.
   - Remain alcohol free.

b. A Weather Watcher/Reporter who monitors the sources below for changes in the weather.

c. "Safety Wardens" (one per 100 attendees minimum) to assure safety notifications and instructions from decision making officials are disseminated to everyone.

d. Protective areas and actions in the event of lightning or severe storms

e. Planned routes to protective areas

f. The specific notification process or signal to take protective measures and an ALL CLEAR notice.

g. Planned sources of weather information. In addition to visual assessments (30-30 rule, outlined under Weather Hazards Decision Criteria, below), weather information sources must include <u>at least two</u> of the following:
   - Internet
   - All-Hazards NOAA Weather Radio
   - Hand-held lightning detector
   - Continuous contact with NWS or private weather service

h. The method to be used to maintain 2-way communications between the primary and backup decision makers, the weather watcher, and all safety wardens. Possible options include cell phones and hand held radios.

Note: The decision making officials, weather watcher, and safety wardens should meet before the event and review their planning as defined in this template.

2. Use the following criteria for weather hazard decisions:

c. Base any <u>Lightning safety decisions</u> on the 30/30 rule:
   - 30 seconds or less flash - to - bang: seek safe shelter.
   - Wait at least 30 minutes from the last thunder before resuming outdoor activities.
   - If you can't assess flash-to-bang time, use the sound of thunder as the cue to seek safer shelter.

d. Base any <u>severe weather safety decisions</u> on an NWS Severe Thunderstorm or Tornado Warning for southern Harris County or northern Galveston County. Alternately, factors should include visual observations and "common sense." For example, a funnel cloud or small tornado that may be just forming, with no official NWS warning, should trigger protective measures for severe weather.

Verify this is the correct version before you use it by checking the on-line version.

3. The following are additional recommendations for weather safety at your event:

a. Include lightning safety tips or action plan in programs, posters, flyers, etc.
b. Post lightning safety placards around the event area.

Attachment 5.9B
Large Group Weather Safety Action Plan

Large Group Weather Safety Plan Template

You must complete all sections. If you need more space, continue on the back. Please print legibly.

Date of Event: _____ **Location**: ☐ Gilruth ☐ Other – Specify_____

Group Name: _____ **Estimated Number of Attendees**: _____

Primary Decision Making Official: _____ **Phone**: _____

Back-up Decision Making Official: _____ **Phone**: _____

Weather Watcher or Reporter: _____

Safety Wardens -- at least 1 for each 100 attendees

1. _____ 6._____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

Specific Lighting and Shelter Location(s) for Attendees:

Evacuation route(s):

Notification Signals or Methods: Take Cover/Evacuate:_____

All-Clear: _____

Weather Monitoring Methods (two required – other than visual assessment and using 30/30 rule):
____Internet ____NOAA All Hazards Weather Radio
____hand-held lightning detector ____continuous contact with NWS or private weather service

Communication method used between Decision Making Officials, Weather Watcher, & Safety Wardens:

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Part 6
Safety and health practices for certain hazardous tasks

This could be you . . .

A warehouse worker cut his finger on a metal plate while unloading it from a truck.

Lightning struck near a hydrogen exhaust stack and ignited the hydrogen.

A laboratory worker cut a finger on a broken flask while reaching into a cabinet.

1. Who must follow Part 6

You must follow Part 6 if you work at JSC or a JSC field site. The following table tells you which chapters from Part 6 apply to what jobs.

If you . . .	*Then you must follow . . .*
Work with batteries	Chapter 6.1, "Battery safety"
Work with lasers	Chapter 6.2, "Laser safety and health"
Work in a warehouse	Chapter 6.3, "Warehouse safety and health"
Are involved in preparing or serving food	Chapter 6.4, "Food safety"
Work with cryogenic fluids	Chapter 6.5, "Working safely with cryogenic fluids"
Do any underwater operations	Chapter 6.6, "Underwater operations safety and health"
Handle new or unique hardware or materials	Chapter 6.7, "JSC's policy for handling new or unique hardware or materials"
Work in a laboratory	Chapter 6.8, "Laboratory safety and health"
Do any testing or hazardous training activities	Chapter 6.9, "Space systems and test safety"
Are involved with work in confined spaces	Chapter 6.10, "Entering confined spaces"
Use pressurized systems	Chapter 6.11, "Pressurized gas and liquid systems"
Use chemicals that require a warning alarm	Chapter 6.12, "Local chemical hazard alarms"

2. How to use Part 6

Part 6 provides you with safe work practices for the hazardous operations listed above. Find the chapters that apply to your job from the table above and follow the requirements they

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Chapter 6.1
Battery Safety

This could be you . . .

A sealed metal box containing a lead acid battery exploded and fatally injured a technician. Sparks from open electrical contacts in the box ignited the hydrogen released by charging and discharging the battery.

A battery pack with four D cell lithium batteries accidentally shorted on a metal work table and the battery exploded. A nearby technician fell from a chair, but escaped serious injury.

A worker was checking out an auto starter motor by placing the terminals across a lead acid battery. The motor was suspended over a battery. The motor ignited the venting hydrogen and blew the lid off the battery. The worker escaped serious injury from flying debris and battery electrolyte.

1. Who must follow this chapter

You must follow this Chapter if you:

a. Purchase, store, test, handle, maintain, or use batteries.

b. Purchase, design, develop, build, handle, or test devices or systems that use batteries.

c. Approve the activities in sub-paragraphs a or b above as an employee of or support contractor to the Safety and Mission Assurance Directorate (Mail Code NA), the Energy Systems Division (ESD) (Mail Code EP), or the Facilities Management and Operations Division (Mail Code JM).

2. Scope of this chapter

This Chapter defines the specific provisions required for handling batteries to be used for common battery, facility, and spaceflight operations as follows:

a. **Common battery operations**, with the exception of disposal, are excluded from this Chapter. These applications include batteries used in calculators, watches, cell phones, pagers, car batteries, etc. A list of these exemptions is contained in Paragraph 4 of this Chapter.

b. **Facility operations** include a wide range of ground support operations that indirectly support space operations. Examples of such are maintenance facilities, battery back-up power systems, batteries for vehicles, etc.

c. **Spaceflight operations** include prototype, flight, and flight type batteries to be used on ISS, shuttle, or any spacecraft application.

The hazards associated with facility and spaceflight operations are unique to each other and require a different approval process. The extent of the hazard controls and verification

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required depends on the battery chemistry, capacity, complexity, charging profile, and application. A battery is defined as two or more cells connected in a series or parallel configuration.

3. Battery application

Certain battery chemistries are toxic and potentially lethal in certain environments. For instance, some batteries that are safe for facility operations may not be safe inside a crewed vehicle (spaceflight operations). It is important to understand the battery's application and seek advice from the appropriate experts. The activities listed in Paragraph 1 require coordination and approval from one of the following sections depending on the application:

a. For Facility Operations: The Safety and Mission Assurance Directorate (NA) and the Utilities Branch of the Facilities Management and Operations Division (JM5). For battery facility operations, Paragraph 4 lists the exceptions to the approval requirements.

b. For Spaceflight Operations: The Safety and Mission Assurance Directorate (NA) and the Energy Systems Division (EP). For spaceflight battery uses, reference JSC 20793, the "Manned Space Vehicle Battery Safety Requirements."

4. Exemptions from approval requirements

There are currently no exemptions from the approval process for spaceflight operations. Refer to Paragraph 2 for the definition of facility and spaceflight operations. The following batteries in the following applications do not require the approvals listed in Paragraph 3 above if used for non spaceflight applications. These exemptions apply only if you use the batteries or devices as the manufacturer intended with no modifications:

a. In general, the battery uses an electrochemical couple (chemistry) that is well known, well understood, non-toxic, and has a long application history. Also, the battery is used in a device that:

- Is a commonly used commercial design and available commercially.
- Usually includes a user's manual that describes the use or maintenance of the battery.
- Uses a battery with well-known hazards that are controlled with the battery's or device's design.

b. Lead-acid, nickel-cadmium, or nickel-iron secondary batteries to start or power:

- Vehicles such as cars, trucks, buses, mobile cranes, mobile manlifts, electric drive wheelchairs, earth moving equipment, forklifts, and other materials handling equipment.
- Standard boats and aircraft.
- Facility emergency lighting systems, emergency communications systems, or other commercially available emergency power systems.

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c. Alkaline-manganese; lead-acid; lead-acid batteries with immobilized electrolyte(gel-type); leclanche; lithium ion and lithium ion polymer secondary; lithium primary coin or button cells of 300 milliamperes or less; mercuric oxide-zinc; nickel-cadmium; nickel-metal hydride; silver-zinc button cells; silver-zinc primary; and silver-zinc secondary batteries with no modifications may be used in the following commercial off-the-shelf (COTS) equipment for personal use and non-flight applications according to manufacturer's instructions:

- Calculators, personal digital assistants, laptop computers, and small computer uninterruptible power supplies.
- Watches and clocks.
- Radios, walkie-talkies, and cellular telephones.
- Flashlights and lanterns.
- Cameras and flashes.
- Portable sound and video recorders and players including battery-operated microphones, television sets, and compact disc players.
- Hearing aids.
- Radiation detectors (Radiacs).
- Metal detectors.
- Test equipment such as multimeters, ohm-meters, or pyrometers.
- State-of-the-art medical equipment in wide use in hospitals and clinics.

If a battery use is not listed above, but meets the criteria in Paragraph 4.a of this Chapter, contact the Safety and Mission Assurance Directorate (NA) and the utilities Branch of the Facilities Management and Operations Division (JM5). You may request a deviation from this Chapter.

5. Battery hazards

A Materials Safety Data Sheet (MSDS) must always be available for anyone using a non-exempt battery regardless of the application (see Paragraph 4 for a list of exceptions). Always refer to the MSDS to learn about specific hazards for the planned application. The Energy Systems Test Area (ESTA) covers planned abusive testing under its GOPM, EP-WI-004. General battery hazards may be any of the following:

a. Crushing Forces: Certain batteries may require a lifting plan due their mass to avoid crushing forces due to drop, which can then lead to other hazards. Chapter 8.5, "Lifting Operations and Equipment Safety" provides the details.

b. **Electrical Potential:** All batteries possess the potential for electrical shock if mishandled or abused. Depending on the battery and chemistry, this can range from minor personal discomfort to a lethal shock.

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c. **Electrolyte Leakage:** A battery can leak electrolyte from a number of conditions such as charging or discharging incorrectly, dropping, penetration, short circuit, vacuum, etc.

- If electrolyte gets on your skin or clothing, flush the affected area with copious amounts of water and get medical attention immediately. Do not put any neutralizing solution on your skin.
- If electrolyte gets in your eyes, flush thoroughly and continuously with only water for a minimum of 15 minutes while rolling your eyes and lifting your eyelids. Do not put any neutralizing solution in the eyes. Get medical attention immediately; you may need help effectively flushing your eyes.

d. **Environmental Pollution:** All batteries contain materials considered to be an environmental pollutant if venting or leakage occurs. Planned venting and release of polluting compounds must be inside a controlled environment designed to handle such an event. Proper disposal of all batteries is required (see Paragraph 12).

e. **Fire:** Many batteries contain flammable electrolyte. Planned fires must be inside a controlled environment designed to handle such an event. Be careful: do not unintentionally abuse a battery, mechanically or electrically.

f. **High Sound Levels:** High sound levels include noise from the battery bursting or venting. Planned venting must be inside a controlled environment designed to handle such an event.

g. **Oxygen Deficient Atmosphere:** This is typically not a hazard since the toxic atmosphere will come into effect before asphyxiation occurs. However, inert gases used during battery testing may cause an oxygen deficient atmosphere and should be examined on a case-to-case basis.

h. **Shrapnel or Blast Wave Over-Pressurization:** High-temperature venting, rupture, or explosion may occur when a battery gets too hot from external heat sources or heat generated by the battery itself (runaway reaction). Planned venting or bursting must be inside a controlled environment designed to handle such an event. Observe the following precautions:

- Hydrogen or mixtures of hydrogen and oxygen generated during open circuit storage, discharging, over discharging, charging, and overcharging can be explosive
- Brazing or soldering operations may be necessary for attaching pressure fitting and sealing vent on the battery for pressure testing. Test articles need to be prepared properly, that is, fully discharged, vented with a separate hole and have liquid electrolyte removed before attaching the pressure fitting.

i. **Temperature:** During abusive conditions such as overcharge or over-discharge, battery case temperature may exceed the upper touch temperature limits of 45° C (113° F). Planned abusive testing must be done in the appropriate thermal chamber and the temperature verified before handling.

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j. **Toxic Atmosphere:** Batteries contain materials that may be considered toxic. This can be in the form of a liquid or a gas. In addition, batteries contain strong corrosives, either acid or alkali dependent on battery chemistry.

6. General battery precautions

The following precautions apply to both facility and spaceflight operations. See Paragraph 2 for the definition of facility and spaceflight operations:

a. Have all non-exempt batteries or related assembly and test procedures approved by ESD personnel before performing any work. Assembly procedures must include, where appropriate, mandatory inspection points and step-by-step assembly instructions or drawings

b. Keep metallic objects, which could cause short circuits or arcing, away from battery terminals.

c. While storing or operating batteries, store or operate such that accidental shorting cannot occur. Use a nonconductive rack or a rack with a nonconductive coating or use the original manufactures storage container or plastic bags individually wrapped.

d. Don’t wear rings, metal watchbands, chains, or other jewelry while handling or working with batteries. If you can’t remove your ring, cover it with insulation, tape, or a glove.

e. Erect barriers or shields to protect nearby personnel from exploding or rupturing batteries in battery charging areas.

f. Provide adequate ventilation systems.

g. Never attempt to charge a non-rechargeable (primary) battery.

h. Never charge or discharge batteries by any device or method other than that supplied by the equipment manufacturer. If a commercial battery test stand is to be used, a Test Readiness Review must approve the test before operations can proceed.

i. Consider all leakage from batteries as toxic and corrosive. Take precautions to avoid touching, ingestion, or inhalation of battery electrolyte liquid or gases.

j. Never store batteries or battery electrolyte with food or drink items.

k. Construction or Test Operations: Provide facilities for quick drenching or flushing within 25 feet of battery handling areas.

l. Flush the eyewash before starting battery work or have an approved safety maintenance process for eyewash and safety shower upkeep. The Facility Safety Officers (NS226) shall approve this program.

m. All aqueous battery systems must be vented, not hermetically sealed.

n. Use spot welding, not soldering, to attach leads directly to a battery. Soldering generates excessive heat and can lead to the battery venting. Never do any hot work unless you are qualified and understand the hazards of hot work on batteries.

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o. If a battery vents or catches on fire, take precautions to avoid inhalation of the fumes. In the event of an unplanned fire, call x33333 at JSC and SCTF or x44444 at Ellington Field.

p. Provide equipment and supplies for emergency flushing and neutralizing spilled electrolyte in areas where electrolyte is used outside of the battery or the possibility exists for venting or leaking such as in a test area. Wastes or wastewaters generated during flushing or neutralizing spilled electrolyte may not be discharged to the storm sewer, ground, or ditch unless they are generated during emergency response. Before discharging wastes or wastewaters to the sanitary or process sewer, you must get approval from the Environmental Office. In general, you must call uncontrolled spills or releases of electrolyte into the Emergency Operations Center (x33333 at JSC and SCTF or x44444 at Ellington Field) and unplanned spills or releases into Facility Work Control (281-483-2038). Always reference the MSDS for neutralizing agents, but in general use:

- Sodium bicarbonate (baking soda) for spills involving an acid electrolyte.
- Citric acid for spills involving an alkali (base) electrolyte.

NOTE: This sub-paragraph applies to unplanned releases and does not apply to routine discharges to the sanitary sewer that have been approved by the Environmental Office via JF1109, Sanitary Sewer Discharge Approval Request.

q. Review the MSDS for each battery and battery chemistry and have this MSDS locally available for operators of the battery.

r. The Energy Systems Test Area (ESTA) routinely handles abusive tests on batteries such as the ones listed below. Unless planning an abusive test with an approved test readiness review (TRR), never perform any of the following actions:

- Attempting to charge primary (non-rechargeable) batteries. They could vent toxic materials or explode.
- Short-circuiting or high-current discharging batteries.
- Overheating or exposing batteries to temperatures higher than the manufacturer's recommendations.
- Over-discharging a battery. This includes discharging at high currents or below the manufacturer's recommended voltage cut-off.
- Opening, crushing, puncturing, or otherwise mutilating a battery.

7. Facility operation requirements

a. Provide emergency eyewashes and showers for quick drenching or flushing in accessible locations that require no more than 10 seconds to reach for the following activities:

- Doing maintenance work on or with electrolyte- or corrosive-based batteries (examples: removing battery cap to fill or refill or adding electrolyte or water).

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- Moving or handling batteries where they could be dropped.

b. Maintain batteries only in designated battery maintenance areas.

c. Battery banks designed to supply power must have disconnect devices. This will prevent sparks during the connection process.

d. Follow these requirements when lifting or moving batteries:

- See Chapter 8.5, "Lifting Operations and Equipment Safety," of this Handbook.
- Use a conveyor, an overhead hoist , or other material handling equipment to handle heavy batteries, such as those used in forklifts or other materials handling equipment.
- Use a suitable spreader when lifting batteries with an overhead lifting device. This prevents the lifting cables or chains from squeezing and possibly cracking the battery case.
- Protect battery terminals and exposed conductive surfaces with nonconductive materials when using cables or chains for lifting.
- Use proper terminal straps to lift a battery, unless the battery case has lifting pad eyes or similar attachment points.

e. Ground all switch, control, light, and indicator cases as described in National Fire Protection Association (NFPA) 70, Article 250, of the National Electric Code.

f. If possible, route alternating and direct current circuits separately.

g. Provide fire protection in charging areas.

8. Facility operation requirements for lead-acid batteries

You must observe the following precautions to protect yourself from the following hazards:

a. General lead-acid battery precautions:

- Wear a face shield and goggles when handling or servicing a battery.
- Locate servicing and charging installations in areas designated for that purpose.
- Guard charging equipment for industrial trucks to prevent damage by the trucks.
- Use replacement batteries of the same amp hour or higher rating for industrial trucks as the original batteries.
- Position industrial trucks or vehicles properly and apply the brakes before changing or charging the batteries in place.

b. Protection from explosion and fire hazards:

- Provide appropriate ventilation to prevent an explosive hydrogen-air mixture from accumulating.
- Never smoke where batteries are being charged, serviced, or worked on; in battery rooms; and near battery cabinets. Post NO SMOKING signs.

Verify this is the correct version before you use it by checking the online version.

- Prevent open flames, sparks, or electrical arcs in battery storage and servicing areas.
- Provide fire protection in battery rooms and charging areas.
- Open battery compartments or covers when charging batteries to aid ventilation and heat dissipation, if applicable.
- Don't do any work involving heat sources or arcing on batteries until venting all of the hydrogen or oxygen gases by purging with an inert gas or by positively ventilating all spaces that could trap explosive gas mixtures. Use a combustible gas meter to confirm ventilation is complete.
- Equip each battery with a flash arrestor vent cap for stationary installations and wherever else it is feasible.
- Inspect electrolyte levels in emergency light batteries to make sure they don't fall below the level of the plate tops.

c. Protection from chemical hazards:

- Wear a face shield or goggles, protective aprons, gloves, and boots while mixing electrolyte, activating dry charge batteries, or doing any work that could result in an electrolyte spill.
- Coat charging benches or tables with a nonconductive material that can withstand an electrolyte spill.
- Provide enough ventilation to prevent acid fumes from entering areas where alkaline batteries are serviced or used.
- Service alkaline-electrolyte batteries in an area isolated from lead-acid batteries.
- Label acid and alkaline electrolyte battery servicing equipment carefully and keep each kind of equipment separate.
- Don't use acid electrolyte equipment with alkaline batteries or alkaline equipment with acid batteries, otherwise, you may generate large amounts of hydrogen and create an explosive mixture.
- Keep vent caps in place and make sure the vent caps work to avoid electrolyte spray when charging batteries. If the vents are clogged, the battery case may rupture from internal overpressure causing electrolyte to spray over a large area.
- Use a carboy tilter or siphon to handle electrolyte.
- Pour acid into water when mixing electrolyte. **Note: Never pour water into an acid**. The intense heat of the solution can cause violent boiling on the surface of the acid and can splatter onto your skin, eyes or clothing.

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9. Facility operation requirements for nickel-cadmium (Ni-Cd) batteries

Aircraft Ni-Cd batteries are usually made of series-connected, prismatic, pressure-relieved cells. COTS equipment with Ni-Cd batteries installed typically use cylindrical cells with spring-loaded valves. These batteries operate as sealed cells except under abusive conditions.

When using or handling nickel-cadmium batteries, follow the precautions listed below:

a. Wear safety goggles, protective gloves, and a protective apron to work with vented nickel-cadmium batteries or caustic electrolyte. Potassium hydroxide is a caustic electrolyte that can cause severe burns. Note: COTS Alkaline cylindrical cells use essentially the same electrolyte.

b. Assemble the battery in a container separate from the rest of the electrical control system.

c. Make portable battery containers for vented cells as follows:

- Keep the free volume in the battery container to an absolute minimum. The free volume is the space in which hazardous gases may accumulate. There is no restriction on volume filled with other materials.
- Coat the battery terminals, interconnects, and wiring with a suitable alkali-resistant potting material. Coat all current-carrying battery components, if possible.
- Make sure the potting material doesn't seal vented cells.
- Provide an easily removable cover for the battery container.
- Consider using a splash-proof pressure vent to relieve pressure in the container.
- Make sure that all individual cells are vented.
- Don't seal vented cells in a container that will trap gases.

d. To control explosion and fire hazards:

- Use a voltage limited current taper and temperature monitoring charging method to reduce gassing and electrolyte spray. Charge in a well-ventilated area under the manufacturer's recommendations with the battery box cover removed. An approved test program that has undergone a TRR may deviate from the manufacturers charging recommendations.
- Make sure the individual cells are able to dissipate heat to prevent overheating during charge. Equip individual vented cells with flash arrestor vent caps where applicable.
- Never replace a battery box cover until the battery has been cleaned and at least four hours have elapsed since charging the battery where applicable.
- For each sealed battery, select cells that are matched for charge voltage capacity and charge retention.

e. To address chemical hazards, use absorbent wicking materials to control electrolyte leakage within the battery box or case.

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Requirements for lithium batteries

10. Requirements for safely using and handling lithium primary and secondary batteries

To safely use and handle lithium batteries, you must follow these precautions:

a. Hazards of handling lithium primary and secondary batteries:

- Under abusive conditions, lithium batteries can vent, explode, and burn releasing highly toxic and corrosive materials. For more information on the toxic and explosive behavior of these batteries, reference ESTA-OP-0-49, "Lithium Battery Handler Certification" and JSC 20793, "Manned Space Vehicle Battery Safety Requirements."
- Some of the toxic, flammable, or corrosive ingredients that can be released are carbon disulfide, carbon monoxide, hydrobromic acid, hydrochloric acid, hydrocyanic acid, hydrogen, methane, methyl cyanide, sulfur dioxide, thionyl chloride, and secondary battery electrolyte solvents.

b. Keep lithium primary batteries safe at all times. Never put them on conductive surfaces, on metal shelves, in desks, in electronics assembly areas, in receiving inspection areas, in machine shops, etc.

c. Assemble, process, and handle lithium cells and battery packs with caution:

- Protect batteries under assembly from shorting against foreign objects by storing them in plastic bags or in the original carton.
- Use spot welding, not soldering, to attach leads directly to a battery. Only qualified personnel in the Energy Systems Test Branch may do spot welding on lithium batteries.
- Return lithium batteries to a controlled storage area in plastic or in the original containers when the assembly or fabrication process is interrupted or stopped for any reason other than normal shift changes.

d. Store lithium batteries at room temperature or lower in a dedicated, dry, well-ventilated location indoors.

e. Handle lithium batteries only if trained and certified to use them safely as described in Chapter 5.8, "Hazardous Operations: Safe Practices and Certification," of this Handbook.

f. ESTA requires personnel operating and handling lithium primary batteries to be certified using ESTA-OP-0-49, "Lithium Battery Handler Certification."

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11. What to do if a primary lithium battery emergency occurs

If a primary lithium battery emergency occurs, take the following actions as appropriate for the emergency:

a. If the primary lithium battery has toxic electrolyte and abnormal use, or you have observed leaking, venting, or increasing battery temperature:

- Clear the area of personnel and have qualified and properly equipped personnel remove the batteries to a safe area.
- If possible, disconnect the batteries electrically from associated equipment after they have stabilized.
- Dispose of them using instructions in Paragraph 12 below.

b. If the primary lithium battery has toxic electrolyte and a rupture occurs, evacuate the area and notify the fire department by calling your emergency number (x33333 at JSC and SCTF or x44444 at Ellington Field). Response personnel must use air breathing equipment—such as air packs or air face masks and separate K-bottle of breathing air—rubber gloves, and chemical apron.

c. If a small fire occurs:

- Use a graphite powder or a Lith-X (Class D) extinguisher to extinguish burning lithium.
- Do**n't use** water, sand, carbon tetrachloride, carbon dioxide, or soda acid extinguishers in lithium battery fires.
- Use these extinguishers only on nearby materials to prevent the fire from spreading.

12. Disposing of batteries

Dispose of discrepant or depleted cells as quickly as possible. The method of disposal depends on the chemistry of the battery as follows:

a. In small quantities, you may dispose of alkaline batteries in site trash or garbage disposals. You must dispose of large quantities, leaked or vented batteries through the Environmental Services Office (JE) support contractor using a Form 1161. You can contact the facilities work control center at 281-483-2038.

b. You must dispose of all other battery chemistries through the Environmental Office (JE) support contractor using a Form 1161. You can contact the facilities work control center at 281-483-2038.

NOTE: Refer to JPR 8550.1, "JSC Environmental Compliance Procedural Requirements," Chapter 3 for complete information on proper disposition of batteries.

c. If disposing large quantities of batteries, contact the Environmental Office (JE) support contractor in advance to plan for the proper accumulation, packaging, funding, and disposal to prevent a delay. You can contact the facilities work control center at 281-483-

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2038.

NOTE: This does not apply to routine generation of large quantities batteries from test activities where a JSC Form 1104, Waste Notification, has been submitted.

d. Before contacting the Environmental Office (JE) support contractor (Facilities Work Control Center 281-483-2038), perform the following actions:

- Tape each battery with fiberglass or Kapton tape across the positive terminal to prevent inadvertent shorting. Place batteries dispositioned as "scrap" in an individual ziplock plastic bag or a plastic container for each battery.
- Separate the different chemistry batteries into different storage containers. For example, do not mix nickel metal hydrides with lithium ion batteries.

13. Reference documents

The following documents may help in the understanding or clarification of this Chapter.

a. EP-WI-004, "Energy Systems Test Branch's General Operating Procedure Manual (GOPM)."

b. ESTA-OP-0-49, "Lithium Battery Handler Certification."

c. JPR 1700.1, Chapter 5.8, "Hazardous Operations: Safe Practices And Certifications"

d. JPR 1700.1, Chapter 8.5, "Lifting Operations And Equipment Safety"

e. JPR 8550.1, "JSC Environmental Compliance Procedural Requirements."

f. JSC 25159, "Toxicological Hazard Assessments on Batteries used in Space Shuttle Missions."

g. JSC-20793, "Crewed Space Vehicle Battery Safety Requirements."

h. NASA Reference Publication 1099, "Lithium/Sulfur Cell and Battery Safety."

i. NFPA 70 (National Electric Code), Article 250, "Methods of Grounding Conductor Connection to Electrodes."

j. MSDS for the battery chemistry of the planned application.

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Chapter 6.2
Laser safety and health

This could be you . . .

Following safe practices has paid off. JSC has no recorded laser incidents.

1. Who must follow this chapter

You must follow this chapter if you operate lasers or supervise anyone who operates lasers. At this time, laser pointers are exempted from the requirements of this chapter. (See JSC Safety Alert 99-009 "Safety Hazards of Laser Pointers")

2. Laser classes

JSC uses the laser classes in American National Standards Institute (ANSI) Z-136.1, "Safe Use of Lasers":

a. Class 1: No risk lasers aren't hazardous under normal operating conditions.

b. Class 2: Low risk lasers are low power lasers that are dangerous only if you stare at a direct beam for long periods of time.

c. Class 3A: Moderate risk lasers that are too dangerous to view directly.

d. Class 3B: Moderate risk lasers that are dangerous if you look at a direct or reflected beam.

e. Class 4: High risk lasers could cause eye or skin injuries and fires.

3. Requirements for working with lasers

You must register all Class 3A, 3B, and 4 lasers on JSC Form 44B and get approval for use from with the Radiation Safety Officer (RSO) (SD33, extension (281) 483-6726). The RSO may require a person, with substantial laser training, be designated as the Laser Safety Officer (LSO) for your area. You must follow these requirements when you operate any Class 3A, 3B, or 4 lasers:

a. Follow ANSI Z-136.1, 21 CFR 1040.10, "Laser Products," and 21 CFR 1040.11, "Specific Purposes of Laser Products."

b. Each Class 3A, 3B, or 4 laser must have an approved JSC Form 44B from the RSO before you may operate it.

c. If you modify the laser, you must submit a new JSC Form 44B for RSO approval.

d. Don't operate a laser unless you are certified to do so by the RSO.

e. Know the hazards and hazard controls of each laser you operate. You must take other

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precautions if:

- The target material could vaporize into a toxic substance
- The laser uses toxic dyes as a lasing medium
- The laser components cause radiation such as x-ray, ultraviolet, infrared, or radio frequency
- The laser could reflect off a smooth surface; e.g., glass, metal, or glossy paint

f. Lasers have high voltage power supplies. Take precautions to avoid being shocked.

g. Operate lasers with a beam stop.

h. Don't exceed the maximum permissible exposure (MPE) values found in ANSI Z136.1.

i. Tell all visitors in your laser area who aren't certified operators what the laser hazards are and what safety requirements they must follow. Visitors must also:

- Be under the direct supervision of at least one certified operator.
- Wear required protective equipment.

j. Operate Class 3A, 3B, and 4 lasers only in areas with:

- No unplanned reflecting or transmitting surfaces.
- Emergency lighting fixtures.
- Standard warning placards as described in ANSI Z136.1.

k. Keep all flammable materials away from laser areas unless specifically authorized by an operations or test plan.

4. Engineering controls for laser hazards

Each laser must have hazard controls that meet ANSI Z-136.1. You must use engineering controls as much as possible. You must also post a current copy of your operating procedures, when applicable.

This table tells you which engineering controls are required for each laser class and when. Next to each control is an ANSI Z-136.1 paragraph number that offers more details. See the legend below the table for an explanation of the symbols.

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Engineering Control Measure	Laser Class				
	1	*2*	*3A*	*3B*	*4*
Protective housing (4.3.1)	X	X	X	X	X
Without protective housing (4.3.1.1)	RSO/LSO must establish alternative controls				
Interlocks on protective housing (4.3.2)	**	**	**	X	X
Service access panel (4.3.3)	**	**	**	X	X
Key control (4.3.4)	---	---	---	#	X
Viewing portals (4.3.5.1)	---	MPE	MPE	MPE	MPE
Collecting optics (4.3.5.2)	MPE	MPE	MPE	MPE	MPE
Totally open beam path (4.3.6.1)	---	---	---	X NHZ	X NHZ
Limited open beam path (4.3.6.2)	---	---	---	X NHZ	X NHZ
Enclosed beam path (4.3.6.3)	None is required if 4.3.1 and 4.3.2 fulfilled				
Remote interlock connector (4.3.7)	---	---	---	#	X
Beam stop or attenuator (4.3.8)	---	---	---	#	X
Activation warning systems (4.3.9.4)	---	---	---	#	X
Emission Delay (4.3.9.1)	---	---	---	---	X
Indoor laser controlled area (4.3.10)	---	---	---	X NHZ	X NHZ
Class 3B laser controlled area (4.3.10.1)	---	---	---	X	---
Class 4 laser controlled area (4.3.10.2)	---	---	---	---	X
Laser outdoor controls (4.3.11)	---	---	---	X NHZ	X NHZ
Laser in navigable airspace (4.3.11.2)	---	---	#	#	#
Temporary laser controlled area (4.3.12)	** MPE	** MPE	** MPE	---	---
Remote firing and monitoring (4.3.13)	---	---	---	---	#
Labels (4.3.14 and 4.3.7)	X	X	X	X	X
Area posting (4.3.9)	---	---	#	X NHZ	X NHZ

LEGEND: X - required; # - recommended; --- - not required; ** - required if embedded Class 3B or Class 4; MPE - required if MPE is exceeded; NHZ - Nominal Hazard Zone analysis required; (4.3.5.2) - referenced paragraph from ANSI Z-136.1-2000

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5. Administrative controls for laser hazards

You may use administrative controls instead of or in addition to engineering controls as required by the RSO. Laser hazard controls must meet ANSI Z-136.1. You must also post a current copy of your operating procedures, when applicable.

This table tells you which administrative controls are required for each laser class and when. See the legend below the table for an explanation of the symbols.

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Administrative Control Measures	Laser Class				
	1	*2*	*3A*	*3B*	*4*
Standard operating procedures (4.4.1)	---	---	---	#	X
Output emission limitations (4.4.2)	---	---	RSO/LSO determines		
Education and training (4.4.3)	---	#	#	X	X
Authorized personnel (4.4.4)	---	---	---	X	X
Alignment procedures (4.4.5)	---	X	X	X	X
Protective Equipment (4.6)	---	---	---	#	X
Spectator control (4.4.6)	---	---	---	#	X
Service personnel (4.4.7)	** MPE	** MPE	** MPE	X	X
Demonstration with general public (4.5.1)	MPE (a)	X	X	X	X
Laser optical fiber systems (4.5.2)	MPE	MPE	MPE	X	X
Laser robotic installations (4.5.3)	---	---	---	X NHZ	X NHZ
Eye Protection (4.6.2)	---	---	---	# MPE	X MPE
Protective windows (4.6.3)	---	---	---	X NHZ	X NHZ
Protective barriers and curtains (4.6.4)	---	---	---	#	#
Skin protection (4.6.6)	---	---	---	X MPE	X MPE
Other protective equipment (4.6.7)	Use may be required				
Warning signs and labels (4.7) (Design requirements)	---	#	#	X NHZ	X NHZ
Service and repairs (4.4.7)	RSO/LSO determines				
Modifications and laser systems (4.1.2)	RSO/LSO determines				

LEGEND: X - required; # - recommended; --- - not required; ** - required if embedded Class 3B or Class 4; MPE - required if MPE is exceeded; NHZ - Nominal Hazard Zone analysis required; (a) – Applicable only to UV and IR lasers (4.5.1.2); (4.4.5) - referenced paragraph from ANSI Z-136.1-2000

6. Requirements for software that controls lasers

Software that controls lasers must:

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a. Provide safety precautions for fast moving-lasers and prevent misdirected lasers.

b. Undergo a hazard analysis as described in Chapter 2.4, “Hazard Analysis,” of this Handbook and NASA-STD-8719.13, “NASA Software Safety Standard.”

7. Requirements for laser enclosures

In addition to laser enclosure requirements in Paragraph 4 above, you must:

a. Use flame resistant materials or commercial products designed for laser enclosures to enclose Class 4 lasers. Laser levels above 10 watts per-square-centimeter could set the enclosure materials on fire.

b. Enclose high-pressure arc lamps and filament lamps or laser welding equipment in housings that can withstand the maximum pressure of a lamp explosion or disintegration.

c. Enclose laser targets and optical elements that could shatter during laser operation.

8. Protective equipment for operating a laser

If engineering controls don’t eliminate the possibility of overexposure, you must wear the following protective equipment:

a. Protective glasses or goggles designed to protect you from the laser you are using. Different lasers require different kinds of glasses or goggles. Make sure your protective glasses or goggles are on before you turn on the laser.

b. Skin protection as required.

See ANSI Z-136.1 for more details.

9. Training for operating a laser

You must be certified to operate a laser as described in Chapter 5.8 of this Handbook. The RSO certifies all laser operators.

10. Emergency actions for laser mishaps

If laser mishap occurs, follow the emergency procedures in Chapter 3.8, “Emergency Preparedness,” of this Handbook and the emergency procedures for your facility. You must contact the RSO as soon as possible to help you investigate the mishap.

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Chapter 6.3
Warehouse safety and health

This could be you . . .

Several warehouse workers have suffered back strain and pulled muscles because they didn't follow proper lifting techniques.

An employee suffered a broken toe while trying to steady an object on a forklift. The operator inadvertently lowered the fork on his foot.

A warehouse worker punctured his forearm on a nail while reaching through a wooden pallet.

1. Who must follow this chapter

You must follow this chapter if you work in a warehouse.

2. Fire prevention in warehouses

Fire is a major hazard in any warehouse or storage facility. Chapter 5.1, "Fire safety," will give you more details. To prevent warehouse fires:

a. Put combustible wastes, rags, or other flammable materials in metal containers with self-closing lids. Label each container with its contents, such as, clean rags, oily rags, dirty rags, etc.

b. Empty waste containers or move them to safe locations outside the building for pickup, at the end of each shift.

c. Smoke only in designated smoking areas.

d. Don't use flammable liquids for cleaning purposes.

e. Use only forced air space heaters (never radiant type heaters) with a "tip-over cutoff switch." To use a heater, you must get approval from the Safety and Test Operations Division and concurrence from the Facility Manager.

f. Follow the electrical safety practices in Chapter 8.1, "Electrical safety," of this Handbook.

g. Provide Class ABC fire extinguishers for each liquid-fuel or liquefied petroleumgas-powered industrial truck.

h. Use the following table when stacking materials.

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Clearances between . . .	*When a stack is . . .*	*Must be . . .*
The top of any stack and Sprinklers, ceiling joists, rafters, beams, or trusses	Less than 15 feet high	18 inches
The top of any stack and Sprinklers, ceiling joists, rafters, beams, or trusses	15 feet high or higher	36 inches
Any stack and Heating or lighting fixtures	Any height	18 inches
Any stack and Building structural members or fixtures	Higher than the horizontal level of the roof truss	18 inches

3. Requirements to prevent stacked material from falling in a warehouse

These requirements will help prevent injuries from falling objects:

a. Follow these practices when you stack any materials:

- Store only properly packaged items.
- Place your material on firm foundations to prevent settling.
- Don’t overload floors.
- Stack material so it is stable.
- Secure all materials, whether palletized or non-palletized in a safe manner.
- Square all pallet loads to achieve a four-point level top.
- Protect crushable containers so that they aren’t supporting exessive weight of materials stored on top.

b. Place the mouths of bags inward unless they are pre-palletized by the manufacturer.

c. Follow these practices when you stack loaded boxes, crates, or cartons:

- Stack them on the side with the largest area unless the container states to lay them otherwise, such as with a “this side up” arrow.
- Cross-tie the stacks.
- Don’t stack so high that the weight could collapse the lower cartons.
- Protect from moisture.

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d. Follow these practices when stacking pipe and bar stock:

- Store the stock on stable storage racks so that you can safely remove items from the rack.
- Store the stock in layers on wood strips with stop blocks on the ends or on metal bars with upturned ends if storage racks are not available.
- Keep the ends of the stock out of aisles to prevent walking into, tripping over, or other mishaps.

e. Follow these practices when you stack loaded barrels, drums, large pipes, rolls of paper, or other cylindrical items:

If the items are stacked on their . . .	***Then . . .***
Sides	• Stack them symmetrically and in a stable manner • Wedge every item on the bottom row
Ends and not palletized	• Lay two planks side by side on top of each row before starting another row • Limit each stack to a stable height

4. Safe housekeeping practices for warehouses

a. Store materials so they won't interfere with:

- Lighting.
- Passageways, traffic lanes, or doors.

b. Keep warehouse floors smooth, clean, clear, and free from slippery substances.

c. Mark all aisles and passageways clearly and keep them free and clean at all times.

d. Don't block fire exits.

e. Maintain enough clearances in aisles, at loading docks, and through doorways to safely operate handling equipment such as forklifts or palate jacks.

f. Remove nails that stick out from crates, cases, packing boxes, or lumber.

g. Use cleaning products only when there is enough ventilation to remove any vapors.

h. Clean up spills immediately with approved cleaning materials. Use only approved, non-combustible absorbents to dry up spills of flammable liquids. See Chapter 9.1, "Hazardous materials safety and health," of this Handbook for hazardous material spills.

i. Never store materials so they block aisles and passageways or interfere with the use of firefighting equipment.

j. Keep hallways open to allow large numbers of people to leave in emergency situations. See Chapter 5.1 of this Handbook for additional requirements.

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5. Warehouses that store hazardous materials

If your warehouse stores hazardous materials, you must mark hazardous storage areas and follow the requirements in Chapter 9.1 of this Handbook.

6. Other requirements for warehouses

You must follow:

a. Chapter 8.5, "Lifting operations and equipment safety," of this Handbook if you operate any lifting devices such as cranes or forklifts in the warehouse. See Attachment 8.5C in Appendix 8B for requirements for safely operating forklifts.

b. Chapter 8.7, "Ladders, scaffolds, and elevated platforms: how to work with them safely," of this Handbook if you use ladders, scaffolds, or elevated platforms.

c. National Fire Protection Association 21, “Indoor General Storage,” for more fire safety requirements.

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Chapter 6.4
Food Safety

This could be you . . .

An employee didn't wash his hands before returning to work after using the restroom. The germs on his hands transferred to a food product and contaminated it. Several food consumers became ill for several days.

1. Who must follow this chapter

You must follow this Chapter if you handle, store, or transfer food as a part of your job.

2. What this chapter covers

This Chapter describes the basic methods for you to use in preventing food-borne illness. Food served at JSC must be clean, wholesome, free from germs or other toxins, and must meet consumer expectations. It applies to transporting, storing, preparing, serving, vending, and inspecting food.

This Chapter follows the provisions in the following:

a. Food and Drug Administration (FDA) food code.

b. Texas Food Establishment Rules.

c. Food Ordinance of the City of Houston.

3. Certifications and employment conditions for food service

To be certified to serve food, you must:

a. Have an initial medical examination before employment and one each year while you are employed (JSC Form 270). See Chapter 3.6, "Occupational Healthcare Program," of this Handbook for more details. This applies to anyone involved in preparing or serving food and beverages. The JSC Clinic must give you the examination and a health certificate card (JSC Form 1169). The health certificate card must be on file for inspection purposes.

b. Never work with or around food or food preparation areas if you:

- Are affected with a disease in a communicable form or are a carrier of a disease.
- Are afflicted with boils.
- Have infected wounds.
- Have an acute respiratory infection.

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4. Who to coordinate with for food service concerns

This table tells you whom to contact for certain food service concerns.

For . . .	***Coordinate with the . . .***
Scheduling and performing food service inspections or investigating food-related complaints	Occupational Health Services (281) 483-6726
Scheduling medical examinations	JSC Clinic (281) 483-4411
Ensuring compliance with requirements	Exchange Operations Manager

5. Other rules you must follow or know about

You must follow these rules when handling food:

a. Never remove or alter hold orders, notices, or tags placed on food by the health authorities. Relabeling, repacking, reprocessing, altering, disposing of, or destroying this food is also forbidden without permission. You may put food that is on hold or has a tag on it from the health authorities in suitable storage for holding.

b. Thoroughly wash your hands and arms with soap and warm water:

- Before starting work.
- During work hours, as often as necessary, to remove soil and contamination.
- After using the toilet room.

6. How to protect food

To prevent food-borne illnesses you must:

a. Protect all food being stored, prepared, displayed, served, sold, or transported between activities from contamination including dust, flies, rodents and other vermin, unclean utensils and work surfaces, unnecessary handling, coughs, sneezes, and flooding.

b. Provide conveniently located refrigeration facilities, hot food storage and display facilities, and effective insulated facilities as needed to make sure all food is kept at required temperatures during storage, preparation, display, and service. Keep all at temperatures below 40 degrees Fahrenheit and keep all hot food at temperatures above 140 degrees Fahrenheit. All dated food items should be within designated shelf life. Remove outdated food items.

c. Protect unwrapped food placed on display from contamination from customers and other sources. Use effective, easily cleaned, counter protective devices, cabinets, display cases, containers, or other kinds of protective equipment.

d. Design and arrange self-service openings in counter guards to protect food from contact by customers.

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e. Keep all garbage and rubbish that contains food waste in plastic bags that are in containers of durable metal or other approved materials that don't leak and don't absorb liquids.

f. Dispose of all garbage and rubbish daily in a manner as to prevent a nuisance. The Occupational Health Branch may approve other frequencies for disposing of garbage or rubbish.

g. Take effective control measures to keep rodents, flies, roaches, or other vermin from entering or breeding in any food service or preparation areas. All buildings must be effectively vermin-proofed, free of vermin, and kept in a vermin-proof and vermin-free condition.

h. Prevent flies and other flying insects from entering through windows, door, skylights, intake openings, or exhaust openings. Use any effective methods such as the following:

- Self-closing doors that open outwards.
- Closed windows.
- Screens.
- Controlled air currents.

i. Keep the entire food service facility and all areas used for food service or preparation neat, clean, and free of litter, refuse, and garbage.

j. Keep all refrigerators used for food storage clean at all times.

7. Vending machines

All food offered for sale through vending machines must be:

a. Made, processed, and prepared in facilities that follow applicable federal, state, and local laws and regulations.

b. Wholesome.

c. Stored or packaged in clean, protective containers and be handled, transported, and vended in a sanitary manner.

8. Protective clothing required for food service

You must wear:

a. Gloves when:

- You do multiple tasks such as handling money and preparing sandwiches.
- Frequent hand washing is not feasible.

b. Reasonably clean outer garments if you handle food or food-contact surfaces, or wash dishes.

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c. A hair restraint if you prepare or serve food. The restraint must completely cover your hair to keep hair from food and food-contact surfaces.

9. Food requirements you should be aware of

As an employee of the NASA Exchange or as a concessionaire, you must:

a. Follow applicable federal, state, and local laws and regulations.

b. Protect food from contamination and spoilage while handling, packaging, storing, or transporting it.

c. Make sure that the food that you serve is:

- Wholesome.
- Free from spoilage.
- Free from contamination.
- Free from misbranding.
- Protected from contamination while preparing, displaying or serving it. You must also protect food you are moving from one activity to another.

10. Inspections and food concerns

Occupational Health Services is responsible for inspections and food concerns and will:

a. Inspect your food service activities at least every three months. Buildings 3 and 11 cafeterias, along with the snack areas in Buildings 1 and 4S, are inspected monthly. Food inspectors may enter your area at any reasonable time to inspect or re-inspect.

b. Examine and sample food as often as necessary to detect contamination or misbranding. Food inspectors will also:

- Place food orders on hold if they are unwholesome or show signs of contamination or misbranding.
- Place food on hold until a laboratory can examine it.

c. Investigate any reports of suspected food-borne illness from any food service establishment or employee. This may also involve examining the history of any suspected employee. Occupational Health Services may:

- Restrict the suspected employee from any food service or vending activities.
- Close any suspected food service or vending activity until it believes no further danger exists.
- Restrict the suspected employee to a certain food service or vending area with no danger of transmitting disease.

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- Require medical or laboratory examinations of the suspected employee, other employees, or bodily discharges.

d. Investigate spoiled food products from vending machines. Occupational Health Services will work with the Exchange Operations to correct problems.

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Chapter 6.5
Working safely with cryogenic fluids

This could be you . . .

Two technicians passed out while transferring liquid nitrogen from a truck because nitrogen spilled into the loading dock and displaced oxygen in the area. They were rescued and are okay.

A liquid helium dewar ruptured. Fortunately, no one was in the room at the time.

A liquid nitrogen dewar exploded and sent glass fragments flying. Fortunately, the technicians working with the dewar were not in the path of the flying glass.

1. Who must follow this chapter

You must follow this chapter if you:

a. Use, handle, store, or transfer cryogenic fluids as a part of your job.

b. Supervise anyone who does the above tasks.

2. What this chapter covers

This chapter covers the minimum requirements to handle and use common cryogenic fluids safely. You'll find emergency treatment information in Attachment 6.5A, Appendix 6B.

3. Definition of a cryogenic fluid

A cryogenic fluid is a liquid with a normal boiling point below -238°F (221°R, -150°C, 123° K). Commonly used cryogenic fluids include the following:

a. Liquid helium – LHe (normal boiling point - 452°F)

b. Liquid hydrogen – LH_2 (normal boiling point - 423°F)

c. Liquid nitrogen – LN_2 (normal boiling point - 320°F)

d. Liquid oxygen – LO_2 (normal boiling point - 297°F)

e. Liquid air – LAir (normal boiling point - 318°F)

f. Liquid argon – LAr (normal boiling point - 303°F)

Fluorine, neon, carbon monoxide, methane, nitric oxide, krypton can be liquefied and are cryogenic fluids, but are rarely used at JSC in the liquid state.

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4. Hazards of cryogenic fluids

Cryogenic fluids could cause any of the following safety problems:

a. Cryogenic burns from the extreme cold, eye damage from cold vapors.

b. Skin stuck to cold surfaces.

c. Overpressurization and rupture of a pressure system or vessel—when cryogenic fluids try to vaporize due to heating from the surroundings, they can increase the pressure 700 to 1000 times.

d. Asphyxiation.

e. Upper respiratory irritation from breathing cold vapors.

f. Fire and explosion.

g. Leaks, sprays, or spills contacting nearby equipment and causing structural failures due to excessive thermal stresses within the materials.

Requirements for all cryogenic fluids

5. Precautions to observe when working with any cryogenic fluids

If you handle any cryogenic fluids, you must observe these precautions:

a. Do tasks involving cryogenic fluids with two or more people except for laboratory use from a small close container.

b. Deactivate systems with proper energy controls found in Chapter 8.2, “Lockout/tagout practices,” of this Handbook before you start any maintenance or repair work.

c. Vent cryogenic systems through appropriate valves. Release gases so that the wind or room ventilation will direct them away from people.

d. If you need to put warm objects in cryogenic fluids, do it slowly and use tongs to insert or remove the objects.

e. If you need to put a cryogenic fluid into a warm container, do it slowly to minimize boiling, splashing, and thermal stresses.

f. Keep unprotected body parts away from the cold surfaces of pipes or vessels that contain cryogenic fluids.

g. Leave frost that forms on uninsulated surfaces undisturbed to help prevent liquid air (liquid nitrogen plus liquid oxygen) from accumulating.

h. Do a written hazard analysis for any area where cryogenic fluids are used or stored.

i. Make sure you have a procedure or hazardous operations permit as described in Chapter

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5.8, "Hazardous operations: safe practices and certification," of this Handbook.

j. Ensure that all personnel involved are trained in the safe handling of cryogenic fluids.

6. Locations for working with cryogenic fluids

Any work you do with cryogenic fluids must be:

a. Near safety and firefighting equipment that you properly maintain.

b. Away from combustibles.

c. Away from unprotected or unauthorized personnel.

d. In well-ventilated areas. Use oxygen analyzers and alarms to monitor for low oxygen concentrations, as required by the hazard analysis, if you are working with LHe, LH_2, LN_2, or LAr. Use oxygen analyzers and alarms to monitor for high oxygen concentrations if you are working with LO_2.

7. Storing cryogenic fluids

Locations where cryogenic fluids are stored should follow these requirements:

a. Store cryogenic fluids outside or in large, open, and well-ventilated rooms that are vented to the outside. Use oxygen analyzers and alarms as described in Subparagraph 6.e above.

b. Continuously ventilate any area where inert cryogenic fluids are used, even at night and on weekends, unless you remove them from the area. Leave air handlers or exhaust ventilation on at all times.

c. Label the entrance to any area with inert cryogenic fluids to alert personnel that asphyxiation is possible in that area due to oxygen-displacing cryogenics.

d. If you store liquid hydrogen inside, make sure to vent any gas that escapes either to the outside or to a safe location. If you vent it through ductwork, the ductwork must be independent of other systems and contain no ignition sources. You must use hydrogen detectors (either permanently installed or portable) wherever you use hydrogen.

e. Within 3 feet of hydrogen sources (such as where connections are regularly made and disconnected), you must use Class I, Division 1, Group B Electrical equipment as described in NFPA 70, "National Electric Code."

f. Between 3 and 25 feet of hydrogen sources, you must use Class I, Division 2, Group B electrical Equipment.

8. Action to take in case of a skin burn from a cryogenic fluid

Before doing any tasks involving cryogenic fluids make sure you have Attachment 6.5A, Appendix 6B readily available. It covers how to treat skin burns from a cryogenic fluid. An injured person needs immediate professional medical help.

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9. Precautions for storing, using, or transferring cryogenic fluids

If you transfer, use, or store any cryogenic fluids, you must observe these precautions:

a. Transfer liquid slowly to reduce thermal shock to containers.

b. Don't breathe cryogenic vapors.

c. Don't allow ice to accumulate on a neck or near the vent of a cryogenic vessel. Ice could plug the vent and cause the vessel to rupture.

d. Empty and purge any cryogenic vessel with ice accumulating on the outer surface and either dispose of it or take it out of service for repair. The ice indicates a poor vacuum in the annular space resulting in poor insulation.

e. Tape or cage exposed portions of glass containers to minimize flying glass if the glass breaks.

f. Follow these requirements to prevent sparks or arcs:

- Ground all stationary hydrogen and oxygen equipment.
- Bond mobile and stationary equipment used to transfer and receive liquid air, oxygen, and hydrogen and make sure that all equipment involved in the transfer shares a common ground.
- Purge all condensable gases from liquid hydrogen transfer hoses in service with helium gas. Transfer liquid hydrogen only with specially designed equipment.

Requirements for certain cryogenic fluids

10. Precautions for handling liquid nitrogen

As a gas, nitrogen is colorless, odorless, tasteless, non-toxic, and almost totally inert as described in Attachment 6.5E, Appendix 6B. The main health hazard of nitrogen is asphyxiation. Nitrogen can displace oxygen in the air in enclosed or semi-enclosed areas. If you use or handle liquid nitrogen, you must observe these precautions:

a. Don't enter a tank, sump, or closed space that has contained liquid nitrogen until you have purged the space and stabilized the oxygen concentration at normal levels. Air testing is required to document that oxygen concentration is at a safe level. To enter an oxygen-deficient space, you must wear an air-supplying breathing apparatus. The Safety and Test Operations Division and the Occupational Health Branch must approve the entry. An approved confined space entry procedure and permit may also be required. Entry into a contaminated space to do routine work is prohibited. If necessary to enter, specially trained rescue personnel must stand by to rescue entry personnel immediately during an emergency.

b. Isolate the liquid nitrogen source using a minimum of two positive blocks, such as valves, between the source and the system or equipment. The Safety and Test Operations Division must approve any other arrangement.

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c. If you use valves to block a system, chain or lock them to prevent accidental opening and tag them with DO NOT OPERATE tags. See Chapter 8.2 of this Handbook for detailed requirements on lockout/tagout.

d. If you use an open bleed valve to prevent nitrogen pressurization, chain or lock it open to prevent pressure buildup between blocks or flanges and vent it to outside the work area.

e. Use blank or blind flanges as necessary. If the system contains no bleed valves, install a bleed valve on each flange.

11. Precautions for handling liquid oxygen

Oxygen is nonflammable but vigorously supports and accelerates combustion as described in Attachment 6.5C, Appendix 6B. Many substances will burn or explode more easily in an oxygen-enriched atmosphere. If you handle liquid oxygen, you must follow these precautions to avoid fires or explosions:

a. Don't allow any organic materials or flammable substances to come in contact with liquid oxygen or oxygen-enriched atmospheres. Some of the organic materials that can react violently with oxygen are oil, grease, asphalt, kerosene, cloth, tar, and dirt that contains oil or grease.

b. Open and close valves in liquid oxygen systems slowly.

c. Remove clothing soaked or splashed with liquid oxygen or oxygen vapors and place it in a well-ventilated area away from flammable and combustible materials for at least 30 minutes. See Paragraph 8 of this chapter for cautions on removing clothing from a person with a cryogenic burn.

d. Avoid or leave any area exposed to an oxygen-enriched atmosphere. Avoid all sources of ignition.

e. Don't do welding, cutting, or spark-producing operations within 100 feet of liquid oxygen storage units or pipes without monitoring the oxygen levels with an oxygen analyzer. Don't do these operations if the work area atmosphere is oxygen-enriched. You may monitor oxygen levels intermittently or continuously at the discretion of the Safety and Test Operations Division or the supervisor.

f. Don't smoke around oxygen systems. Post no smoking signs around oxygen systems. Don't smoke for at least 30 minutes after exposure to liquid oxygen; oxygen tends to cling to your clothing.

g. Keep a fire extinguisher available wherever an exposure to liquid oxygen can occur.

- If most of the material that could be exposed to the liquid oxygen is paper or wood (Class A fuel), keep a 2½-gallon water-filled fire extinguisher within 75 feet. Dry chemical extinguishers are ineffective against this type fire
- If most of the material that could be exposed to the liquid oxygen is oil or grease (Class B fuel), keep a 10-pound dry chemical (60-B:C) or multipurpose (4-A:60-B:C) extinguisher within 50 feet

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h. Don't enter a tank, sump, or closed space that has contained liquid oxygen until you have purged the space and stabilized the oxygen concentration levels. Air testing is required to confirm that the atmosphere is neither oxygen deficient nor oxygen enriched. The Safety and Test Operations Division must approve any space with an oxygen-enriched atmosphere. An approved confined space entry procedure and permit may be required.

i. Isolate the liquid oxygen source by using a minimum of two positive blocks, such as valves, between the source and the system or equipment. The Safety and Test Operations Division and Occupational Health Branch must approve any other arrangement.

j. If you use valves to block a system, chain or lock them to prevent accidental opening and tag them with DO NOT OPERATE tags. See Chapter 8.2 of this Handbook for detailed requirements on lockout/tagout.

k. If you use an open bleed valve to prevent oxygen pressurization, chain or lock it open to prevent pressure buildup between blocks or flanges and vent it to outside the work area.

l. Use blank or blind flanges as necessary. If the system contains no bleed valves, install a bleed valve on each flange.

12. Precautions for handling liquid hydrogen

Liquid hydrogen vaporizes rapidly, is very flammable, and burns with an invisible flame as described in Attachment 6.5D, Appendix 6B. Gaseous hydrogen can be "self-igniting" when released under high pressure. At ordinary temperatures, hydrogen is very light. However, liquid hydrogen vapors are slightly heavier than 70°F air and can spread along the ground for considerable distances. If you handle liquid hydrogen, you must observe these precautions to avoid a fire or explosion:

a. Keep combustible materials away from hydrogen.

b. Don't do welding, cutting, or spark-producing operations within 100 feet of hydrogen storage units, flare stacks, vent lines, or pipes. Use a hydrogen detector to make sure there is no hydrogen in the area.

c. Don't do any welding, cutting, or spark producing operations on components of a liquid hydrogen system until you drain them and purge them with an inert gas.

d. Don't enter a tank, sump, or closed space that has contained liquid hydrogen until you have purged the space and stabilized the oxygen concentration at normal levels. Air testing is required to determine that oxygen atmosphere is within safe levels. The Safety and Test Operations Division and Occupational Health Branch must approve any entry into a space with a flammable or oxygen-deficient atmosphere. See paragraph 10. a. for restrictions on entry into a contaminated space. An approved confined space entry procedure and permit may be required.

e. Isolate the liquid hydrogen source by using a minimum of two positive blocks, such as valves, between the source and the system or equipment. Make sure the line section between the valves has a safety relief device or bleed valve. The Safety and Test Operations Division must approve any other arrangement.

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f. If you use valves to block a system, chain or lock them to prevent accidental opening and tag them with DO NOT OPERATE tags. See Chapter 8.2 of this Handbook for detailed requirements on lockout/tagout.

g. If you use an open bleed valve to prevent hydrogen pressurization, chain or lock it open to prevent pressure buildup between blocks or flanges and vent it to outside the work area.

h. Use blank or blind flanges as necessary. If the system contains no bleed valves, install a bleed valve on each flange.

i. Keep a 10-pound multipurpose (4-A:60-B:C) or a 10-lb. carbon dioxide (10-B:C) fire extinguisher within 50 feet of potential fuel sources.

13. Actions to take for a liquid oxygen spill or fire

Take the following actions in case of an oxygen spill or fire:

a. Keep all ignition sources, equipment, and people away from liquid oxygen spills for at least 30 minutes after all frost or fog has disappeared. The spill area surfaces, especially asphalt, could ignite from friction or shock.

b. Attempt to extinguish a liquid oxygen fire with hand fire extinguishers immediately because many materials burn rapidly in liquid oxygen. Then quickly evacuate the area in an orderly manner.

14. Actions to take for a liquid hydrogen spill or fire

Take the following actions in case of a hydrogen spill or fire:

a. Shut off the hydrogen flow as soon as possible, and especially before attempting to extinguish a hydrogen fire.

b. Remember, hydrogen burns with an invisible flame.

c. If no hydrogen flame detector is available, use a long piece of wood or other combustible material to probe for flames before approaching the area of the spill.

d. Spray water on the spill to prevent a fire.

e. Spray large quantities of water on adjacent equipment to cool the equipment.

f. Attempt to extinguish only small fires.

15. Special precautions for handling other cryogenic fluids

If you use any cryogenic fluids not mentioned above, contact the Safety and Test Operations Division for additional safety requirements. Other cryogenic fluids may include liquid argon or liquid helium.

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Other requirements for cryogenic fluids

16. Protective clothing and equipment you must use when handling cryogenic fluids

When you work with cryogenic fluids, you must wear the protective equipment that is appropriate for the hazards of the task you are doing. The following list includes common protective equipment for working with cryogenic fluids:

a. Eye protection

b. Face shields

c. Insulated gloves with gauntlets—the gloves should be loose fitting

d. Cuffless trousers outside of boots or work shoes; don't wear tennis shoes or open-toed shoes

e. Coveralls or smocks approved for use with the cryogen you are using

See Chapter 5.6, "Personal protective equipment," of this Handbook for more requirements on protective equipment.

17. Training you must have to work with cryogenic fluids

You must be certified to handle cryogenic fluids as described in Chapter 5.8 of this Handbook. Your training must cover the following subjects for each cryogenic material you work with:

a. Nature and properties of the cryogenic fluid in both liquid and gaseous states.

b. Correct personal protective equipment to use in specific environments and where you can find it.

c. Approved materials that are compatible with the cryogenic fluid.

d. Proper use and care of protective clothing and equipment.

e. First aid procedures.

f. Emergency procedures for handling situations such as leaks, spills, and fires.

g. Good housekeeping practices.

18. Design requirements for cryogenic areas and systems

In addition to the standards listed in Paragraph 19 below, systems handling cryogenic fluids must meet these requirements:

a. Insulate cryogenic vessels and lines or provide drip pans under exposed pipes.

b. Insulate cryogenic containers.

c. Provide frangible (burst) discs or other pressure relief devices between the inner vessels

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and outer tank shell so that pressure rupture cannot occur.

d. Provide frangible (burst) discs or other pressure relief devices between sections of a cryogenic fluid system that may trap liquid cryogen, such as between two valves.

e. Provide emergency showers and eyewashes for quick drenching or flushing in accessible locations that require no more than 10 seconds to reach.

f. Provide enough continuous ventilation and hazardous gas monitors where accidental releases or spills could occur, as indicated by the hazard analysis.

19. Other requirements you must follow while handling cryogenic fluids

In addition to the requirements in this chapter, you must follow these standards as they apply to the work you do. Chapter numbers are for chapters in this Handbook.

For . . .	***Follow this standard . . .***
Working with cryogenic fluids	29 CFR 1910.103 & 29 CFR 1910.104
Handling liquid oxygen	NSS 1740.15, "NASA Safety Standard for Oxygen and Oxygen Systems"
Handling liquid hydrogen	NSS 1740.16, "NASA Safety Standard for Hydrogen and Hydrogen Systems"
Handling liquid oxygen or hydrogen as propellants	Chapter 9.5, "Explosives and propellants safety" NSS/GO 1740.12, "NASA Safety Standard for Explosives, Propellants, and Pyrotechnics"
Certifying employees to work with cryogenic liquids	Chapter 5.8 of this Handbook
Designing cryogenic systems	JPR 1710.13, "Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems," (current version) NFPAs 50, "Bulk Oxygen Systems at Consumer Sites"; 50B, "Liquefied Hydrogen Systems at Consumer Sites"; 59A, "Liquefied Natural Gas"; and others, as applicable
Finding more data on cryogenic fluids	Attachments 6.5A - 6.5E, Appendix 6B
Finding requirements for electrical equipment you can use in areas with hydrogen	NFPA 70

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Chapter 6.6
Underwater operations safety and health

This could be you . . .

A scuba diver was working upside-down for about 45 minutes when he noted a slight chest pain. The diver was treated for Medistanal Emphysema and returned to diving after two weeks.

During a free dive training exercise, a dive instructor suffered from shallow water blackout. A dive student retrieved the instructor from the pool bottom. Surface observers performed Cardiopulmonary resuscitation on the dive instructor.

1. Who must follow this chapter

You must follow this chapter if you operate or work with neutral buoyancy facilities, plan open water training or use other non-open water facilities.

2. What this chapter covers

This chapter covers dive operation for open and non-open water diving. It includes the following:

a. Underwater testing and training.

b. Dive standards.

c. Requirements for divers, equipment, and breathing gases.

d. General operating procedures.

3. Open and non-open water diving

For the purpose of this chapter, non-open water diving is conducted in water that is in a man-made enclosure and is treated with chemicals.

Non-open water diving

4. Steps to follow when using a neutral buoyancy facility (NBF)

As a test requester or operator, you must:

a. Follow Chapter 6.9, "Space systems and test safety," of this Handbook for training and testing operations in JSC NBFs.

b. Follow the requirements in NSS/WS-1740.10, "NASA Safety Standard for Underwater Facility and Non-Open Water Operations."

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c. Develop a dive plan that includes the following at a minimum:

- Purpose of the test.
- Test objectives.
- Scope of the test.
- Test requirements.
- Safety and medical planning provisions.
- Any known medical issues.
- Any special precautions or safety considerations.
- Method of testing.
- Other items that might be required by the neutral buoyancy facility you are using.
- Neutral buoyancy facility's critical lift procedures.

The facility may have more requirements than those listed here.

Open water diving

5. Requirements for open water operations

If you, as a test requester, are involved with human open-water testing or training, you make your management, the Safety and Test Operations Division, and the Occupational Health Branch aware of your intentions.

6. Standards for open water operations

You must:

a. Follow 29 CFR 1910, Subpart T, "Commercial Diving Operations."

b. Develop alternate standards if your operations involve unique equipment and methods not addressed by the Occupational Safety and Health Administration (OSHA). These standards must be:

- Developed by the responsible line management.
- Based on consensus standards.
- Approved as described in Chapter 1.4, "Written Safety and Health Program," of this Handbook.

Other requirements that apply to open and

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non-open water diving

7. Using the "buddy system"

As a diver, you must use the "buddy system." Never dive alone unless all of the following are true:

a. There is an emergency and someone's life is in danger.

b. You volunteer for the rescue. No one may force you.

c. You are in direct visual contact or are tethered.

8. Medical requirements for dive team members during a test

You must have a medical examination:

a. At least yearly by a doctor who knows the hyperbaric conditions that you will encounter, your mode of diving, and what type of work you will be doing. If you are a guest diver, you must have an examination at least every 3 years.

b. Before diving.

c. If you are injured or become ill and have to be hospitalized for more than 24 hours.

d. At the attending doctor's discretion.

9. Training for dive team members

You must be certified as described in Chapter 5.8, "Hazardous operations: safe practices and certification," of this Handbook. Your formal training must include the following:

a. The use of tools, equipment, and systems you will use.

b. Techniques and procedures of the assigned diving modes, including the buddy system concept and open water communication.

c. Diving operations, including diving related physics and physiology.

d. Emergency procedures, including cardiopulmonary resuscitation and first aid for lifeguards only.

10. Minimum requirements for diving equipment

Breathing gases and equipment used in NBFs must meet these minimum requirements:

a. Breathing air must comply with Grade E air as described in Compressed Gas Association pamphlet G-7.1, "Commodity Specification for Air."

b. Breathing oxygen must meet the United States Pharmacopoeia Standard for Medical or Breathing Oxygen.

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c. Equipment must meet the following:

- 29 CFR 1910 “Occupational Safety and Health Standards.”
- Industry consensus standards, good practice standards, or standards as required by the Safety and Test Operations Division for equipment not specifically covered by OSHA standards; such equipment may include that used for shallow water scuba instruction or search and rescue.

d. All discrepancies you find in equipment must be documented and corrected before you use it on any more dives.

11. Electrical equipment for underwater use

You must follow these requirements for electrical equipment used underwater:

a. Tools and underwater equipment must meet the minimum electrical requirements contained in this section of NSS/WS 1740.10, or must be accepted for use by an ad hoc committee composed of representatives of the Center's safety, underwater facility line management, medical, and electrical engineer with bio-electrical experience. The special ad hoc committee must assess the shock hazard, recommend controls to reduce or eliminate the hazard, and discuss the risk associated with any remaining hazards. The ad hoc committee must present its results to the appropriate Test Readiness Review Board for approval.

b. You must safeguard batteries used underwater to prevent hydrogen outgassing, and package them to prevent chemical leakage into the water or electric short circuits from water leaks.

c. You must protect personnel from exposure to any electrical hazard that can result in injury, created by underwater tools and equipment, by at least two independent verifiable controls. Controls must be verified operational before use. The potential for exposure to electric currents greater than or equal to 6.0 mill amperes represents a potential electric hazard.

d. The special ad hoc committee mentioned in subparagraph 11.a above must review tools, equipment, or systems using greater than 30 volts (AC (rms), DC, or combination) and present the results to the TRRB for approval before use in the underwater facility. Tools and underwater equipment limited to 30 volts or less (AC (rms), DC, or combination thereof) that include a verifiable barrier to electric shock are not normally considered potentially hazardous.

e. You must install listed ground fault circuit interrupters in the branch circuit supplying underwater lighting fixtures operating at more than 15 volts AC, so that there is no shock hazard during relamping. Areas around the pool that are subject to saturation with water or other liquids shall be considered “wet area locations” and must be protected with listed ground fault circuit interrupters in the branch circuits.

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12. General operating procedures

If you oversee any diving operations, you must have a "safe practices manual" available to each dive team member at the open water dive location. The manual must include standards, general information, requirements, and:

a. Specific procedures and checklists for each diving operation. See Paragraph 14 below for minimum requirements.

b. Responsibilities of the dive team members and support personnel.

c. Equipment procedures and checklists.

d. General emergency procedures, including rescue techniques and medical treatment.

13. What the general operating procedures must cover for each dive phase

Follow these requirements:

a. The pre-dive phase must include:

- Planning the dive.
- Assessing the safety of the dive.
- Identifying and inspecting equipment and supplies.

b. The dive phase must include:

- Entering and exiting the water.
- Communications between divers and surface personnel.
- Dive profiles and limits.
- Individual and crew responsibilities.
- Decompression tables as appropriate.
- Tools and equipment.
- Use of hazardous materials.
- Dive termination under normal and emergency conditions.
- Use of support and rescue equipment.

c. The post-dive phase must include:

- Checks on physical conditions of the divers.
- Other precautions necessary following the dive.
- Preparation of records of the dive.
- Records of equipment malfunctions.
- If required, assessment of recompression capability and decompression procedure.

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14. Pre-dive briefing

Before the dive you must have a diver and crew briefing by a person familiar with the safety requirements and operational aspects of the dive. The briefing must include a review of the following:

a. The applicable portions of the Safe Practices Manual.

b. The specific operating procedures and individual diver and responsibilities.

c. Dive profiles and operational limits.

d. The buddy system (no one dives alone), assignments of pairs, and communications.

e. Emergency and rescue procedures and responsible personnel.

15. Records you must keep

You must keep the following records, make copies available for employees to review, and protect them under the Privacy Act of 1974:

a. Records, reports, and other documents pertinent to the safety and health of employees in open water operations. You must prepare and maintain them under an established schedule that includes at least the requirements in OSHA 29 CFR 1910.440, "Record Keeping Requirements."

b. Breathing air records, such as sampling and analysis results.

c. Records of all maintenance on the diving equipment and support apparatus.

d. Records of all materials used in an oxygen-enriched environment if enriched gas mixtures are used.

16. Responsibilities for underwater safety

The following have responsibilities for underwater safety:

a. If you are a ***line manager***, you must make sure that the regulations in this Handbook and applicable OSHA regulations are met.

b. The ***Safety and Test Operations Division*** must:

- Make sure that human testing, training, or preparations follow the regulations in this Handbook, applicable OSHA regulations, and approved procedures.
- Monitor all suited subject testing or training. The Safety and Test Operations Division may decide to monitor other testing or training.

c. The ***Occupational Health Branch*** must:

- Monitor all human testing or training based on the requirements of NSS/WS-1740.10.
- Make sure that those people involved in open water operations meet the physical requirements to perform their duties.

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Chapter 6.7
JSC's policy for handling new or unique hardware or materials

This could be you . . .

A foreign mock-up fell from a crane because it wasn't properly rigged. All of the rigging equipment used was foreign. There was no policy to ensure the Americans understood the foreign hardware or would handle it properly.

1. Who must follow this chapter

You must follow this chapter if you are:

a. A line manager at any level and your organization handles new or unique items as defined in Paragraph 2 below.

b. Appointed to oversee any operations involving new or unique items. Paragraph 8 of this chapter lists your responsibilities.

2. New or unique items this chapter covers

For this chapter, new or unique items are defined as any systems, components, materials, or substances that are unfamiliar to your organization. They can be spaceflight or institutional items. They can come from any foreign country, any U. S. company or organization, or any JSC organization. New or unique items include:

a. Unfamiliar hardware or systems that will require material handling operations or that your organization will test, evaluate, modify, or repair.

b. Unfamiliar substances or materials your organization will use to make hardware or use in its processes.

3. Process you must have for handling new or unique items

If your organization handles any new or unique items, you must have a written process that describes how your organization handles these items. You may tailor your process to apply to the types of items your organization handles. The process must have responsible line manager, signature approval.

The process must address any of the following issues that apply to the type of items your organization handles. It must also assign persons to be responsible for those issues. The Safety and Test Operations Division and Occupational Health Branch can help you if needed. The process should:

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a. Identify what documentation must accompany new or unique items that are delivered to your organization. It should address how you handle the documents and where you keep them. English translations are necessary for foreign items. Such documentation should include the following, as necessary:

- Drawings of the items.
- Procedures for handling, operating, or maintaining the items to include the use of hazardous materials and chemicals.
- Hazard analyses of the items, processes, and materials and recommendations for control of hazards (such as engineering solutions and personal protective equipment).
- A list of changes to items you may have used previously.

b. Identify what your organization requires for shipping and receiving the items. This should include the following, as necessary:

- Shipping manifests.
- Material safety data sheets on any hazardous materials.
- A list of hazardous materials and their quantities.
- Schedules for shipping and receiving the items.
- A list of items that don't comply with U.S. law (Department of Transportation (DOT), Occupational Safety and Health Administration (OSHA), and Environmental Protection Agency (EPA)), NASA requirements, or JSC requirements. You must also decide how to meet those requirements or request variances.
- Specifications for containers and packing.
- A list of personnel designated to receive the items.
- Export authorizations.

c. Define how your organization accepts new or unique items. This should include as necessary:

- A list of personnel authorized to accept the items.
- What inspections or reviews you do before accepting the items.
- What criteria you use to determine if the items are acceptable.
- How you track the items while they are with your organization.

d. Identify any special storage and handling requirements such as:

- Lifting requirements.
- Environmental and security restrictions during storage.
- Limited life considerations.
- Any other safety and health precautions.

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e. Define how you report problems with the items and whom you report them to. Such problems may include:
   - Nonconformances with any applicable requirements.
   - Mishaps that occur during handling, test, or training.
   - Damage to the items.

f. Define how you train or certify anyone involved with handling the items, such as:
   - Material and hardware handlers.
   - Test team members.
   - Flight crews.

g. Define how you handle any excess items and byproducts, such as:
   - Hazardous wastes.
   - Unused hazardous materials.
   - Recyclable materials.

h. Define how you resupply any consumables used in processing the items such as batteries, oxygen, and fuel.

i. Define how you inform management of the risks of handling the items.

4. What else you must do for handling new or unique items as a line manager

If your organization handles any new or unique items, you must:

a. Make sure your employees follow your process when handling new or unique items.

b. Make sure that anyone who handles new or unique items understands the items and their interfaces with JSC equipment.

c. Provide adequate precautions that safeguard both those handling the items and safeguard the items themselves.

d. Make sure that all operations involving new or unique items follow JSC, NASA, and other federal requirements that apply (see Paragraph 6 of this chapter).

e. Make sure that configuration control is maintained on the items. This should be to a level that is appropriate for the type of items they are (flight, training, etc.).

f. Assign someone at the project level to oversee any handling of new or unique items while they are with your organization. This person will:
   - Have primary responsibility for the new or unique items and their interfaces with JSC systems.
   - Be accountable for all decisions involving the new or unique items.

g. Fulfill the responsibilities listed in Paragraph 8 of this chapter.

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5. Special precautions for handling foreign items

If you handle new or unique items that are foreign, you must:

a. Make sure you account for differences between Standard International units of measurement and English units if necessary. The foreign items will use Standard International units. Your JSC equipment may use English units.

b. Have English translations of all documents that accompany the items.

c. Make sure you understand any cultural differences that may affect how you handle foreign items. Engineering conventions may differ between the U. S. and the country the items came from.

6. Other requirements to ensure safety while handling new or unique items

Your process and any individual project procedures must make sure that operations involving new or unique items follow these requirements if they apply, or request variances.

For operations involving . . .	***Follow . . .***
General handling	• 29 CFR, parts 1910, “Occupational Safety and Health Standards, General Industry” & 1960, “Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters,” (OSHA) • 49 CFR, “Transportation” • 40 CFR, “Protection of Environment” • JPR 1700.1, “JSC Safety and Health Handbook” • JSC 17773, “Instructions for Preparing Hazard Analysis for JSC Ground Operations”
Lifting the items	• NSS GO-1740.9, “NASA Safety Standard for Lifting Devices and Equipment” • Chapter 8.5, "Lifting operations and equipment safety," of this Handbook
Pressurized systems	• JPR 1710.13, “Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems,” (current version)
Human research	• JSC 20483, “JSC Institutional Review Board, Guidelines for Investigators Proposing Human Research for Spaceflight and Related Investigations” • NPD 7100.8C, “Protection of Human Research Subjects” • 45 CFR 46, “Protection of Human Research Subjects”
Zero gravity aircraft	• JSC 22803, “JSC Reduced Gravity Program User’s Guide”

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For operations involving . . .	*Follow . . .*
Spaceflight	• NSTS 1700.7B, "Safety Policy and Requirements for Payloads Using the Space Transportation System" • NSTS 13830 "Implementation Procedure for NSTS Payloads System Safety Requirements"
Radioactive Materials, Lasers, and other ionizing and non-ionizing radiation devices	• 10 CFR, U.S. Nuclear Regulatory Commission Rules and Regulations, with particular emphasis on Parts 19, 20, 30, 31, and 35 • 29 CFR 1910.97, Non-Ionizing Radiation • 29 CFR 1910.1096, Ionizing Radiation • Applicable consensus safety and health standards for ionizing and non-ionizing radiation exposures • Approvals and guidance from the JSC Radiation Safety Committee and Radiation Safety Office

7. Responsibilities of an organizational director or program manager for handling new or unique items

If your organization handles any new or unique items, you must:

a. Develop policies for handling new or unique items within your organization.

b. Make sure processes for handling new or unique items are developed in your organization as necessary and are reviewed by safety and health professionals.

c. Designate which level of management must approve processes or project procedures for handling new or unique items.

8. Responsibilities for those appointed to oversee handling of new or unique items

If you are appointed to oversee the handling of new or unique items, you must:

a. Serve as the single point-of-contact for all decisions about the new or unique items and their interfaces with JSC systems.

b. Develop project-specific procedures that follow all safety and health regulations applicable to your specific project.

c. Determine what safety and health regulations apply to your project before you develop any project procedures. The Safety and Test Operations Division and Occupational Health Branch can help you with this.

d. Obtain signature approval from the appropriate level of management on any project-specific procedures before anyone begins any work on the project.

Chapter 6.8
Laboratory safety and health

This could be you . . .

Hydrofluoric acid overflowed from a container. A worker tried to clean it up with paper towels and only caused more vapors. The worker experienced delayed symptoms and received severe chemical burns to his hands and lungs.

A glass separator funnel ruptured from being shaken and sprayed a chemical on a chemist. The chemist was wearing safety glasses, lab coat, and gloves. After washing off the chemical, the chemist was okay.

A laboratory worker broke a glass laboratory device he was working on and cut his finger.

1. Who must follow this chapter

You must follow this chapter if you work in a laboratory as described in Paragraph 2 below or supervise those who work in a laboratory.

2. What is a laboratory?

In this chapter the term "laboratory" will be used as it is defined in the OSHA Standard, 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories." Therefore, laboratory means "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis for analysis or research." It involves "work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safety manipulated by one person."

3. Requirements for working in a laboratory

You must follow the requirements in this chapter and 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories." You must use engineering and administrative hazard controls as much as possible. You must also follow your laboratory's chemical hygiene plan and standard operating procedures.

4. Chemical hygiene plans (CHP)

If your laboratory uses hazardous chemicals, your supervisors must make sure that the laboratory has a written CHP. Your laboratory may have its own CHP or it may use a CHP that covers several laboratories in your organization. You must review your CHP and evaluate its effectiveness at least yearly and update it as necessary. A CHP must include:

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a. Methods to protect workers from chemical hazards in the laboratory and keep exposure levels below any Occupational Safety and Health Administration (OSHA) or NASA permissible exposure limits (PELs) or below any American Conference of Industrial Hygienists (ACGIH) threshold limit values (TLVs).

b. Methods to provide extra protection from carcinogens, reproductive toxins, and acute toxins. Extra protection must include:

- An area set aside for these chemicals.
- Devices to contain or control these chemicals.
- Procedures for safely removing wastes contaminated by these chemicals.
- Decontamination procedures.

c. Operating procedures for safely using hazardous chemicals in the laboratory.

d. Criteria to decide what control measures to use to reduce the chance of a dangerous chemical exposure. Control measures may include engineering controls, personal protective equipment, or safe work practices.

e. Requirements to make sure that laboratory safety equipment such as fume hoods, emergency showers, and eyewashes work properly.

f. Provisions for worker information and training as described in Paragraph 12 of this chapter.

g. Criteria to decide when a particular laboratory activity requires prior approval from the laboratory supervisor.

h. Provisions for workers to get medical help as described in Paragraph 13 of this chapter.

i. A list of personnel responsible to implement the plan that includes chemical hygiene officers.

5. Safe practices for working in a laboratory

When you work in a laboratory, you must:

a. Follow your laboratory's CHP and operating procedures. See Paragraph 4 of this chapter for more details.

b. Follow these requirements for exhaust hoods:

- Use hazardous chemicals under exhaust hood.
- Keep sashes between the 100 lfpm (linear feet per minute) and 150 lfpm marks when working at the hood face.
- Always wear required personal protective equipment; even when working under a hood.

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- Make sure your exhaust hoods are evaluated by Occupational Health Services yearly, and twice per year if carcinogens are used in the hoods.
- Get approval from the Safety and Test Operations Division and Occupational Health Services before using other exhaust methods.

c. Keep exposure to hazardous chemicals in the laboratory to the lowest level practical. Never exceed the OSHA or NASA permissible exposure level for any chemical.

d. Keep aisles and areas around safety equipment such as eyewash stations and emergency showers clear.

e. Keep material safety data sheets (MSDSs) for each chemical in your laboratory. Develop MSDSs for each chemical developed in your laboratory for use outside the laboratory as described in Chapter 9.2, "Hazard communication," of this Handbook.

f. Review any experiment that involves storing energy (such as mechanical, electrical, or chemical) for hazards before conducting it.

g. Take precautions to prevent injuries from broken glass. Use the guide for safety in the chemical laboratory, Manufacturing Chemists Association Inc., “Handling Glassware.”

h. The lab safety representative/ chemical hygiene officer should review changes in laboratory operations/ chemicals before a procedure is conducted for the first time.

i. Recipes for mixed chemical reagents should be scaled down whenever possible to the minimum quantity for the task.

6. Storing chemicals in a laboratory

When you store chemicals in your laboratory, you must:

a. Label all containers of laboratory chemicals, samples, and other materials. Don’t remove or tear labels on incoming chemical containers. If a label on a chemical container becomes unreadable, put your own label on the container that identifies the chemical and its hazards. If you move a chemical to another container, properly label the new container.

b. Keep MSDSs for hazardous chemicals where laboratory workers can easily find them during all duty hours.

c. Keep an up-to-date inventory of the names and amounts of all hazardous chemicals in your laboratory at a given time.

d. Keep only the smallest amount of chemicals possible in your laboratory. If your laboratory uses a large amount of chemicals in a short time, designate an internal chemical storage area. This area must:

- Have enough ventilation
- Be physically separated from workrooms
- Separate potentially reactive chemicals and incompatible materials

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- Have readily available a listing of all chemicals in the storage area
- Include fire protection

e. Never use an exhaust hood for permanent chemical storage.

7. Monitoring chemical exposures in a laboratory

The Occupational Health Branch is responsible for monitoring chemical exposures during yearly inspections or because of complaints or requests. This office may write you and your coworker a report or post the results on a bulletin board in the your area. The Occupational Health Branch will:

a. Sample chemical exposures to workers if it believes that chemical exposures could exceed PELs.

b. Monitor chemical exposure periodically if earlier samples or monitoring show exposures over PELs.

c. Keep accurate records on any monitoring results. You have access to these records as described in 29 CFR 1910.20, "Access to Employee Exposure and Medical Records."

Your supervisor must tell you the results within 15 days after he or she receives them.

8. Design requirements for laboratories

Laboratory designs must meet these requirements:

a. Follow National Fire Protection Association 45, "Fire Protection for Laboratories Using Chemicals."

b. For new installations, laboratory hoods shall not be located adjacent to a single means of access to an exit or to high-traffic areas.

c. For existing fume hoods, provide a second means of access to an exit from the laboratory work area if the hood in the laboratory work area is located adjacent to the primary means of exit access. Refer to Chapter 5.1 for exit widths between aisles.

d. Install permanent pipes as much as possible to reduce the use of flex hoses and temporary tubing. Label all pipes.

e. Provide permanent gas-venting where venting of gases is needed.

f. Provide blast and fragment protection for operations that may cause explosions, implosions, or flying fragments such as high-pressure equipment, high-vacuum equipment, or explosive reactions.

g. Provide emergency showers and eyewashes if hazardous chemicals are used. Locate emergency eyewashes and shower for quick drenching or flushing in accessible locations that require no more than 10 seconds to reach.

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h. Include other design requirements and engineering controls; e.g., appropriate laboratory ventilation systems, from 29 CFR 1910.1450.

i. Meet the requirements in Paragraph 6.10.1 of NPR 8715.3, "NASA Safety Manual."

9. Emergency planning for laboratories

As a supervisor, you must make sure your laboratory has written emergency action plans that cover any possible emergencies in the laboratory and make sure all workers know what to do in an emergency. You must also make sure the laboratory has enough emergency equipment and supplies to deal with any emergency.

10. Protective equipment you must use when working in a laboratory

You must use:

a. Any protective equipment such as gloves, aprons, or protective clothing required by a materials safety data sheet or OSHA standard for the chemicals you are working with.

b. Respiratory protection if engineering or administrative controls don't keep chemical levels below PELs. See Chapter 7.2, "Respiratory protection," of this Handbook.

See Chapter 5.6, "Personal protective equipment," of this Handbook for more requirements on protective equipment.

11. Training you must have to work in a laboratory

You must have briefings or training when you first come to work in the laboratory and whenever you change your work assignment in the laboratory. See Chapter 4.1, "Program Description (for safety and health training), of this Handbook for more information. You must:

a. Know:

- The contents of 29 CFR 1910.1450
- Where you can find the CHP and needed reference material
- Exposure limits for hazardous chemicals in the laboratory
- Signs and symptoms of exposures to the chemicals in the laboratory
- Where you can find MSDSs for laboratory chemicals
- How to get medical help if you think you are exposed to chemical levels above PELs (see Chapter 3.6, "Occupational Healthcare Program," of this Handbook).

b. Have initial and refresher training in:

- The physical and health hazards of chemicals in the laboratory

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- Hazard controls such as exhaust hoods, respirators, or special procedures you must use to protect yourself and your coworkers
- How to detect the presence of a hazardous chemical
- How to enter and leave contaminated areas and how to decontaminate yourself and others
- Details of your CHP that apply to your work
- Yearly emergency response training.
- Employee hazard reporting systems

12. When you must get medical help

JSC has a "Clinic First" policy for any injury for illness occurring at JSC, Sonny Carter Training Facility, or Ellington Field. We encourage all NASA civil servant and contractor employees to use the JSC Clinic as the Clinic is tasked to provide occupational medicine evaluations to all employees. You or your supervisor should ensure you get to the JSC Clinic for medical evaluation and treatment. Using the JSC Clinic will ensure you are seen by a licensed health care professional.

If the exposure could be life-threatening, call your emergency number for an ambulance. The emergency numbers are:

NASA/JSC: extension 33333

Ellington Field: extension 44444

Sonny Carter Training Facility or off-site facility: 911

White Sands Test Facility: extension 5911

Follow these rules for medical help:

a. You must get medical help if:

- You notice signs or symptoms associated with a hazardous chemical to which the worker may have been exposed
- Repeated exposure monitoring indicates exposure levels above PELs
- You have a spill, leak, explosion, or other event in your laboratory that may have exposed you to a chemical above its permissible exposure level

b. Your supervisor must give the doctor the following information:

- What chemicals you may have been exposed to
- How the possible exposure happened and any quantitative data on the exposure
- What signs and symptoms you have, if any

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c. Your doctor will provide an opinion as described in 29 CFR 1910.1450(g)(4). The opinion will only cover job-related exposures and will include the examination results and recommendations for further medical action.

d. JSC will keep accurate records on any medical help you receive as a result of a possible chemical exposure. You may see your records as described in 29 CFR 1910.20.

13. For more information on laboratory safety and health

You can find more information on laboratory safety and health in these documents:

a. *Patty's Industrial Hygiene and Toxicology, Volume I, 4th Ed.*, John Wiley & Sons, Inc., New York, NY, 1991

b. Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Research Council, National Academy Press, Washington, DC, 1981

c. ANSI/AIHA Z9.5-1992, "American National Standard for Laboratory Ventilation", 1992

d. Industrial Ventilation, a Manual of recommended Practice, 23rd ed., The American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 1998

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Chapter 6.9

Space systems and test safety

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1. Who must follow this chapter

You must follow this chapter if you:

a. Conduct or participate in testing activities at JSC or JSC field sites.

b. Are involved in tests at other locations, foreign or domestic including those with JSC equipment.

2. What this chapter covers

This chapter covers the basic safety requirements and references for all tests conducted at JSC and for tests conducted at other locations that involve JSC personnel or property or that are sponsored by JSC. This chapter applies to equipment being tested, test personnel, test facility interfaces to test equipment and personnel, test conduct, and test documents. Test hardware and operations must also follow the requirements of other chapters in this Handbook. The term "testing," as used in this chapter, includes hazardous activities designed to accomplish training, demonstrations of test hardware or procedures, data acquisition, and hardware evaluation, qualification, or acceptance.

3. Exclusions from this chapter

This chapter doesn't cover testing of institutional systems and equipment, diagnostic medical tests, or medical treatment procedures. (This exclusion doesn't apply to medical research testing.)

This chapter also excludes laboratory analysis, research and experimentation that doesn't involve human subjects, flight hardware, prototype hardware, explosives, and oxygen-enriched atmospheres.

4. Requirements for test operations

You must keep the Safety and Test Operations Division informed of upcoming test activities by a test request, schedule, or by other means and follow these requirements:

a. For non-hazardous test, you must follow Paragraphs 5 and 9 through 11 (operating procedures, test systems, and test team members) of this chapter and any other requirements from this chapter that you or the Safety and Test Operations Division decide to include. You must also make test documentation available to them on request.

b. For hazardous tests, you must follow all the requirements in this chapter that apply to your tests. You or the Safety and Test Operations Division may also decide to follow more stringent requirements.

c. Include the applicable requirements of this chapter in any requirements you provide to

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test requestors.

Test team requirements

5. Test team members

The following personnel must be present during each test as required below or in other sections of this chapter. These personnel may not be required to be present throughout the entire test. The testing organization's operating procedures or detailed test procedures (DTPs) must specify when each member is to be present.

If you are the . . .	***Your duties are . . .***	***Your certification requirements are . . .***
Test Director (TD)	To be the central authority and has overall responsibility for all aspects of the test.	The responsibility of the testing organization
Test Conductor (TC) (Optional)	Described in the testing organization's operating procedures or DTPs.	The responsibility of the testing organization
Test Safety Officer (TSO)	To monitor the all phases of test activities for certain human or especially hazardous tests, and to advise the TD of any activities deemed to be hazardous to JSC personnel or property. To advise the Safety and Test Operations Division of any safety concerns that surface during the test To advise the Occupational Health Branch of any health concerns that surface during the test.	The responsibility of the Safety and Test Operations Division Or the Occupational Health Branch
Medical Officer or Medical Representative (MO or MR)	To monitor the test conduct, provide medical assistance or opinions when necessary, and advise the TD any time the well-being of anyone involved in the test is being compromised.	Defined by the Occupational Health Branch

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If you are the . . .	*Your duties are . . .*	*Your certification requirements are . . .*
Facility or Test Support Personnel Facility or test support personnel include all other personnel necessary to support a test such as console operators, divers, test article support personnel, audiovisual personnel, or pressure suit engineers	Listed in the testing organization's operating procedures, test plan, or DTPs.	Specified in the testing organization's operating procedures, test plan, or DTPs.
Test Subject (the human subjected to the test environment)	Inform the TD if you feel that you maybe in danger and desire to stop the test.	Specified in the operating procedures, test plan, or DTPs.

6. Other requirements for test team members

You must observe the following additional requirements if you are the Medical Officer (MO) or Medical Representative (MR):

a. As the MO, you must certify the fitness of test team personnel to do hazardous operations and of test subjects to participate before any hazardous testing begins.

b. An MR must monitor the medical conduct of tests under the following conditions unless excluded by, and as deemed necessary by, the Occupational Health Branch:

- Personnel in hypobaric, hyperbaric, and oxygen-enriched environments.
- Suited underwater neutral buoyancy operations.
- Ambient pressure suit operations using other than ambient air or where the suit pressure is greater than 8.8 psid.

c. As the MR or TSO, you must:

- Keep in communication with the TD at all times when your presence is required during the test.
- Review test documentation and participate in test readiness reviews (TRRs) as required.
- Make sure that there is adequate and functional bioinstrumentation on each test subject.

d. As a TSO, you must also review test and safety documentation for all tests conducted within your area of responsibility. You should attend test reviews as well. A TSO must monitor the following tests:

- Personnel in hypobaric, hyperbaric, and oxygen-enriched environments.
- Suited underwater neutral buoyancy operations.
- Testing or training involving personnel at heights greater than 10 feet above the

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ground or on a platform.

- Ambient pressure suit operations using other than ambient air or where the suit pressure is greater than 8.8 psid.
- Suited subject testing on the precision air bearing floor, Orbiter training mock-ups, and any other hazardous training.

7. Training and certification for test team members

If you are a team member or support person, you must be trained for your job as described in your operating procedures. Never fill a position without being certified. See Chapter 5.8, "Hazardous operations: safe practices and certification," of this Handbook for more requirements on certification. See Chapter 4.1, "Program Description" (for safety and health training) of this Handbook and JPR 8550.1, "JSC Environmental Compliance Procedural Requirements," for more requirements on training.

8. Operating procedures for testing

As a testing organization, you must have and follow Chapter 10.2, "Safety and health requirements for test, vacuum, and oxygen-enriched facilities," of this Handbook. The operating procedures may contain more stringent requirements than those of this Handbook if you and the Safety and Test Operations Division believe they are required. If you have no operating procedures, you must include the required information for operating procedures in your test plan or DTPs. The Safety and Test Operations Division must approve the safety assessment and DTPs.

Requirements for test systems

9. Requirements for all test systems

The following requirements apply to all test systems, hazardous and non-hazardous. You can find additional requirements in other chapters of this Handbook:

a. Test systems must be designed and constructed so that a single-point failure, loss of utilities, fluctuation of utilities, or software command can't cause injury, property damage, or uncontrolled environmental spill, release, non-compliance, or non-conformance. Follow fault tolerance requirements in Paragraph 1.8 of NPR 8715.3, "NASA Safety Manual."

b. Test systems used in oxygen-enriched, high-vacuum, or enclosed environments must undergo materials scrutiny as defined by the testing organization's material control process. The test system's materials must follow the material control requirements of Chapter 10.2 of this Handbook, if the facility does not have a material control process.

c. Safety and environmental instrumentation must be calibrated and certified before the test and as required by the test documentation or the testing organization's operating

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procedures.

d. Test systems are approved for testing after the Test Readiness Review Board (TRRB), including the Safety and Test Operations Division, has signed the TRRB approval sheet. (See Paragraph 13.)

e. Software that interfaces with test systems must meet NASA-STD-8719.13, "NASA Software Safety Standard."

f. Make sure that no test team member can be exposed to hazardous materials used in the system.

10. Requirements for tests systems involving human subjects

In addition to the requirements above, human test systems must meet the following requirements:

a. Have a means of immediately detecting an incipient fire or other hazardous condition in each occupied compartment of any test area. Automatic detection must be provided for critical areas not suitable for visual monitoring.

b. Be designed for rescue of an incapacitated test subject.

c. Be designed for safe test termination and removal of test subjects if a power failure, fire, or other emergency occurs.

d. Have software controlling test systems analyzed to make sure no command can cause death or injury to test subjects.

e. Provide manual overrides for software commands to ensure the safety of test subjects. The commands must support safe test termination and egress of the test subject.

Test documentation

11. Documentation requirements for tests

You must complete the following documentation as part of the test process. Everything but the test report and the mishap report must be completed before the test:

a. The ***test plan*** is a top-level summary of the test. A test plan must be written for each new test. The test plan must include the following as a minimum:

- Test objectives.
- Safety, occupational health, and medical planning provisions and known medical issues.
- Test requirements.
- Special safety, occupational health, and environmental considerations for test.
- Other items, if required by the testing organization; test plans containing final DTPs (as described below) must be approved in the same manner as a DTP document.

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b. The ***DTP*** describes the steps you will use to run the test. You should make the test procedures available for critical review at least 3 to 5 days before the TRR. You must write test procedures in a step-by-step sequential format. DTPs must include the following as a minimum:

- Operating procedures to accomplish the test.
- Measures to prevent mishaps.
- Emergency procedures to be taken in the event of systems failure or malfunction such as fire, smoke, power outages, environmental spills and releases, and system failure.
- Test rules which define equipment and instrument limits, operating limits, off-nominal conditions, and operational situations which would require abort, hold, or proceed decisions for each test or checkout operation.
- The safety requirements, individual tasks, and personnel involved in hazardous operations.
- Special considerations and procedural steps that address specific hazards identified during the hazard analysis process; these and steps containing actions critical to the protection of life or property must be flagged as safety critical steps for easy identification by test team personnel.

c. A ***safety, health, and environmental assessment*** that identifies the safety and health hazards associated with the test, the hazards' controls, and verification. Your operating procedures must outline the assessment process and identify specific assessment subjects. The process should begin in the early phases of test planning and operations and should involve the Safety and Test Operations Division and the Occupational Health Branch at every step. You must eliminate, control, or close all hazards or accept the risk before testing begins:

- Your operating procedures will state how you document the results of safety and health assessment. You must update your assessments for changes to the hardware or operations.
- Chapter 2.4, "Hazard Analysis," of this Handbook describes system safety requirements and concepts. This includes an environmental impact assessment as described in JPR 8553.1, "JSC Environmental Management System Procedural Requirements." You may use JSC 17773, "Instructions for Preparing Hazard Analysis for JSC Ground Operations," as a guideline for format or thought process for conducting safety assessments. Other information sources on safety assessments include MIL-STD-882, "System Safety Program Requirements," and NPR 8715.3, Chapter 3, "NASA Safety Manual."

d. If you prepare a ***test report***, you should include any anomalies, safety, health, or environmental implications, and safety or health lessons learned. Send a copy of the report to the Safety and Test Operations Division and the Occupational Health Branch. You may send lessons learned by means other than the report.

e. You must send in a ***mishap report*** for any incident causing damage, injury, or

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environmental spill or release or any incident that could cause damage, injury, or environmental release (close call). See Chapter 2.7, "Mishap and Incident Investigation," of this Handbook for mishap reporting requirements.

12. Requirements for certain test documents

You should give the reviewers 3 - 5 days to carefully review the test documentation before the TRR. The more complex the test, the more time you should give them (see Paragraph 15.b of this chapter for special cases). You should also follow these rules:

a. Each DTP containing safety-critical steps must state that on its cover.

b. Emergency procedures must be immediately available to personnel at their duty stations unless it isn't practical (such as divers).

c. You must have the Safety and Test Operations Division concur on DTPs.

Operations requirements

13. Test readiness reviews

a. You must hold a TRR for each test involving human subjects, other hazardous test, or series of tests. An annual TRR is acceptable for an undefined number of tests where the tests are similar, involve no significant changes to the hardware, low risk (RAC 4 with the concurrence of the Safety & Test Operations Division), and individually approved by the branch chief. A TRR determines:

- The readiness of the test facility and the test article.
- The adequate completion of the safety, health, and environmental assessments.
- The status and closure of key issues.
- The test's constraints.
- The open items.
- The qualification or certification of the test team.

b. The TRRB will be chaired by a management official or designee from the testing organization who is not personally involved with the test. The board's membership will include:

- A Safety and Test Operations Division's Occupational Safety Group representative.
- An Occupational Health, Medical, or Industrial Hygiene representative (as appropriate) from the Occupational Health Branch.
- A Safety and Test Operations Division's Quality Assurance Group representative (for tests supported by the Quality Assurance Group).
- An Environmental Office Representative (if appropriate).

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- The board chairman or the testing organization might add other members who are selected for their special knowledge. The TRRB members will sign a TRRB summary sheet to indicate their approval to proceed with your test.

c. A TRRB summary sheet generally will include:

- The test's objective.
- A statement covering test article's readiness.
- The test's schedule.
- Approval of the staffing, operation, procedures, and safety, health, and environmental assessments.

14. Other test reviews

You must have the following reviews unless they are indicated as "optional."

a. A ***pre-test briefing*** conducted by the TD or TC for each series of tests. The intent is to make sure that all test team members understand the test's normal and emergency operations and all test hazards.

b. ***Pre-test checkout*** operations, using approved test procedures. You must conduct this before each series of tests to make sure that the test personnel will function effectively as a team and that the facility and test equipment are compatible. Your pre-test checkout operations must include:

- Verification that all critical systems are functional.
- A "dry run" for complex tests, if practical, to exercise the facility and equipment for final compatibility and provide training and familiarization for the test team.
- Simulated emergency drills unique to the specific test.

c. A ***post-test debriefing*** (optional) by the TC or TD for human or complex tests. The intent is to discuss the test results and any facility or test system anomalies that have occurred with the test team and subjects (if appropriate).

15. Repeat, real-time, and quick-turnaround tests

You must follow these requirements:

a. You may repeat a test using previously approved configurations and procedures without another TRR, as long as the test complies with the constraints of the original TRR and the paperwork has not changed. Modifications to the hardware or procedures will require a new TRR. Retests, modified procedures, and safety analyses must be approved as described in your testing organization's operating procedures.

b. Real-time and quick-turnaround testing refers to testing that is required real time to support a mission or pre-mission testing for a space mission. This testing is essential for timely start or safe continuation of the mission. For this type of testing, you must streamline the

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test process. As a minimum, you must have test procedures and a TRR held. You must notify the Safety and Test Operations Division of such tests as soon as possible. An Safety and Test Operations Division representative must be present for any procedure reviews, the TRR, and the test, if required.

16. Requirements for all test operations

You must follow these requirements during any phase of test operations, both hazardous and non-hazardous, including buildup and teardown:

a. Follow limits on work shifts for test team members and personnel supporting tests found in Chapter 5.8, "Hazardous operations: safe practices and certification," of this Handbook.

b. Keep test data records such as voice and video tapes, or computer tapes for at least 14 days after the test in order to help investigation and analysis of any mishaps or anomalous conditions. Safety may require keeping the records longer.

c. Follow the approved procedures. Each Testing Organization must have a form for Test Deviations. You must document deviations from approved procedures on a deviation sheet. Deviations sheets require signature approved by the Safety and Test Operations Division if the deviation affects hazard closure or creates a new hazard. The Test Director and any appropriate engineers must approve the deviation by signature along with the TSO and MR, if on station for the test. Never make deviations from test rules during the test.

d. Make sure the TD maintains voice contact with all critical test team members. Communication requirements must be specified in your operating procedures, test plans, or test procedures.

e. Follow these requirements as a TD:

- Redirect the test to a safe position or stop the test if advised to stop the test by a TSO. You may resume the test after you resolve the safety issues with the TSO.
- Follow the MR's direction if the MR declares a medical emergency, following established procedures.
- Give the TSO access to any area of the test facility whenever the TSO deems it necessary, provided the TSO is present, it doesn't create any additional hazard, and the TSO is certified for the environment after coordinating with the TD.

17. Requirements for tests involving human subjects

In addition to the requirements in Paragraph 5 through 16 test operations involving human subjects must follow the following:

a. Keep in voice and visual contact with test subjects. Provide backup voice communications if feasible. Deliberate loss of voice or visual (but not both simultaneously)

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communications as part of a test is allowed if you document it in the approved test procedures.

b. Equip rescue crews for tests with protective equipment suitable for the specific hazards of that test, such as breathing apparatus.

c. Keep a hyperbaric treatment chamber on standby during the following test operations with human subjects:

- Pressure-suited operations in a vacuum or underwater environment.
- Ambient pressure suit operations where the suit pressure is greater than 8.8 psi above ambient.

d. Have an MO certify the fitness of each test team member to test subjects doing hazardous operations before a test.

e. Stop the test when a test subject requests that the test be discontinued.

f. Use instruments on test subjects to monitor critical physical parameters the MO requires.

g. Make sure appropriate emergency medical treatment is available.

18. Requirements for certain kinds of tests

Some tests must meet other requirements besides this chapter because of the hazards or the nature of the test. Tests not covered here or by other chapters of this Handbook should be coordinated with the Safety and Test Operations Division and Occupational Health Branch at the earliest possible time to develop specific requirements in a timely manner. The following test operations must follow these requirements:

a. You must observe the following additional requirements for ***hypobaric tests*** at pressures below normal atmospheric pressure:

- Follow JPD 8080.4 (current version), "Exposure to Reduced Atmospheric Pressure," for hypobaric tests involving human subjects.
- Monitor the oxygen level if the test isn't approved for an oxygen-enriched atmosphere. Stop the test if the atmosphere becomes oxygen-enriched.
- Maintain internal suit pressure at predetermined levels above ambient during pressure-suited operations.
- Take measure to prevent corona discharge.

b. You must observe the following additional requirements for ***hyperbaric tests*** at pressures above normal atmospheric pressure:

Note: This paragraph doesn't apply to hyperbaric medical treatment.

- Monitor the oxygen level if the test isn't approved for an oxygen-enriched atmosphere. Stop the test if the atmosphere becomes oxygen-enriched.
- Follow exposure times and decompression stops in the Navy Dive Tables or more

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stringent tables using equivalent pressure depth.

- Never expose anyone who has been exposed to hyperbaric environments to any hypobaric conditions such as flying or altitude chambers for at least 12 hours after the hyperbaric exposure unless the subject has prebreathed for a specified time according to JPD 1830.3.

c. For ***underwater neutral buoyancy operations*** you must meet the following requirements and the requirements found in Chapter 6.6, "Underwater operations safety and health," of this Handbook and must follow these requirements:

- JSC neutral buoyancy operations are considered non-open water operations that must meet the requirements of Chapter 6.6 of this Handbook by the individual facility operating procedures.
- You must meet requirements for oxygen-enriched environments if other than ambient air oxygen percentage is used in the suit or if the differential suit pressure exceeds 8.8 psi.
- All underwater personnel must observe the restrictions on flying after diving of JMI 1830.3 (current version), "Limitations Applicable to Personnel Exposed to Diving."
- Never require pressure-suited subjects to walk.

d. You must use fall protection if personnel involved are at a height greater than 4 feet.

e. Physiological training must follow the requirements for hypobaric tests listed above. A TSO needn't be present during all physiological training runs. A TSO must monitor each type of physiological training profile yearly.

f. The requirements of Subparagraph b above also apply to ambient ***pressure suit operations***, except that suits using ambient air at pressures less than 8.8 psid aren't considered oxygen-enriched. You must follow procedures or lesson plans for testing, training, or demonstrations involving personnel in pressure suits at ambient conditions.

g. You must develop handling procedures to protect high-cost and mission-critical ***flight hardware***. New or modified procedures must be approved before handling the hardware.

h. You must meet the following additional requirements for test systems flown on JSC ***zero-gravity aircraft***:

- Avoid hazardous materials including high-pressure gases, toxic, corrosive, explosive, and flammable materials where possible. If such materials are necessary, use proper containment. You may also require provisions for dumping and purging in flight to include minimizing or controlling impact to the environment.
- Never use wet cell batteries with free electrolyte such as lead acid car batteries. Battery circuits require analysis by battery experts and battery circuit safety protection to avoid shock, shorts, or overheating.
- The maximum total volume of inert gases or gases you may use on a flight is limited to one K-bottle ($\approx$ 200 ft^3 @ 14.7 psi).

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- Airworthiness is determined by the JSC Aviation Safety Officer and the Aircraft Commander.
- Follow the laser requirements in Paragraph 6.16.3 of NPR 8715.3 if lasers are used.

i. Tests on ***air-bearing floors*** involving moving articles pose a threat of injury to personnel involved in the test. You must take appropriate measures to prevent the impact of moving objects with personnel.

j. When you work in direct view of a bare (pressurized arc) lamp of a ***solar simulator***, you must wear eye and skin protection.

19. Off-site tests

JSC safety requirements still apply if you perform your testing off site at any foreign or domestic location. You must follow the requirements in Paragraph 20 for any one of the following:

a. Off-site tests sponsored by JSC.

b. Off-site tests involving JSC personnel as test subjects.

c. Off-site tests involving JSC high-cost and mission-critical hardware.

20. Requirements for off-site tests

If you or your organization sponsors an off-site test, you must:

a. Make sure, with help from the Safety and Test Operations Division, that the intent of these requirements is met either by the test site or by JSC. The JSC sponsor must notify the Safety and Test Operations Division of the test at the earliest possible time. New facilities or new applications in existing facilities will require more scrutiny by JSC than established facilities and operations.

b. Make sure that the safety requirements of the test site are followed. JSC may require that the applicable provisions of this chapter be followed in addition to the test site requirement.

c. Provide the following additional data to the Safety and Test Operations Division as needed:

- Test site safety requirements and a safety point of contact from the testing organization.
- Existing test facility documentation such as drawings, specifications, hazard analyses, operating procedures, and emergency procedures necessary for an adequate review, if available.

d. Make sure that a TD or equivalent will be in charge of the test at all times. The TD may be from JSC or from the testing organization.

e. Coordinate access by the Safety and Test Operations Division personnel to all test areas.

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The Safety and Test Operations Division must:

- Review and concur on the test setup.
- Coordinate JSC safety and medical monitoring with the Medical Operations Branch as required.

21. TRRs and facility reviews for off-site tests

The following requirements apply:

a. If a TRR is held at JSC, it will be chaired by a JSC management official who is not personally involved with the test.

b. A specially appointed JSC committee may review an off-site test facility and operations, and then grant approval for JSC participation via a letter for off-site facilities where testing with JSC personnel or hardware will occur on a regular basis. JSC may hold an operational readiness inspection for the facility and grant approval. JSC personnel and hardware may be involved in operations at approved facilities that follow the conditions of JSC approval. Modification of the facility or operating procedures will require JSC review before resuming operations with JSC personnel or hardware.

22. Off-site users of JSC test facilities

Personnel from other NASA centers, NASA contractors, and others often use JSC test facilities. Off-site users must follow this chapter and the testing organization's operating procedures.

23. For more information on testing

a. 29 CFR 1910, Occupational Safety and Health Association, "General Industry," Applicable Subparts.

b. JPR 1710.13 (current version).

c. JPR 5322.1, "Contamination Control Program Requirements Manual."

d. JSC 09331, "The Prevention of Electrical Breakdown and Electrostatic Voltage Problems in the Space Shuttle and its Payloads." (parts I and II provide guidelines on corona and its prevention)

e. NFPA 70, "National Electric Code."

f. Other appropriate standards such as NFPA, ASTM, ANSI, etc.

g. Individual JSC test facility operating procedures and safety plans.

h. Paragraph 6.15 of NPR 8715.3.

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24. Responsibilities for test safety

a. ***Testing organizations*** must:

- Ensure compliance with facility safety, health, test, environmental, and operational requirements.
- Maintain personnel and facility documentation as required by this chapter and Chapter 10.4, "Facility baseline documentation requirements for hazardous or critical facilities," of this Handbook.
- Inform the Safety and Test Operations Division of planned test activities by a mutually agreed method as per Paragraph 5.3 of this chapter.
- Inform your directorate-level management of any additional risks before starting each new or non-routine test or test series, where there is the potential during test operations for serious injury, loss of life, environmental spill or release, or loss of critical high-dollar-value hardware.
- Make sure that potential environmental impacts have been considered before or during the TRR and coordinate with the Environmental Office as needed.

b. ***Test requesting organizations*** must:

- Follow test and facility safety, health, and environmental requirements and preparing and submitting test documentation required by your operating procedures.

c. The ***Occupational Health Branch*** must:

- Provide medical support, surveillance, and monitoring as required by Paragraph 4 of this chapter.
- Provide industrial hygiene support as required.
- Make sure that appropriate emergency medical treatment facilities are available.

d. The ***Safety and Test Operations Division*** must:

- Make sure that a program is implemented to provide a safe and healthful workplace for test operations and test team personnel, and protect government resources from loss, damage, and destruction.
- Help testing organizations, test requesting organizations, and resident Quality Assurance, Reliability, and Safety Offices (QARSOs).
- Provide safety surveillance via a certified TSO as required by Paragraph 5 of this chapter.
- Review and critique test equipment designs and documents to ensure appropriate safety requirements are included.
- Provide concurrence on hazardous test operations.
- Make sure that mishaps and anomalies are investigated, that results are reported to appropriate offices, and that proper controls are in place to prevent recurrence.

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- Provide Safety Technical Expertise to the Committee for the Protection of Human Subjects.

e. ***Resident QARSOs*** must:

- Coordinate with, and fulfill the responsibilities of, the Safety and Test Operations Division at JSC remote sites.
- Develop local test safety requirements and procedures that follow this chapter and Chapter 10.2 of this Handbook.

f. ***The Institutional Review Board*** must:

- Review and approve all test plans where human research is involved in accordance with NPD 7100.8 (current version), "Protection of Human Research Subjects."
- Review the safeguards of tests involving hazardous materials, where human test subjects or the test team may be exposed to those materials.

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Chapter 6.10
Entering confined spaces

This could be you . . .

Three technicians died in a confined space that contained nitrogen. The first one passed out and died when he entered the space. The other two passed out and died trying to rescue him.

1. Who must follow this chapter

You must follow this chapter if you:

a. Do or oversee any work that involves entering confined spaces at JSC.

b. Have a confined space in your work areas as a facility manager or line manager.

If you do any of the above work at White Sands Test Facility (WSTF), you must follow WSTF procedures and requirements for entering confined spaces and use WSTF forms that meet the intent of this chapter.

2. What this chapter covers

This chapter contains JSC's requirements for safely entering confined spaces that meet and exceed those in 29 CFR 1910.146, "Permit-Required Confined Spaces."

Defining and classifying confined spaces

3. What is a confined space?

A confined space is a space that meets all of the following criteria:

a. An employee can completely enter and work in the space.

b. The space has limited or restricted entries or exits.

c. The space isn't designed for continuous employee occupancy.

Examples of confined spaces include tanks, vessels, silos, storage bins, hoppers, vaults, and pits. Hazards of confined spaces include possible asphyxiation, explosions, poisoning from toxic vapors, slips, trips, and falls, and mechanical and electrocution hazards.

4. Classifying a confined space at JSC

All confined spaces at JSC have entry permit requirements. JSC has two classes of confined spaces: JSC permit-required confined spaces and Occupational Safety and Health Administration (OSHA) permit-required confined spaces. Paragraphs 5 and 6 below define

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these spaces. The Safety and Test Operations Division, the Occupational Health Branch, and certain line organizations have classified confined spaces using these definitions. The Safety and Test Operations Division keeps a list of JSC's confined spaces and their normal classifications. Confined space locations and classification may change as facilities and operations change.

The following requirements apply to identifying and classifying confined spaces:

a. JSC and WSTF must evaluate their work areas to identify and classify confined spaces.

b. You must classify a confined space based on its normal use. The work to be done in a confined space may change its normal classification.

c. You must reclassify a JSC permit-required space as an OSHA permit-required confined space if the work to be done increases the hazard in the space. Examples include welding, chemical use, radiography, and painting.

d. You may reclassify an OSHA permit-required confined space as a JSC permit-required confined space if you can eliminate the hazards without entering the confined space. This reclassification is only valid for as long as the hazards remain eliminated for that entry.

5. JSC permit-required confined spaces

A JSC permit-required confined space is a space that doesn't have and won't have any potential to cause death or serious physical harm to anyone entering the space.

6. OSHA permit-required confined spaces

An OSHA permit-required confined space is a confined space that has one or more of the following characteristics. The space:

a. Contains or has the potential to contain a hazardous atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self rescue, injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10% of its lower explosive limit (LEL).
- Airborne combustible dust at a concentration that meets or exceeds its LEL.
- Atmospheric oxygen concentrations below 19.5% or above 23.5%.
- Atmospheric concentration of any substance for which there is a published permissible exposure limit (PEL) and which could result in employee exposure in excess of its dose or PEL.
- Any other atmospheric condition that is immediately dangerous to life or health.

b. Contains a material that could engulf an entrant.

c. Has an internal configuration such that an entrant could be trapped or asphyxiated by

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inwardly converging walls or by a floor that slopes downward or tapers to a smaller cross section.

d. Contains any other recognized serious safety or health hazard.

7. What you must do if you have confined spaces in your work area

If you, as a facility manager or line manager have an OSHA permit-required or a JSC-permit required confined space in your work area, follow these rules:

a. For an OSHA permit-required space, you must:

- Inform exposed employees, by posting danger signs or by any equally effective means, of the existence and location of and the danger posed by the OSHA-permit spaces.
- Lock or bolt the space by a mechanical means.
- Post this sign on all entrances if you can't lock or bolt the space:

DANGER CONFINED SPACE, NO ENTRY WITHOUT PROCEDURE AND PERMIT

b. The JSC-permit required spaces may be labeled per the discretion of the hazard owners, however, they must have access control, and any potential hazards of the space must be communicated to the affected employees.

Requirements for entering confined spaces

8. Requirements for entering any confined space

You must carefully plan and control work in a confined space to prevent death or serious injury. Ideally, you should eliminate the hazards in a confined space before entering it. If you can't eliminate the hazards, you must control them with personal protective equipment (PPE) or other measures. Follow these requirements for entering any confined space.

You must:

a. Have the following before you enter any confined space:

- An approved written procedure as described in Paragraph 13 of this chapter.
- An approved entry permit as described in Paragraph 14 of this chapter.
- Confined space training.

b. Never enter a confined space until you have assessed the hazards, met the requirements in this chapter, and have a permit that authorizes you to enter.

c. Carefully examine any work you will be doing in the space to make sure it doesn't increase hazards. If your work will increase the hazards in a JSC permit-required

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confined space, then you must upgrade the classification to an OSHA permit-required confined space.

d. Only allow the minimum number of people necessary to do the job in or around a confined space.

You may downgrade an OSHA permit-required confined space to a JSC permit-required confined space if you can eliminate the hazards in the space without entering it. You must document that you have eliminated the hazards on your entry permit. Ventilate the space for 30 minutes before testing the atmosphere. Continue ventilation while people are in the space. See Subparagraph 16a of this chapter for more details.

9. Requirements for entering a JSC permit-required confined space

A JSC permit-required confined space is a space that does not have and will not have any potential to cause death or serious physical harm to anyone entering the space. You must notify the Occupational Health Branch (x36726) before entering a JSC permit-required confined space.

In addition to the procedure and permit, you must follow any of these requirements that apply to the space or to the work you will be doing:

a. Follow your current, approved procedure and all conditions on your permit.

b. Use lockout/tagout to isolate any energy sources. See Paragraph 17 of this chapter for more details.

c. Eliminate any conditions that make it unsafe to remove any entrance cover before you remove it.

d. Ventilate the space for 30 minutes or as specified in the procedures. Continue ventilation while people are in the space. See Subparagraph 16.a of this chapter for more details.

e. Do not enter the space until atmospheric testing shows:

- Oxygen levels are between 20.5% and 21.5 %.
- Explosive atmospheres are less than 10% of the LEL. Make sure that the source of the potentially explosive atmosphere is known and controlled.

(See Subparagraphs 16b, 16c and 16d of this chapter for more details).

f. Use at least one attendant. See Paragraph 19 of this chapter for more details.

g. Restrict access with barriers and tape. See Subparagraph 21.f of this chapter for more details.

h. Wear hard hats when required. See Paragraph 22 of this chapter for more details.

i. Make sure you have communications with those in the space and a method to call for emergency services. See Subparagraph 21.c of this chapter for more details.

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10. Requirements for entering an OSHA permit-required confined space

In addition to having an approved procedure and permit, you must:

a. Follow your current, approved procedure and all conditions on your permit.

b. Notify the Emergency Operations Center ((281) 483-4658) and the Occupational Health Branch ((281) 483-6736) that you are entering an OSHA permit-required confined space.

c. Use lockout/tagout to isolate any energy sources. See Paragraph 17 of this chapter for more details.

d. Eliminate any conditions that make it unsafe to remove any entrance cover before you remove it.

e. Ventilate the space for 30 minutes before testing the atmosphere. Continue ventilation while people are in the space. See Subparagraph 16.a of this chapter for more details.

f. Test for a high or low oxygen level, explosive atmosphere, and toxic gas or vapor as specified in the procedure before entering the space. Verify:

- Oxygen levels are between 20.5% and 21.5%.
- Explosive atmospheres are 0% of the LEL.
- Toxic vapor levels meet concentration levels specified in the confined space procedure.

(See Subparagraphs 16b, 16c, and 16d of this chapter for more details.)

g. Use the following equipment:

- Body harnesses, lifelines, and a hoisting or lifting device. Use wristlets for overhead and small openings. See Paragraph 23 of this chapter for more details.
- Required PPE, including hard hats. See Paragraph 22 of this chapter for more details.
- Intrinsically safe lighting and tools. See Subparagraphs 17.c and 17.d of this chapter for more details.

h. Have an attendant and entry supervisor present. The supervisor may leave the space if he or she isn't also the attendant. See Paragraphs 18 and 19 of this chapter for more details.

i. Restrict access with barriers and tape. See Subparagraph 21.f of this chapter for more details.

j. Make sure you have communications with those in the space and a method to call for emergency services. See Subparagraph 21.c of this chapter for more details.

11. Requirements for entering a sewer

Sewer lift stations are classified as an OSHA permit-required confined space. Sewer entry differs from other permit entries in that you can rarely completely isolate the space you will enter. The atmosphere may suddenly become deadly from causes beyond your control. To work in a sewer you must follow the requirements in Paragraph 10 of this chapter and:

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a. Keep in contact with the local weather bureau and fire and emergency services as much as possible. This will help you know if you should delay your entry into the sewer or cause you to remove people from the sewer if:
   - Sewer lines might suddenly flood from rain or firefighting activities.
   - Flammable or other hazardous materials may be released into sewers from industrial or transportation accidents.

b. Never enter a sewer unless you are thoroughly trained in proper sewer entry procedures and the use of atmospheric testing equipment.

c. Monitor the sewer atmosphere before entry and continuously with an instrument that sounds an audible alarm, in addition to a visual display. Monitor for all of the following conditions (See Subparagraphs 16.b, 16.c, and 16.d of this chapter for more details.):
   - Oxygen level within the range of 20.5% and 21.5%.
   - Flammable gas or vapor concentrations above 0% of the LEL.
   - Any detectable hydrogen sulfide and carbon monoxide concentrations.

d. Carry the monitoring instrument at all times while you are in the sewer to warn you of any change in atmospheric conditions. If you are working with others in the same immediate location, the group leader may carry an instrument for the group.

12. Requirements for entering the JSC tunnel system

The JSC tunnel system is normally classified as a JSC permit-required confined space and is continuously ventilated. Atmospheric testing is not normally required in the JSC tunnel system because it is continuously ventilated. To work in the tunnel system, you must follow the requirements in Paragraph 9 of this chapter and:

a. Assess the work you will be doing. If it will create new hazards that require you to upgrade the zone you will work in to an OSHA permit-required confined space, you must follow the requirements in Paragraph 10 of this chapter.

b. Follow your approved, up-to-date procedure.

c. Fill out and sign a confined space permit to show you've met safe entry conditions before you enter the tunnel.

d. Verify through the Operations Control Center ((281) 483-2038) that the ventilation fans in the areas that you will be working in are operating.

e. Notify Operations Control Center ((281) 483-2038) before you enter and when you leave the tunnel system.

f. Wear hard hats, safety glasses, and industrial shoes.

g. Have a flashlight with you at all times.

h. Read, sign, and follow JSC DMI 8410.1, "Tunnel Safety Awareness."

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i. Use the "buddy system." Don't enter the tunnel system alone.

Precautions for entering confined spaces

13. Procedure required to enter a confined space

Before you enter any confined space, you must have a current, approved written entry procedure that covers the specific job you will do in the space.

a. Use JSC Form 992, "Confined Space Entry Procedure," (Appendix 6A).

b. The entry procedure must:

- Be approved yearly by the Safety and Test Operations Division, the Occupational Health Branch, and the contractor safety representative. You may use a procedure several times if its approval is current. If you need to change a procedure, you must write a new one and have it approved.
- Be followed as written.
- Be posted at the entrance so that the entrants can confirm that safe entry conditions have been met.

c. Include material safety data sheets (MSDSs) for any chemicals you will use in or near the confined space.

14. Permits for entering a confined space

Confined space entry permits document that you have met the safe entry conditions required by the entry procedure before you enter a confined space. You must have a completed and endorsed entry permit form, JSC Form 1476, "Confined Space Entry Permit" (Appendix 2A) to enter any confined space.

Entry permits must:

a. Document that all safety measures required in the entry procedure are taken before entry. The entry supervisor does this by completing and signing the entry permit form to authorize personnel to enter.

b. Be posted when completed and signed at the entrance so that the entrants can confirm that safe entry conditions have been met.

c. Be valid only for the time required to complete the job identified on the permit and only for one working shift. If you need it for a longer time, you must get approval from the Safety and Test Operations Division and the Occupational Health Branch.

d. Include MSDSs for any chemical being used in or near the space.

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15. Canceling a permit

As an entry supervisor, you must follow these requirements to cancel a permit:

a. Cancel if one of the following occurs:

- The work covered by the entry permit is done.
- A condition arises in or near the space that is not allowed under the permit.

b. All entrants must leave the space when the permit is canceled.

c. Follow these steps after you cancel the permit:

- Note any problems you encountered during the operation on the permit so that JSC can improve its confined space program.
- Send a copy of each canceled permit to the Occupational Health Branch for a yearly review.
- Keep each canceled entry permit for at least 1 year to help JSC review the confined space program.

16. Controlling atmospheric hazards in a confined space

You must control atmospheric hazards in a confined space before entering it by following these requirements:

a. Ventilate all confined spaces with clean air for at least 30 minutes or as required by the procedure before testing the atmosphere in the confined space. If the space has permanently installed continuous ventilation that has been running and continues to run, you may enter without the 30-minute waiting period if you have met all other safe entry conditions in the procedure and permit (in some cases atmospheric testing may not be required in continuously ventilated spaces and as approved in the confined space procedure). You must follow these requirements for forced-air ventilation:

- Ventilate the space continuously until the job is done, whether the space is occupied or not.
- Don’t enter the space until the forced-air ventilation has eliminated any hazardous atmosphere without approval from the Safety and Test Operations Division, Occupational Health Branch, and your Safety Representative.
- Direct the ventilation to the immediate areas where employees are or will be working within the space.
- Take air from a clean source and make sure that the source won’t increase the hazard in the space.

b. Test the atmosphere in the confined space with a calibrated direct-reading instrument from outside the space. Testing is always required before the initial entry. Periodic or continuous testing may also be required while working inside the space. A qualified person shown on the approved entry procedure must do the initial testing. This person

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must be an authorized representative of Occupational Health Services or an employer-designated confined space entry supervisor. The Safety and Test Operations Division and the Occupational Health Branch will decide who will do the testing while reviewing the entry procedure.

Test for the following conditions **in this order** and record the results on the entry permit form:

- Oxygen content.
- Flammable gases and vapors.
- Potential toxic air contaminants.

c. Confirm that the following acceptable atmospheric conditions exist in the confined space before entry:

- An oxygen level between 20.5% and 21.5% and
- No positive indication of a combustible, explosive, or toxic gas or vapor.

If initial testing shows conditions are unacceptable, you must continue ventilation and retest the atmosphere unless the procedure says otherwise. Call Occupational Health Services to do further air quality testing before entering the space.

d. Follow these rules while working in the confined space:

- Test the atmosphere in the space periodically to make sure that acceptable conditions are being maintained during entry operations. The time period between tests must be specified on the confined space procedure and entry permit.
- Test the atmosphere continuously if you can't isolate the space because it is large or is part of a continuous system, or the work being done in the space makes continuous testing necessary.
- A continuously ventilated confined space may not require periodic or continuous atmospheric testing if no chemicals leak into the space or if no hazardous conditions are generated by the work being performed. If you detect a chemical leak or change in conditions in the space, you must re-evaluate the continuously ventilated space and test the atmosphere.
- Variations from atmospheric conditions as indicated above are acceptable.
- Record all readings on the permit.

e. Make sure all instruments used to test the atmosphere in a confined space are:

- Calibrated under the manufacturer's guidelines.
- Working properly before using them.
- Labeled with calibration dates and cycles to show that they are within the calibration period.

f. Isolate pipelines that contain flammable, toxic, irritating, or oxygen-displacing gases or

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vapors if feasible to prevent a hazardous atmosphere from forming inside the space while work is being done. Isolate pipelines by:

- Completely depressurizing and disconnecting possible contaminant supply lines and placing a blank flange on the pipe leading into the confined space.
- Using two blocking valves with a vent valve open between them.
- Using other blank, block, and bleed valve configurations that have been previously approved by the Safety and Test Operations Division and the Occupational Health Branch.

17. Controlling other hazards in a confined space

You must isolate energy sources to the area you will be working in to prevent mishaps such as electrical shock, fire, or injury from moving parts. To do this, you must:

a. Follow lockout/tagout and isolation requirements in Chapter 8.2, "Lockout/tagout practices," of this Handbook to:

- De-energize electrical or pneumatic equipment within the space.
- Lock and tag all control devices for fixed equipment in the space. This doesn't include fixed lighting or ventilation equipment unless you are working on them.

b. Deactivate, shield, or remove all radioactive sources.

c. Safeguard electrical equipment by:

- Using only properly insulated or grounded portable electrical equipment. Double insulated electrical hand tools are acceptable. Inspect all electrical before entry.
- Using ground fault circuit interrupter (GFCI) circuit breakers for all case-grounded handheld electrical equipment. GFCIs should be 4 to 6 milliamp, where possible. Place them at the power source unless the source is an ungrounded portable generator, an ungrounded battery of less than 28 volts, or an ungrounded isolation transformer of less than 28 volts.
- Using pneumatic power tools instead of electrical tools when possible. Pneumatic tools must have conductive air supply hoses. Never use nitrogen or other inert gases to power the tools. Use breathable air to power pneumatic tools.
- Using cordless rechargeable portable power tools, with an intrinsically safe rating, when possible. If they are used, they must have an explosion-proof or intrinsically safe rating for spaces that could contain or develop an explosive atmosphere.
- Protecting temporary lighting with bulb guards or by recessing the bulbs. Power temporary lighting in locations that are wet or have standing fluids with batteries or low-voltage circuits.
- Grounding or double-insulating heavy-duty electric cords and all metal housings.

d. Control ignition sources by:

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- Using explosion-proof or intrinsically safe lighting, ventilation equipment, and tools in potentially flammable atmospheres.
- Never bringing ignition sources into an OSHA permit-required confined space until tests by a confined space monitor have confirmed that combustible or flammable gases or vapors aren't present in the space. You may work in confined space atmospheres with more than 0% but never more than 10% of the LEL if you have previous approval from the Safety and Test Operations Division or Occupational Health Services.
- Never using polyethylene and other materials that generate static electricity where explosive atmospheres could exist. Tents erected over or around the space must be of a conductive material and properly grounded.

People and equipment required for entering confined spaces

18. Duties of entry supervisors

As an ***entry supervisor***, you must, for each entry:

a. Know the hazards entrants may face in a confined space, including information on the mode, signs or symptoms, and consequences of the hazard exposures.

b. Make required pre-entry notifications and coordinate all entries with your safety representative.

- Notify the JSC Emergency Operations Center ((281) 483-4658) and the Occupational Health Branch (x36736) immediately before anyone enters an OSHA permit-required confined space.
- Notify the area fire warden if you will do hot work before entry. If you are at Ellington Field, notify the Ellington Field fire inspector as well.

c. Evaluate conditions inside and outside the confined space, including temperature extremes, humidity, noise, and vibration, before entry. Determine what measures are necessary for a safe entry and to make sure that those measures are taken.

d. Get an entry permit and check each entry to make sure of the following before signing the permit and allowing anyone to enter:

- All required blocks are filled in.
- All tests specified by the procedure have been conducted.
- All requirements and equipment specified by the procedure are in place.
- The approved permit is posted at the job site and everyone who needs a copy has one.

e. Make sure that all attendants and authorized entrants are properly trained before entry.

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f. Make sure you have all other required permits, such as hot work and hazardous operations permits, before entry.

g. Make sure that oxygen and combustible gas-monitoring devices are available, calibrated, and used for atmospheric testing if required by the entry procedure.

h. Make sure that rescue services are available and you can maintain communications, and communication devices work.

i. Remove unauthorized individuals who enter or who attempt to enter the space during operations.

j. If you must transfer responsibility for the space to another supervisor, make sure that operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained. Evaluate conditions as often as needed by the hazards of operations in the space.

k. Make sure that the method of communication is appropriate for the atmosphere in the space.

l. Remove all workers from the space and cancel the permit when the job is done or when unacceptable conditions have arisen. Provide a copy of the canceled permit to the Occupational Health Branch.

19. Duties of entry attendants

There must be at least one attendant in the immediate vicinity outside an OSHA permit-required confined space and other spaces if the procedure requires while people are working in the space. As an ***entry attendant*** you must:

a. Know the hazards entrants may face in a confined space, including information on the mode, signs or symptoms, and consequences of the hazard exposures.

b. Be aware of possible behavioral effects on entrants exposed to hazards.

c. Continuously keep an accurate count of authorized entrants in the space on the entry permit form.

d. Remain outside the permit space during entry operations until relieved by another attendant.

e. Keep in visual or voice contact with authorized entrants as necessary to monitor entrant status. If the personnel in the space must leave visual contact and verbal contact with the attendants, use mechanical or electronic communications.

f. Monitor activities inside and outside the space to determine if it is safe for entrants to stay in the space. Order those inside to leave the space immediately if you:

- Detect a prohibited condition.
- Notice behavioral effects of hazard exposure in someone in the space.
- See a situation outside the space that could endanger those inside.

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- You can't effectively and safely perform all your required duties.

g. Maintain the method of contacting emergency services as required in the approved procedures.

h. Call emergency rescue services when you see that those inside may need help to escape from hazards in the space.

i. Take the following actions when unauthorized persons (not involved in the entry) approach or enter a permit space while entry is under way:

- Warn the unauthorized persons that they must stay away from the permit space.
- Advise the unauthorized persons that they must exit immediately if they have entered the permit space.
- Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.
- Stop confined space operations until unauthorized personnel are removed.

j. Perform non-entry rescues when necessary and feasible after notifying emergency rescue services. Never enter a confined space to rescue someone unless you are part of an emergency rescue team as described in Paragraph 24 of this chapter.

k. Never do anything that might interfere with your primary duty to monitor and protect those inside the space.

20. Duties of authorized entrants

If you are an ***authorized entrant***, you must:

a. Know the hazards you may face in a confined space, including information on the mode, signs or symptoms, and consequences of the hazard exposures.

b. Properly use equipment as required by this chapter.

c. Communicate with the attendant as necessary so the attendant can monitor your status and alert you if you need to evacuate the space.

d. Alert the attendant if you:

- Recognize any warning sign or symptom of a dangerous situation.
- Detect a prohibited condition.

e. Exit from the permit space as quickly as possible if you:

- Get an order to evacuate from the attendant or the entry supervisor.
- Recognize any warning sign or symptom of a dangerous situation.
- Detect a prohibited condition.
- Hear an evacuation alarm.

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21. Equipment you must have to enter a confined space

You must have the following equipment before you enter as required by the procedure:

a. Portable ventilating equipment for spaces without permanent mechanical ventilation. You are responsible for providing ventilating equipment.

b. Testing and monitoring equipment for atmospheric testing as indicated on approved entry procedures. You are responsible for providing testing equipment.

c. Communications equipment that is compatible with the atmosphere in the space for communicating with entrants and emergency services.

d. GFCI for all portable electrical equipment.

e. Lighting equipment for safety while working in and exiting the space.

f. Barriers and shields to prevent inadvertent entries into confined spaces while work is in progress. Post the following sign at all open entrances to confined spaces:

CAUTION CONFINED SPACE WORK IN PROGRESS.

NO ENTRY WITHOUT PERMIT AND PROCEDURE.

h. Equipment, such as ladders, needed to safely enter and exit the space.

i. Any other equipment necessary for safe operations in the space.

22. Protective clothing and equipment you must use when entering a confined space

If you enter a confined space, you must wear PPE as required in the procedure to protect you from hazards in the space:

a. Hard hats to protect you from falling objects or overhead bump hazards.

b. Impervious personal protective clothing if you will work with corrosive or irritating products, or toxic chemicals that penetrate the skin.

c. Eye or face protection if your eyes or face could be hurt.

d. Protective footwear.

e. Respiratory protection for hazardous atmospheres. You must also follow these requirements:

- If you wear a respirator in a confined space, you must follow Chapter 7.2, “Respiratory protection,” of this Handbook.
- Use only National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration-approved respirators.
- Use a self-contained breathing apparatus (SCBA) only when you can fit through the entry openings with an SCBA strapped on. If you can’t do this or if free space opening is less than or equal to 18 inches in diameter, use a supplied-air respirator.
- Use only certified breathing air (Compressed Gas Association GRADE D).

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See Chapter 5.6, "Personal protective equipment," of this Handbook for more requirements on PPE.

23. Rescue and emergency equipment

You must have non-entry rescue and emergency equipment in place before anyone enters the confined space as required in the approved procedures. Never enter a confined space to rescue someone.

a. Retrieval equipment for anyone who enters an OSHA permit-required confined space, unless that equipment would increase the overall risk of entry or would not help you rescue an entrant. Each entrant must have the following retrieval equipment:

- A chest or full body harness with a retrieval line that meets ANSI A 10.14, "Construction and Demolition Operations – Requirements for Safety Belts, Harnesses." You must attach the retrieval line at the center of the entrant's back near shoulder level, or above the entrant's head. Inspect harness and lines before each use and load test them yearly as described in the manufacturer's instructions.

- Wristlet harnesses instead of a chest or full body harness if the access to the confined space is less than 18 inches in unobstructed diameter. You may also use wristlet harnesses if you can show that a chest or full body harness isn't feasible or creates a greater hazard. You must also show that wristlet harnesses are the safest and most effective alternative. The Safety and Test Operations Division and the Occupational Health Branch must approve any exceptions.

Note: Wristlets are designed to help remove people from confined spaces by extending their arms, but are not designed to lift a person out of a space. You must do this with a full-body harness.

- A retrieval line from the harness that is attached to a mechanical device or fixed point outside the space so that you can begin rescue if you are aware that rescue is necessary.

b. A mechanical hoist and supporting structure over the opening for OSHA permit-required confined spaces with top opening entrances or that are vertical and more than 5 feet deep. The entry supervisor may require hoist and support for JSC permit-required confined spaces with top opening entrances.

c. Extra supplied air respirators for rescuers if the entrants use supplied air respirators to work in the space. You usually use supplied air respirators if openings aren't large enough for SCBAs or the job will last longer than an SCBA's air supply. Inspect and check all rescue respirators before anyone enters the space.

d. Any other equipment necessary to safely rescue someone from the space.

e. A method of contacting emergency services as required in the approved procedures.

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24. What to do in an emergency

Remember, your emergency numbers are: 33333 at JSC and SCTF, x44444 at Ellington Field, 911 at any off-site location, and x5911 at WSTF.

In an emergency, you as an attendant or entry supervisor must:

a. Follow your emergency procedures. Never attempt to rescue a worker from a confined space until you call your emergency number or call for a rescue team.

b. Never enter a confined space to rescue someone. Only approved rescue teams that meet the requirements of 29 CFR 1910.146(k) and approved by the Safety and Test Operations Division and the Occupational Health Branch may enter a confined space for rescue.

c. Make sure an MSDS or similar written information is provided to the medical facility treating an entrant who is exposed to a hazardous substance if you have the MSDS or information at your worksite.

d. Coordinate with local fire and ambulance services if you rely on them for confined space rescues, by:

- Telling them about the hazards they may face during confined space rescues.
- Having them visit all confined spaces they may be called to so that they can develop rescue plans for each space and practice rescue operations.

Other requirements for entering confined spaces

25. Training for working in confined spaces

Training must provide supervisors, attendants, and entrants with the knowledge and skills to work safely in confined spaces. Training must follow these requirements:

a. If you are involved with any work in a confined space, you must have training:

- Before you are first assigned duties in confined spaces and before your assigned duties change.
- Whenever work in a confined space presents new hazards you have no training for.
- Whenever you think there are deviations from entry procedures or that your knowledge or use of the procedures may be inadequate.
- By taking JSC's Confined Space Entry course. This course meets the requirements of 29 CFR 1910.146 for entry supervisors, attendants, and entrants. You may also take current off-site training after you attend an overview of JSC's confined space program and demonstrate you understand JSC's program.
- Getting a training completion card stating you have been trained and demonstrated proficiency in JSC's confined space requirements. The card is good for 2 years.

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Then you must be retrained.

b. As an ***entry supervisor***, you must at least have training in JSC's confined space entry program and in your duties listed in Paragraph 18 of this chapter.

c. As an ***entry attendant,*** you must at least have training in JSC's confined space entry program and in your duties listed in Paragraph 19 of this chapter.

d. As an ***authorized entrant***, you must at least have training in JSC's confined space entry program and in your duties listed in Paragraph 20 of this chapter.

26. Off-site contracts that involve entering confined spaces

a. If you arrange to have employees of an off-site contractor perform work in a confined space, you must:

- Inform the contractor that the workplace has confined spaces and that the contractor must follow JSC's confined space entry program when working in confined spaces.
- Tell the contractor why a space in question is a confined space, including the hazards identified and JSC's experience with the space.
- Tell the contractor of any precautions or procedures that JSC has implemented under its program to protect employees in or near the spaces contractor personnel will be working in.
- Make sure that contractor employees who will enter confined spaces receive the training in Paragraph 25 of this chapter.
- Coordinate entry operations with the contractor.
- Debrief the contractor when the job is done about JSC's permit space program and the hazards found or created in the spaces during entry operations.

b. If you are the contractor in Subparagraph a above, you must follow JSC's confined space requirements in this chapter and:

- Obtain any available information on permit space hazards and entry operations from the contracting organization.
- Make sure that all employees who will work in confined spaces are trained as described in Paragraph 25 of this chapter. They must also provide documentation of prior class work in confined space entry, receive JSC confined space overview, and demonstrate an understanding of JSC's program.
- Coordinate entry operations with the contracting organization.
- Inform the contracting organization of any hazards you find or create in any confined space, either at a debriefing or while you are working.

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27. For more information on entering confined spaces

You can find more information on entering confined spaces in these documents:

a. 29 CFR 1910.146, “Permit-Required Confined Spaces.”

b. ANSI A10.14-91, “Safety Belt Use.”

c. ANSI Z1171.1-1989, “Standard on Confined Space Entry.”

d. NIOSH Criteria Document on Working in Confined Spaces.

e. NIOSH Publication IF 87-113, “A Guide to Safety in Confined Spaces.”

f. NHS/IH 1845.2, Publication No. 80-106, “Entry Into and Work in Confined Spaces.”

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Chapter 6.11
Pressurized Gas and Liquid Systems

This could be you . . .

A technician was burned by a fire in a component of a high-pressure oxygen system.

An expansion bellows on a section of piping ruptured during pressure testing and injured several employees. The bellows wasn't properly restrained during the testing.

A gate valve on a high-pressure nitrogen trailer flew off and killed an employee during maintenance. The maintenance workers didn't take all possible steps to make sure the trailer wasn't pressurized before working on it.

1. Who must follow this chapter

You must follow this Chapter if you use pressurized gas or liquid systems.

2. Requirements for using any pressurized systems

All your pressure vessels, pressure systems, and pressure systems components must:

a. Be designed, installed, tested, certified, and periodically re-certified to the requirements of JPR 1710.13, "Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems," (current version).

b. Have their current design, installation, testing, certifications, modifications, periodic re-certifications, and maintenance properly documented.

c. Be marked, tagged, or otherwise identified to indicate the certified use.

d. Be located to minimize the risk to personnel and surrounding equipment and facilities if a leak or rupture occurs.

3. Requirements for systems that contain pressure vessels, fixed piping or tubing, valves, or other components

Your pressure vessel must be designed, installed, tested, certified, and periodically re-certified under JPR 1710.13 (current version). If your pressure system contains hydrogen, it must meet American Institute of Aeronautics and Astronautics (AIAA) Guide 095-2004 "Guide to Safety of Hydrogen and Hydrogen Systems." You must also:

a. Make sure relief valves and other discharge parts follow minimum separation distances as called out in the references given above.

b. Properly restrain relief valves, rupture discs, burst discs and associated piping or tubing to prevent movement from the thrust created by a pressure release.

c. Properly bond and ground your systems.

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4. Requirements for fire protection systems

All fire protection systems must meet the requirements of the National Fire Protection Association for the specific type of fire protections system involved.

5. Requirements for flex hoses

You must meet the following requirements:

a. Proof pressure test and tag flex hoses according to the requirements of JPR 1710.13 (current version).

b. Secure flex hoses used in 150 psig or greater normal service, which are not in a cabinet or other containment at both ends and tether or weigh them down at no greater than 6-foot intervals. You must secure hoses between three and six feet in length at both ends and tether or weigh them down in the middle. Hoses shorter than three feet in length only need to be secured at both ends. This securing, tethering, or weighting must be sufficient to withstand forces arising from sudden failure. Strapping hoses together is considered tethering. You must secure flex hose vent and drain lines at the free end.

   Flex hoses need not be secured if in vacuum service or a written hazard analysis or technical order, which controls the hazard, is approved Safety and Test Operations Division.

6. Requirements for systems using oxygen or oxygen-enriched gas (greater than 25 mole percent oxygen or oxygen greater than 25 percent oxygen by volume)

You must meet the following requirements:

a. Oxygen systems must meet NASA-STD-6001, “Flammability, Odor, Off-Gassing and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion.” Use ASTM MNL36, “Manual for Safe Use of Oxygen Systems: Guidelines for Oxygen System Design, Materials Selection, Operations, Storage, and Transportation” as a guide.

b. For systems using oxygen or oxygen-enriched gas above 250 psi and involve humans in the loop, you must flow the oxygen through the system unmanned before introducing a human into the system. Examples of systems include chambers and breathing gas systems. Testing must follow these requirements:

   - Test new systems and after modifications to existing systems that require disassembly and reassembly of the parts of the system.
   - Test the system at maximum operating pressure (just below relief valve pressure) for ten cycles.
   - Sample for chemical purity per MIL-PRF-27210G. Also test moisture levels per specific program requirements. Sample the system before use or monthly and after any maintenance activities that violate system integrity.

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7. Requirements for using compressed gas

You must meet all the requirements of 29 CFR 1910.101, “Compressed Gas Cylinders.”

8. For more information on pressurized gases and liquids

You can find more information on pressure systems in the following:

a. 29 CFR 1910.101.

b. JPR 1710.13 (current version).

c. NASA-STD-6001, “Flammability, Odor, Off-Gassing and Compatibility Requirements & Test Procedures for Materials in Environments That Support Combustion.”

d. ASTM MNL36, “Manual For Safe Use of Oxygen Systems: Guidelines For Oxygen System Design, Materials Selection, Operations, Storage, and Transportation.”

e. AIAA Guide 095-2004, “Guide To Safety of Hydrogen And Hydrogen Systems.”

Chapter 6.12
Local Chemical Hazard Alarms

This could be you . . .

A chemist was overcome by an oxygen deficiency, which occurred in a lab down the hall from where the chemist worked. The lab contained a dewar of liquid nitrogen, which failed and released nitrogen into the room, displacing the oxygen to a dangerous level. An oxygen alarm was sounding but the chemist did not know what it meant, and entered the room to investigate.

1. Who must follow this chapter

You must follow this chapter if you:

a. Have a hazardous operation in your work area that uses an alarm system to warn of an air quality problem due to airborne contaminants.

b. Manage or supervise a work area or facility that contains an alarm system that warns of a hazardous airborne chemical.

c. Enter a facility that has an alarm system to warn of a hazardous airborne chemical.

2. What this chapter covers

This chapter covers the requirements for using local hazard alarms to control exposures to hazardous materials. It includes information for assessing the need for an alarm, registration of the alarm, alarm care and record keeping, and response requirements for facility occupants.

3 Examples of hazard alarm systems found at JSC, Sonny Carter Training Facility, and Ellington Field

The following alarms are examples of alarms found at JSC:

a. Carbon monoxide alarms in the high bay of building 31.

b. Oxygen deficiency alarms found in various rooms in buildings 37, 31, 31N, 9, and 13.

c. Freon 21 alarm found in the high bay of building 7.

You can find a list of current alarms in JSC facilities at the JSC Safety and Total Health web site under the Total Health/Industrial Hygiene Section.

4. Alarms not covered by this Chapter

Examples of alarms not covered by this Chapter are those not alerting people of a chemical hazard, such as fire alarms, freezer alarms, security alarms, equipment overheat, water

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leakage, etc. If you have one of these alarms, consult the Occupational Health Branch for advice on whether the alarm should be registered or connected to the Emergency Operations Center. The decision is usually based on the results of a hazard analysis.

5. How to decide if you need an alarm in your work area

You should refer to your work area's hazard analysis or job hazard analysis (also see chapter 9.1, "Hazardous Materials Safety and Health") to see if an alarm is required. Your supervisor is responsible for doing a hazard analysis for all hazardous chemical use areas. Whether or not an alarm is needed is based on many factors including chemical quantities, chemical physical properties, toxicity, facility layout, ventilation, and others.

6. If you need an alarm in a work area

Many issues must be addressed when an alarm is needed for chemical exposure control:

a. You must register the alarm with the Occupational Health Branch for inclusion in the JSC inventory. Submit JSC form 1879, "JSC Chemical Hazard Alarm Registration," along with a copy of the hazard analyses to the Occupational Health Services Office (building 229, SD33, x36726). The form requires specific information including alarm owner, alarm type, chemicals of interest, location, calibration, maintenance, and record keeping. Occupational Health Services will assign an individualized registration number to the alarm and place it into the Occupational Health Services alarm-monitoring program. All chemical alarms, fixed in place and portable, must be registered. Portable testing equipment not used for alarm purposes need not to be registered. You can find a link to form 1879 in Appendix 6A.

b. When an alarm is no longer needed, use the same form (JSC Form 1879) to decommission the alarm.

c. The alarm may require connecting to the Emergency Operations Center for proper monitoring and response.

d. You must develop written procedures for alarm use, calibration, and maintenance. Maintain documentation to show compliance with these requirements (dates, times, calibration results, maintenance issues). You must keep the documentation or a copy with the alarm for Occupational Health Services safety, and management inspection purposes.

e. The facility "Emergency Action Plan" must include appropriate alarm response by all occupants to all alarms found in the facility. You must brief or train facility occupants on this plan.

f. You must maintain a list of names and methods of contact (phone #, pager #) of work area responsible parties and keep it readily available for support during off-hour alarm activations.

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7. Alarm Testing

Before testing any alarm, you must first notify the Emergency Operations Center.

8. Responsibilities

a. As a ***work area supervisor***, you are responsible for:

- Doing hazard analyses for all potentially hazardous jobs or activities in your area of responsibility. You must use procedures in Chapter 9.1. Occupational Health consultation is available by calling x36726 or x37896.
- Making sure that the alarm is properly registered with Occupational Health Services.
- Making sure that calibrations and maintenance are done in the specified frequency and keeping records at the alarm site to verify the alarm to be reliable and working properly.
- Writing an emergency response plan specific for the alarm, training affected workers in the plan, and making the plan available to the Facility Manager.
- Providing help to JSC emergency responders during an alarm event.
- Ensuring remediation activities (ventilation, point source safing, etc.) by requesting support from the appropriate organizations.

b. As a ***Facility Manager***, you are responsible for:

- Maintaining an inventory of all alarm systems in the facility.
- Maintaining a means of contacting responsible, knowledgeable support personnel for technical advice during an alarm event.
- Periodically inspecting the alarm and records to verify that the alarm is properly maintained, calibrated, and working for its intended purpose.
- Verifying that the alarm is properly registered by Occupational Health Services.
- Making sure that the facility's Emergency Action Plan includes the chemical alarm systems and response requirements.
- Making sure all facility occupants and visitors are informed, briefed, or trained in alarm response requirements.

c. ***Occupational Health Services*** is responsible for:

- Maintaining an inventory of all chemical alarm systems at JSC, Ellington Field, and the Sonny Carter Training Facility.
- Assigning alarm registration numbers at JSC, Ellington Field, and Sonny Carter Training Facility.
- Providing help to JSC emergency responders during an alarm event.

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- Inspecting all registered alarms at JSC, Ellington Field, and Sonny Carter Training Facility yearly.

d. The ***Emergency Operations Center*** is responsible for calling the Facility Manager and supporting personnel call back.

e. The ***Security Office*** is responsible for enforcing perimeters around emergency scenes.

f. The JSC ***fire protection specialists*** are responsible for providing initial response to calls received from the Emergency Operations Center from hazard detection alarms. Other aspects of the Emergency Action Plan based on the initial response which may include:

- Initiating the plan.
- Evacuating remaining nonessential personnel.
- Defining an area perimeter in an emergency.
- Industrial hygiene program air testing.
- Developing specific controls for protecting response personnel.

g. The JSC ***Safety and Test Operations Division*** is responsible for:

- Providing support in connecting alarms to the Emergency Operations Center.

Performing the duties required by JSC 05900, “JSC Emergency Preparedness Plan.”

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Chapter 6.13
Safety and Health Requirements for Ground-Based Breathing Gases and Breathing Gas Systems

1. Who must follow this chapter

You must follow this Chapter if you design, build, operate, oversee, maintain or modify a ground-based breathing gas system.

2. Definition of a breathing gas systems

A breathing gas includes breathing air (CGA-G7.1), breathing oxygen (MIL-PRF-27210G), oxygen-enriched breathing air such as nitrox or heliox (NASA SD-B-0023-A), and any other breathing gas approved as required by this Chapter for human breathing. A breathing gas system is a hardware assembly providing a breathing gas to a human. The breathing gas system may contain gas and liquid pumps, gas compressors, piping, filters, analysis equipment, tanks and pressure vessels, regulators, valves and safety devices, connectors, soft-goods, lubricants, heating, cooling and mixing equipment, gages, and other hardware.

3. Surface cleanliness requirements for breathing gas systems

To ensure surface cleanliness in breathing gas systems, you must:

a. Clean breathing gas systems to national consensus standards. Paragraph 12 references several of these national consensus standards. The cleanliness level must be determined by the user organization and an appropriate oxygen hazards review organization, committee, or similar recognized oxygen system design expert. An operational readiness inspection (ORI), use readiness review (URR) or test readiness review (TRR) must approve the determined breathing gas cleanliness level(s) before use.

b. Clean soft good components, such as neoprene rubber hoses used at or below 0.689 MPa (100 psig) and other non-metallic materials to level 100 or 300 per JPR 5322.1. There is no non-volatile residue (NVR) requirement for soft goods. More stringent cleanliness levels may be required for breathing gas systems depending upon the system hazard assessment and cleanliness requirements for flight hardware attached to these systems.

c. During normal and routine operations, install and monitor inlet filters and other in-line filters as required by design and operation to maintain system cleanliness. Maintain system cleanliness during non-routine operations such as unscheduled maintenance, system modifications and repairs. To maintain system surface cleanliness, you must establish the following protocols:

- Wear approved gloves when internal surfaces are exposed.
- Take care to minimize exposure time to maintain both the particulate and NVR

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cleanliness levels.

- Use only approved clean materials, protective films, and caps or plugs.
- Use only approved lubricants, soft goods, and sealants, valve seats, and alloys. Apply lubricants sparingly.
- Use only approved wipes and solvents.

d. Established a process to verify, periodically, cleanliness to ensure surface cleanliness is maintained for the life of the system. The user organization is responsible for maintaining the surface cleanliness level and must document procedures for periodically evaluating system cleanliness. The procedures must determine and establish the frequency of these evaluations as necessary. The user organization must do this evaluation, including particulate matter determination and NVR, or other suitable film or non-particulate matter determination such as total organic carbon, as is agreed necessary.

4. Breathing gas chemical purity requirements

To establish and maintain the breathing gas chemical purity, also referred to as the breathing gas chemical composition or breathing gas specification, you must follow these requirements:

a. A JSC medical doctor must approve the breathing gas purity requirements for breathing gas systems.

b. Breathing gases prepared by mixing or blending must have established written procedures and sampling methods to assure breathing gas purity and homogeneity.

c. All JSC supply breathing gases must be analyzed and approved to meet the breathing gas chemical purity requirements before the breathing gas is to be inhaled or used. The table below lists minimum sampling requirements to establish gas purity. The following source testing requirements are intended to ensure all gases used for breathing on site at JSC are analyzed by JSC approved personnel and meet the gas purity requirements before breathing the gas.

For . . .	***You must . . .***
Large compressed gas bottles (Compressed gas cylinders containing greater than or equal to 4247.53 liters (150 ft^3) of gas at maximum allowable operating pressure (MAWP), also commonly referred to as K-Bottles).	Test all large compressed gas bottles used for breathing on-site at JSC individually as approved by the Space Medicine and Health Care Systems Office, SD, and inspected and certified as approved by the Safety and Test Operations Division, NS, before use.

Table continues on next page.

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For . . .	*You must . . .*
Small compressed gas bottles (Compressed gas cylinders containing less than 4247.53 liters (150 ft^3) of gas at MAWP, commonly referred to as SCUBA cylinders, SCBA cylinders, small emergency cylinders, etc.).	Due to their small size, as a minimum, all SCBAs and small emergency breathing gas bottles must have either the gas fill source analyzed as approved by the Space Medicine and Health Care Systems Office (SD) and the Safety and Test Operations Division (NS) before use, or each individual bottle may be tested similarly to the large compressed gas bottle requirement listed above.
Cryogenic-Supplied Aviator's Breathing Oxygen (AB)	A member of the Safety and Test Operations Division (NS) or by a delegate of the U.S. government as approved by NS must inspect all cryogenic-supplied ABO.
Compressed Air Systems	All on-site compressed air systems gas purity requirements must by approved by the Medical Sciences Division (SD) and the Safety and Test Operations Division (NS) prior to operations. Normally as a minimum, a fail-safe, in-line calibrated carbon monoxide system is required that complies with 29CFR1910.134.

5. Labeling and certification

For proper labeling and certification of pressure systems, you must:

a. Identify use-point outlets by displaying a sign, tag, or label that reads "Compressed Gas for Breathing Purposes" or a similar statement that clearly indicates the contents of the breathing gas.

b. Have new breathing gas systems certified. Breathing gas systems which have been modified in design or which have undergone a major maintenance overhaul or which have been contaminated and subsequently decontaminated and re-cleaned must be re-certified. Certification or re-certification is required before the breathing gas systems may be used.

c. Operate breathing gas systems to be certified or re-certified without breathing the gas, and take a gas purity sample once after 24 hours and once following 48 hours. If the samples, when analyzed, meet the applicable specification, and if the user organization documents that the requirements of sections 9 and 10 are established, then the breathing gas system is certified or re-certified.

NOTE 1: Check new breathing gas systems initially for mercury contamination as specified in applicable medical and safety requirements. Mercury vapor concentrations shall not exceed 0.005 mg/m^3.

NOTE 2: Because of the difference in boil-off temperatures between liquid oxygen and liquid nitrogen, liquid air systems require strict analysis sampling schedules to preclude a breathing system from becoming nitrogen rich.

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6. General requirements

All breathing gas systems must:

a. Meet the requirements found in other Chapters of this Handbook that apply. This includes Chapter 10.2, "Safety And Health Requirements For Test, Vacuum, Or Oxygen-Enriched facilities," for breathing gas systems in test facilities or those using oxygen-enriched breathing gases.

b. Provide an environment where a credible single-point failure, loss of or change in utilities, or loss of software command will not injure personnel or damage property.

c. Employ a "buddy system" to monitor the system for safe operations when breathing gases are used.

d. Provide emergency power and other necessary utilities for systems, which, if lost, would endanger test personnel or property.

e. Meet the applicable requirements in the following documents:

- NPD 7100.8, "Protection of Human Research Subjects"
- JPD 8080.4, "Exposure to Reduced Atmospheric Pressures"
- NFPA STD 99B, "Standard for Hypobaric Facilities"
- ASTM Coursebook, "Fire Hazards in Oxygen Systems"
- ASTM-MANL-36, "Manual for Safe Use of Oxygen Systems: Guidelines for Oxygen System Design, Materials Selection, Operations, Storage, and Transportation"
- CGA-P39ED1, "Oxygen-Rich Atmospheres"

7. Safety and quality assurance provisions for breathing gas systems

For safe operations that meet quality requirements, you must:

a. Have a safety plan that addresses how you make sure your system operations are safe. The plan may be part of an overall facility plan. The Safety and Test Operations Division (NS) must approve the plan.

b. Prepare and maintain system failure and hazard analyses as described in Chapter 2.4, "Hazard Analysis," of this Handbook. This may be part of an overall facility hazard analysis. The hazard analysis must address all hazards of the system hardware, support equipment, system software, and operations and how the hazards are controlled.

c. Document quality assurance tasks for the system in either the facility operating procedures or a quality assurance plan. Quality assurance tasks may include:

- Calibrating instruments.
- Making sure consumables in life support systems such as breathing air or water meet any standards that apply.

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- Inspecting hardware and making sure operations meet requirements.
- Certifying pressure systems if pressurized breathing gases or blends are employed.

8. Operating procedures

For breathing gas systems, the user organization must develop, document, and approve procedures for system operation, maintenance, preventive maintenance, servicing, and sampling, if such procedures do not exist.

The operating procedures must:

a. Carry out the safety requirements of this Chapter and of Chapter 6.9 of this Handbook.

b. Outline the processes, ground rules, and personnel for system operation.

c. Outline the process to work with the Safety and Test Operations Division (NS).

The Space Medicine and Health Care Systems Office (SD) and the Safety and Test Operations Division (NS) approve procedures prepared for JSC onsite breathing gas systems.

9. Training for working with oxygen-enriched breathing gas systems

Your system must have written training and certification requirements for each position. You must be trained in:

a. Your duties for normal operations and emergencies.

b. Hazards you face and safety precautions you must take.

10. Emergency planning for breathing gas systems

You must:

a. Have an emergency action plan as described in Chapter 3.8 “Emergency Preparedness,” of this Handbook.

b. Conduct emergency drills at least twice a year under the emergency procedures to make sure the team can react to emergencies effectively. A representative of the Safety and Test Operations Division (NS) must monitor and evaluate your emergency drills. Regular emergency drills are not required for inactive systems. If the system has been inactive, all test team members must have participated in an emergency drill within three months before the test.

11. References

a. CGA-G7.1, “Commodity Specification for Air”

b. MIL-PRF-27210G, “Oxygen, Aviator’s Breathing, Liquid and Gas”

c. NASA SD-B-0023-A, “Helium/Oxygen Breathing Mixtures”

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d. JPR 5322.1, “Contamination Control Requirements Manual”

e. JPR 1710.13, “Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems”

f. NASA-STD-6001, “Flammability, Odor, Off-Gassing and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion”

g. NASA MSC-SP-40M39580B, “Connectors, Electrical, Zero-G, Specifications”

h. NPD 7100.8D, “Protection of Human Research Subjects”

i. NASA JPD 8080.4, “Exposure to Reduced Atmospheric Pressures”

j. ASTM Committee G4.05, “Fire Hazards in Oxygen Systems: ASTM Standards Technology Training Coursebook”

k. ASTM-MANL-36, “Manual for Safe Use of Oxygen Systems: Guidelines for Oxygen System Design, Materials Selection, Operations, Storage, and Transportation”

l. CGA-P39ED1, “Oxygen-Rich Atmospheres”

m. Code of Federal Register, 29CFR1910.134, “OSHA Standard for Personal Protective Equipment and Respiratory Protection”

n. ASTM-G93-96, “Cleaning Methods and Cleanliness Levels for Material and Equipment Used in Oxygen Enriched Environments”

o. IEST-STD-CC1246D, “ Product Cleanliness Levels and Contamination Control Program”

p. MIL STD 1330, “Standard Practice for Precision Cleaning and Testing of Shipboard Oxygen, Helium, Helium-Oxygen and Hydrogen Systems”

q. CGA G-4.4, “Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems”

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Appendix 6A

Forms

The following forms are available electronically via forms search at the following web address: http://forms.jsc.nasa.gov/

JSC Form 44B	Laser/Optical Device Hazard Evaluation Data
JSC Form 992	Confined Space Entry Procedure
JSC Form 1476	Confined Space Entry Permit
JSC form 1879	JSC Chemical Hazard Alarm Registration

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Appendix 6B

Miscellaneous guidelines and instructions

This appendix contains the following attachments:

6.5A Emergency treatment

6.5B Normal boiling points of cryogenic fluids

6.5C Liquid oxygen (LOx)

6.5D Liquid hydrogen (LH_2)

6.5E Liquid nitrogen (LN_2)

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Attachment 6.5A

Emergency treatment

Recommended emergency treatment for cold-contact burn until medical assistance is available:

- Remove any clothing that may restrict the circulation to the frozen area unless it is frozen to the skin.
- Do not rub frozen tissue as damage may result.
- As soon as practical, place the affected part of the body in a warm-water bath.
- Never use dry heat to warm a cold-contact burn.
- The victim should be in a warm room if possible.
- If exposure is massive, body temperature will drop and total immersion in a warm water bath will be necessary. Don't warm rapidly. Thawing may require from 15 to 60 minutes and should be continued until the pale blue tint of the skin becomes pink or red.
- Warm drinks and food may be administered to a conscious victim.
- DON'T give alcoholic beverages or allow an injured person to smoke since both decrease the blood flow to the frozen tissues.

NOTE: A cold-contact burn victim requires immediate professional medical treatment. The injured person will be transported immediately to the nearest professional medical facility.

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Attachment 6.5A

Emergency Treatment

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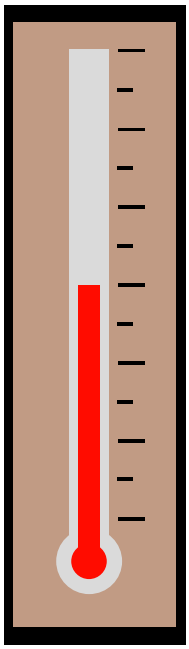
CRYOGENIC THERMOMETER
Normal Boiling Points of Cryogenic Fluids

		DEG. F	DEG. R	DEG. K	DEG. C
KRYPTON	LKr	-242.1	217.59	120.2	-152.8
OXYGEN	LOX	-297.3	162.39	90.2	-182.8
ARGON	LAr	-302.3	157.39	87.4	-185.6
FLUORINE	LF2	-306.7	152.99	85.0	-188
NITROGEN	LN2	-320.4	139.29	77.3	-195.7
NEON	LNe	-410.9	48.79	27.1	-242.9
HYDROGEN	LH2	-423.2	36.49	20.3	-249.7
HELIUM	LHe	-452.1	7.59	4.2	-269/9
ABSOLUTE ZERO		-459.69	0	0	-273.0



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Attachment 6.5C

Liquid oxygen (LOx)

Properties and Characteristics:

- Normal Boiling Point: -297°F (90 degrees Kelvin)
- Appearance: pale blue
- Toxicity: toxic to humans
- Vapor Density: .279 lb/ft^3 (about one-fourth that of air)

Material Incompatibility:

- Causes organic materials to react violently when ignited
- Can detonate powdered organic materials

Flammability: Non-flammable; however, it can rapidly increase rate of burning in a fire

Safety and Handling:

- Avoid skin or eye contact.
- Use proper storage and handling equipment.
- Provide adequate ventilation.
- Prevent sources of ignition.
- Obtain a thorough knowledge of this material before handling.
- Use the "buddy" system when handling.

Major Hazards:

- Fire: Remember that oxygen/fuel mixtures ignite readily and may explode. Materials that burn in air usually burn much faster in oxygen; materials which do not normally burn in air may burn in oxygen.
- Exposure: Cold gas or liquid may cause skin and eye injuries similar to burns.
- Extreme cold can condense LO_2 and LN_2 on uninsulated surfaces, adding to local fire hazards. The condensed LO_2 can react with oil and grease to cause a fire.

Precautions:

In case of . . .	***Take these actions . . .***
Spill or Leak	Shut off source(s) of ignition. No smoking or use of traffic control flares permitted. Keep unnecessary personnel away from area. DO NOT walk on or roll equipment over spill area until frost has disappeared. Use proper clothing (gloves, face shield, etc.) to enter spill area. Shut off source(s) of supply by using proper equipment. Fog in form of condensed moisture usually indicates water vapor.
Fire	Use water to spray container that is exposed to fire. If substantial parts of container insulation jacket and insulation are gone, vacate general area immediately (explosion hazard).
Exposure	Thaw frosted parts with water. Get prompt medical attention. Air clothing thoroughly for 30-60 minutes before smoking or approaching any source of ignition.

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Attachment 6.5C

Liquid oxygen (LO_2)

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Attachment 6.5D

Liquid hydrogen (LH_2)

Properties and Characteristics:

- Normal Boiling Point: -423°F (20 degrees Kelvin)
- Appearance: colorless, odorless
- Toxicity: non-toxic
- Vapor Density: .083 lb/ft^3 (about one-fourteenth that of air)

Material Incompatibility: not corrosive nor significantly reactive

Flammability Limits in Air by Volume (H_2 GAS): 4.0% to 74.2%

Safety and Handling:

- Avoid contact with eyes and skin.
- Use proper storage and handling equipment.
- Provide adequate ventilation.
- Prevent sources of ignition.
- Obtain a thorough knowledge of this material before handling.
- Use the "buddy" system when handling

Major Hazards:

- Fire: LH_2 is extremely flammable. Hydrogen-air mixtures are readily ignited and may be explosive in confined spaces. Flames are invisible. Hydrogen can self-ignite if rapidly released in large volumes.
- Exposure: Cold gas or liquid may cause skin or eye injuries similar to frostbite. Though vapor is not toxic, breathing it may cause sudden unconsciousness because of lack of oxygen.

Precautions:

In case of . .	*Take these actions . .*
Spill or leak	Shut off source(s) of ignition. No smoking or use of traffic control flares permitted. Be aware that invisible flames may be present. Keep unnecessary personnel away from area. Self-contained breathing apparatus and gloves are required to enter spill area. Shut off source(s) of supply by using proper equipment. Fog in form of condensed moisture usually indicates water vapor.
Fire	Permit escaping hydrogen to burn if flow cannot safely be shut off. Spray tank with water if it is exposed to fire. If substantial part of insulation jacket and insulation are gone, immediately vacate general area (explosion hazard).
Exposure	Remove victim(s) to fresh air. If not breathing, administer CPR; provide oxygen as appropriate. Thaw frosted areas with water. Get medical attention promptly.

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Attachment 6.5E

Liquid oxygen (LN_2)

Properties and Characteristics:

- Normal Boiling Point: -320°F (77 degrees Kelvin)
- Appearance: colorless, odorless
- Toxicity: non-toxic to humans
- Vapor Density: .288 lb/ft^3 (about one-fourth that of air)

Material Incompatibility: non-corrosive

Flammability: non-combustible

Safety and Handling:

- Avoid contact with eyes and skin.
- Use proper storage and handling equipment.
- Provide adequate ventilation.
- Obtain a thorough knowledge of this material before handling.
- Use the "buddy" system when handling.

Major Hazards:

- Fire: LN_2 is inert and will not burn.
- Exposure: Vapor is not toxic, but breathing may cause sudden unconsciousness because of lack of oxygen. Cold gas or liquid may cause skin and eye injuries similar to burns (frostbite).

Precautions:

In case of . . .	***Take these actions . . .***
Spill or Leak	Keep unnecessary personnel away. Appropriate personnel required. Use appropriate self-contained breathing apparatus in spill area. Fog in form of condensed moisture usually indicates vapor area. Shut off leak source(s) of supply using proper equipment.
Fire	Nitrogen can help put out fire. Spray tank with water if it is exposed to fire.
Exposure	Remove victim(s) to fresh air. If not breathing, apply artificial respiration and oxygen. Thaw frosted areas with water. Get medical attention promptly.

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Part 7
Health protection practices

This could be you . . .

A worker used an ammonia cartridge in his air-purifying respirator and worked in an organic vapor environment. He was exposed to the organic vapors because the ammonia cartridge wasn't designed to remove them.

1. Who must follow Part 7

You must follow Part 7 if you work requires you to protect yourself from certain health hazards. The following table tells you which chapters from Part 4 apply to what activities.

If you . . .	***Then you must follow . . .***
Work in an area with noise	Chapter 7.1, "Hearing protection"
Wear a respirator	Chapter 7.2, "Respiratory protection"
Work with ionizing or non-ionizing radiation	Chapter 7.3, "Radiation protection"
Work with infectious material such as blood or body fluids	Chapter 7.4, "Biosafety and bloodborne pathogens"

2. How to use Part 7

Part 7 tells you how to protect yourself from certain health hazards. Find the chapters that apply to your job from the table above and follow the requirements they contain.

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Chapter 7.1
Hearing protection

This could be you . . .

A worker didn't wear hearing protection while in a high noise area. He later noticed ringing in his ears and experienced a temporary hearing threshold shift. This reduced his hearing capability for several days.

1. Who must follow this chapter

You must follow this chapter if you work in an area that has been designated a hazardous noise area or source, such as the flight line at Ellington Field or machines in a sheet metal shop.

2. What this chapter covers

This chapter covers the minimum requirements for JSC's hearing conservation program. It covers how to know if your work area is too noisy and how to protect yourself from hearing loss.

3. What is "too noisy"?

The NASA action level for noise is a noise level greater than or equal to the equivalent of 80 dBA (decibels on the A-weighted scale) measured as an 8-hour time-weighted average (TWA). NASA also has requirements for areas and machines that have noise levels greater than 85 dBA as instantaneous measurements. The Occupational Safety and Health Administration (OSHA) action level for noise is a noise level greater than or equal to the equivalent of 85 dBA as an 8-hour TWA. There are two kinds of noises that are harmful: the continuous noise that that occurs without interruptions and the impact or loud noise that occurs intermittently.

Whenever you are exposed to noise levels that exceed the NASA action level of 80 dBA, 8-hour TWA, for 30 or more days per year, or if you are exposed to noise levels that exceed the OSHA action level of 85 dBA, 8-hour TWA, for one day, you will be included in a hearing conservation program that encompasses several elements, including medical surveillance and training. Whenever you work in areas or around machines with instantaneous noise levels above 85 dBA, you will be required to wear hearing protection regardless of the duration of your exposure.

a. This table shows the equivalent exposures to the NASA and OSHA action levels. As noise levels increase it takes less time to get the same exposure. For continuous noise, a work area is considered too noisy if measured noise levels exceed the decibel and duration limits in this table. Usually, the area is too noisy if you have trouble understanding a normal conversation with someone 2 feet away from you or if you have to shout at someone 3 feet away from you to make yourself understood.

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OSHA Action Level Duration in hours . . .	*8-hr TWA Decibel* limit . . .*	*NASA Action Level Duration in hours . . .*
16	80	8
8	85	4
4	90	2
2	95	1
1	100	0.5
0.5	105	0.25
0.25	110	0.13
0.125 or less	115	0.06 or less

*Sound level in decibels measured on the A-scale (dbA) of a standard sound level meter set at "slow response"

b. For impact noise, "too noisy" is anything that exceeds the limits in this table.

*Impulse Sound level**	*Number of impacts or impulses allowed per day*
140	100
130	1000
120	10000

*Decibel peak sound pressure level

c. Under no circumstances are you to be exposed to noise exceeding 115 decibels continuous noise or 140 decibels impulse or impact noise without protective equipment.

4. Warning signs for noise hazards

If the noise level equals or exceeds 85 dBA, you must:

a. Make sure caution signs are posted at the entrance or around the edge of the area that:

- Clearly indicate that the area is a high noise area.
- State that hearing protection is required.
- Are yellow or orange with black letters.

b. Put warning decals on power tools and machines with hazardous noise levels.

5. How to know if your work area is too noisy

The easiest way to know if your work area is too noisy is to check for warning signs posted just outside the hazard areas or on power tools or machines with hazardous noise levels. If

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your work area, tool, or machine is new or you think your work area is too noisy, call Occupational Health Services at (281) 483-6726 to get an evaluation.

Occupational Health Services will monitor the situation and report back to you in writing with their findings and recommendations. If your work area is too noisy, you will be notified that you may be included in the hearing conservation medical monitoring program (see Paragraph 6 of this chapter).

6. Precautions you must observe when working in a noisy area

If you work in a noisy area, you must observe these precautions:

a. Use personal protective equipment when exposed to hazardous noise levels.

b. Use earmuffs or plugs if you are exposed to continuous noise that equals or exceeds 85 dBA for an 8-hour TWA or impulse noise that equals or exceeds 100 dB. Using hearing protectors is a mandatory part of your job and your supervisor will enforce it. For nuisance noise areas less than 85 dBA (TWA), your supervisor or company should make earplugs or earmuffs available.

c. Never trade or share earplugs. They are for your use only.

d. Occupational Health Services will tell you what kind of hearing protection to wear in your noisy area.

e. Have your noisy area re-evaluated by Occupational Health Services whenever the noise level increases to see if your current protection is still adequate.

f. You will be provided both earmuffs and earplugs when analysis shows that the protection provided by earplugs doesn't reduce noise exposures below 85 dBA (TWA).

g. Inspect your earmuffs on a regular basis. Don't use them if they have been damaged, altered, or modified.

h. Make sure equipment is operating properly. Loose drive belts, worn out bearings, worn out shock absorbing mounts, etc., can increase noise levels.

7. How to know if you have hearing damage

Whenever you are exposed to noise levels that exceed the NASA action level of 80 dBA (TWA) (see Paragraph 3 of this chapter) for more than 30 days per year, or if you are exposed to noise levels that exceed the OSHA action level of 85 dBA TWA for one day, you will have an annual medical examination that includes an audiogram. Medical personnel will advise you if you have a hearing loss. Within 6 months of your first noise exposure, you should receive a baseline medical examination that includes:

a. An audiogram.

b. A medical examination to determine any pre-existing ear problems.

c. A work history to document past noise exposures.

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When you leave the job in the noisy area, you will have an exit audiogram.

8. Training you must have to work in a noisy area

If you are exposed to noise at or exceeding the OSHA or NASA action levels (see Paragraph 3 of this chapter), you will be put into the JSC hearing conservation program and receive initial and annual training. Your training must cover:

a. Elements of JSC's hearing conservation program.

b. Effects of noise on hearing.

c. Noise control practices including hearing protection at home.

d. Purpose, types, and maintenance of hearing protectors.

e. Explanation of audiometric testing purpose and procedures.

The initial training, and training taken every three years, must be in an instructor-led class. The other two years of annual training can be from your supervisor or from viewing noise training video tapes. If you are a supervisor, you must take training so that you are familiar with the hazards of noise, the controls to be used in your area, and your responsibilities.

9. Other requirements you must follow when you work in a noisy area

You must also follow:

a. NASA Procedures and Guidelines (NPR) 1820.1, Hearing Conservation, current version.

b. 29 CFR 1910.95, "Hearing Conservation."

10. Other potential noise exposures

In addition to noise exposures at work, your activities off the job may also cause hearing loss. Some of these activities include:

a. Motorized vehicles and equipment such as: motorcycles, boats, lawn mowers, and power tools (saws, drills, etc.)

b. Audio equipment such as: radios, televisions, and musical instrument amplifiers if the volume is set too high

c. Attendance at concerts and night clubs

Chapter 7.2
Respiratory Protection

This could be you . . .

A worker wore a respirator while painting after his beard had grown out. He was exposed to paint vapors that leaked in between the respirator and his whiskers.

1. Who must follow this chapter

You must follow this chapter if you wear a respirator or if you are assigned duties as a Respirator Program Administrator. Paragraph 13 contains the responsibilities of a Respiratory Program Administrator in and the Occupational Health Branch.

2. What this chapter covers

This chapter covers the minimum requirements for using a respirator. This chapter does not meet Occupational Safety and Health Administration (OSHA) requirements for a written Respiratory Protection Program (RPP) plan. You'll find information on the requirements for a Respiratory Protection Program and a written RPP Plan in Paragraph 12.You'll also find information on respirators designated for emergency use in Paragraph 10.

3. How to know if you need to use a respirator

You must use a respirator if:

a. Your specific job description or work document says you must.

b. The Occupational Health Branch's hazard assessment says you must.

c. Your supervisor or respirator program administrator says you must.

d. Your breathing is uncomfortable in your work area due to airborne contaminants.

If you need to wear a respirator, your employer must have a written respiratory protection program that meets the requirements of 29 CFR 1910.134, "Respiratory Protection." (see Paragraph 12 below)

Whenever possible, control air contaminants with engineering controls such as enclosure, ventilation, wet methods, or substitution of less hazardous materials. If you can't control the contaminants or while an engineering fix is being put in place, you must use an appropriate respirator to protect yourself. If you suspect there are airborne contaminates in your work area, have it evaluated.

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4. Precautions you must observe when using a respirator

If you use a respirator, you must observe these precautions:

a. Use a National Institute for Occupational Safety and Health (NIOSH)-approved respirator for each task. Don't use a respirator in an unknown environment or in one for which the respirator isn't assigned.

b. Don't wear anything that interferes with the face-to-respirator seal. Never wear beards and long sideburns. You may wear corrective lenses if they don't interfere with the seal or get spectacle kits for full-face respirators.

c. Use only the respirator assigned to you. Make sure your respirator is identified as yours in such a manner that it does not interfere with the respirator's function.

d. Make sure your work procedure includes a respirator positive and negative pressure check before beginning work. Do the pressure check just before you enter an area where respirators are required.

e. Make sure you have a current medical exam and are qualified to wear a respirator. See Chapter 3.6, "Occupational Healthcare Program," of this Handbook for more requirements on medical exams.

f. Make sure you have been properly fit-tested for the type of respirator you will use.

g. Make sure you receive annual respirator fit testing and training.

h. Make sure you are using the correct make, model, and size of respirator.

5. Choosing a respirator to use

Your respirator program administrator, with the help of an industrial hygienist, will select the right respirator to use in each situation after a hazard assessment is completed. The selection is based on requirements in Occupational Safety and Health Administration (OSHA) Standard, 29 CFR 1910.134, "Respiratory Protection," NIOSH 42 CFR Part 84, and 30 CFR Part 11. Respirator assigned protection factors (APFs) are based on ANSI Z88.2-1992, "Practices for Respiratory Protection," and the NIOSH "Guide to Industrial Respiratory Protection." The lowest assigned protection factor will be used to determine the maximum use concentration. This applies to all respirator types, including disposable ones. Look in your work procedures to find out what type respirator to use. Remember:

a. Never use air-purifying respirators:

- In oxygen-deficient atmospheres.
- For hazardous chemicals with inadequate warning properties, unless approved in writing by the Occupational Health Branch.
- In immediately dangerous to life or health (IDLH) atmospheres.

b. Use only full-facepiece respirators in hazardous areas that irritate your eyes.

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c. You may voluntarily use a NIOSH-approved disposable dust or mist respirator only for nuisance dusts in concentrations below OSHA or the American Conference of Governmental Industrial Hygienists exposure limits. You must follow all aspects of your organization's respiratory protection program if you use them. Your employer is required to provide you Appendix D of 29 CFR 1910.134, "Information for Employees Using Respirators When Not Required Under the Standard."

d. Make sure you are using the appropriate canisters or cartridges for your work environment. Also make sure that there is an established change-out schedule for the canisters or cartridges.

6. Fit testing

You must be fit tested to use a respirator. Fit tests are performed by Occupational Health Services or by contractors. Fit tests must follow OSHA protocols. You must have a fit test yearly. A qualified fit test operator will choose the right-size respirator for you.

Your respirator fit-testing records will be kept for 5 years.

7. Precautions you must take when using a supplied-air respirator

In addition to the general precautions listed in Paragraph 4, you must follow these requirements if you use a supplied-air respirator:

a. Make sure the breathing air you use meets the requirements for Grade D breathing air as described in the Compressed Gas Association (CGA) Commodity Specification G-7.1.

b. Don't use compressed oxygen in supplied-air respirators or in open circuit self-contained breathing apparatus (SCBA) that have previously used compressed air. Never use oxygen with air line respirators.

c. Don't use instrument or utility air supplied by the Central Heating and Cooling Plant for breathing air unless it has been treated, tested, and provided with OSHA-required alarms. Any use of this air requires approval from the Occupational Health Branch.

d. Design air line couplings for use only with breathing air sources. Make sure it is physically impossible to mate air-line couplings with outlets for other non-breathing-air gas systems. Do not use a hose longer than 300 feet. Provide at least 4 CFM to tight-fitting respirators and 6 CFM for loose-fitting hoods. Make sure the hose will not be in chemicals or crimped by heavy objects such as vehicles or cause a tripping or other safety hazard.

e. Follow these requirements for compressors:

- Make sure the compressors are located and installed to keep contaminated air from entering the system.
- Use suitable in-line air-purifying absorbent beds and filters to further ensure breathing air quality.

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- Make sure the system has a reserve of sufficient capacity to enable you to escape from a contaminated atmosphere if a compressor fails or overheats.
- If you are using an oil-lubricated compressor, make sure it has a high-temperature or carbon monoxide alarm, or both. If it only has a high-temperature alarm, test the air from the compressor for carbon monoxide under 29 CFR 1910.134 and the CGA guidelines.
- Use manufacturer-recommended lubricants only.
- Make sure the dew point of the air is 10 degrees below ambient temperature to prevent freezing of your regulator.

f. Follow these requirements if you use a supplied-air respirator in an immediately dangerous to life or health (IDLH) environment:

- Use a buddy system when respirators are worn under IDLH conditions.
- Locate the standby person in a safe area and properly equip him or her with a positive-pressure SCBA to help you in case of emergency. You may also make sure he or she is in direct contact with emergency response personnel who can help in an emergency.
- Maintain communication between you and the standby person at all times.
- Have retrieval equipment so that you can be removed from the area if an emergency occurs. See Chapter 5.6, "Personal protective equipment," of this handbook for more information.

8. Maintaining respirators

When you wear a respirator, you must maintain it in the following manner:

a. Clean and disinfect your respirator after each use or at the end of the day if you will reuse it. Clean and disinfect it after each use if someone else will use it.

b. Store your respirator so that it is protected from damage, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals. The best way to store it is to place it in a plastic bag or other container, then store it on a shelf or in a box to protect the face piece from scratches. Also:

- Never store a respirator in a toolbox; it can become contaminated, distorted, or damaged.
- Always store a respirator with the face seal pointing up. Otherwise the respirator will become distorted and won't provide an adequate seal.

c. Don't use one manufacturer's respirator parts in another manufacturer's respirator. Especially, don't switch cartridges.

d. Inspect your respirator during cleaning and before each use. Make sure it works properly, fits snugly, the connections are tight, and no part is broken or deteriorated.

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Remove respirators that don't pass inspection from service and either replace them or have a competent person repair them.

9. Training you must have to use a respirator

Your training must include:

a. The following initial training:

- General respiratory hazards to which you may be exposed
- Engineering or other controls being used and the need for respirators to provide protection
- The operation, limitations, and capabilities of your respirator
- How to inspect, don, and remove your respirator
- How to check the fit and seals when wearing your respirator
- How to use your respirator so you become thoroughly confident in and familiar with your respirator
- How to maintain and store your respirator
- How to identify respirator malfunctions
- How to recognize medical signs and symptoms that may limit your use of a respirator
- What to do if your respirator malfunctions

b. The following from your respirator program administrator:

- Specific respiratory hazards to which you may be exposed
- The content and location of your written respiratory protection program

Your respirator program administrator must keep written records on all employees who use a respirator, for the duration of their employment. These records include names, training dates, and subject areas covered.

If you supervise a person who uses a respirator, you must be trained yearly in respirator selection, use, and maintenance.

10. Special precautions you must take with respirators designated for use in emergencies

If SCBA is maintained for entering contaminated areas in emergency situations, you must:

a. Have all IDLH respirators approved by the Occupational Health Officer. IDLH respirators must be NIOSH-approved respirators.

b. Inspect it monthly as well as before and after each use.

c. Keep records of monthly inspection dates and findings in a visible location near the SCBA.

d. Have the SCBA tanks tested and filled by authorized agents only, and have them inspected by an authorized repair agent yearly.

e. Maintain pressure-testing requirements for bottle certification.

f. Use only full face-piece pressure-demand supplied air respirators (SARs) with an auxiliary self-contained air supply or SCBA in an unknown or oxygen-deficient atmosphere, or an atmosphere that is IDLH.

g. Make sure each SCBA used in IDLH atmospheres or for emergency entry or fire fighting is certified for a minimum service life of 30 minutes.

h. If you use SARs and SCBAs, make sure you have been trained in their use and limitations.

i. Follow the requirements in Paragraph 7.f of this chapter.

j. If you have respirators for escape from IDLH atmospheres, such as ELSAs, you must receive annual training.

11. For more information on respirators and their use

You can find more information on respirators in these documents:

a. 29 CFR 1910.134, Respiratory Protection

b. 29 CFR 1910.139, Respiratory Protection for M. Tuberculosis

c. ANSI Z88.2-1992, American National Standard for Respiratory Protection

d. ANSI Z88.6, "For Respiratory Protection-Respirator Use-Physical Qualifications for Personnel," 1984

e. Department of Transportation Emergency Response Guidebook, latest edition

f. CGA 7.1, Commodity Specification for Air, Compressed Gas Association

g. *Hazardous Materials, Managing the Incident,* Noll, G. G., Hildebrand, M. S., Yvorra, J. G., Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma 74078, 1995

h. Part 12 of this Handbook, “Asbestos Control Requirements.”

i. National Institute for Occupational Safety and Health (NIOSH) Guide to Industrial Respiratory Protection, Bollinger, N. J. and R. H. Schutz, 1987

j. NIOSH Pocket Guide to Chemical Hazards, latest edition

k. NIOSH Certified Equipment List latest edition

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12. Requirements for a Respiratory Protection Program (RPP) and a written RPP Plan

Each employer or contractor at JSC requiring employees to wear respirators must:

a. Appoint a respirator program administrator:

- The program administrator for JSC civil servants is the JSC Occupational Health Officer (SD3).
- JSC Directorates may appoint their own program administrator if they choose not to follow the SD3 program or may choose to be included in a contractor's program.
- Each program administrator must develop a written Respirator Protection Program (RPP) Plan meeting all requirements of 29 CFR 1910.134.

b. Establish and implement a written RPP Plan and have the plan reviewed and approved by either the JSC Occupational Health Officer (SD3) or the Manager, Occupational Health Services (SD33). The plan must include:

- Responsibilities of the Program Administrator, respirator user, and other people involved in the respirator program.
- Identification of all covered workers if they are not actually "employees" of the employer implementing the plan; for example, subcontractors or JSC civil servants following a contractors plan.
- Procedures for selecting respirators.
- A list of the activities or hazards for which respirators will be worn and the type of respirator selected.
- A change out schedule for all air-purifying respirators used for protection against gases and vapors.
- Voluntary respirator use.
- Medical evaluations of employees wearing respirators.
- Fit testing procedures for tight fitting respirators.
- A list of who will provide medical evaluations and fit testing if not done by in-house staff.
- Procedures for proper use of respirators in routine and foreseeable emergencies.
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators.
- Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators.
- Training employees on respiratory hazards to which they are potentially exposed.

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- Training employees on the proper use of respirators and limitations on their use, on how to put on and remove respirators, on user seal checks, and on the care and maintenance of respirators.
- Procedures for evaluating the effectiveness of the respirator program.

13. Responsibilities for the respirator protection program

a. As a ***respirator program administrator***, you must:

- Arrange for hazard assessment of your work operations by the Occupational Health Branch.
- Arrange for your employees to be fit tested, trained, and medically examined through Occupational Health Services.
- Make sure that your employees correctly use and maintain their respirators.
- Provide respirators and training specific to your work area for your employees.
- Assess your program's effectiveness yearly and document your assessment. The assessment must include employee feedback.
- Maintain a written Respiratory Protection Program with work-site-specific procedures and information. (see Paragraph 12 for the requirements of a written program) See the Occupational Health Services, (281) 483-6726, for assistance in preparing a written program.

b. The ***Occupational Health Branch*** must:

- Provide hazard assessments and recommendations when requested by supervisors.
- Help employees or supervisors write respirator procedures.
- Review and monitor JSC's respiratory protection program.
- Provide appropriate surveillance of work area conditions and degree of employee exposure or stress.
- Provide fit testing, training, and consultation services for on-site respirator users as requested.

Chapter 7.3
Radiation protection

This could be you . . .

A researcher ingested radioactive dust. He made notes on his work and then held his pencil, which had dust on it from his hands, in his mouth.

1. Who must follow this chapter

You must follow this chapter if you handle radioactive materials or radiation-producing equipment.

2. What this chapter covers

This chapter covers the minimum requirements for handling and using radioactive materials or radiation-producing equipment. The chapter includes ionizing radiation such as X-ray diffraction units and non-ionizing radiation such as that produced by radar and microwaves.

Requirements for ionizing radiation

3. What is ionizing radiation and why is it harmful?

Ionizing radiation is any of the following: alpha particles, beta particles, gamma rays, X rays, neutrons, high-speed electrons, protons, and other atomic particles. Ionizing radiation doesn't include sound waves, microwaves, radio waves, or visible, infrared, or ultraviolet light. These are covered in the next subchapter.

Ionizing radiation is harmful because it alters the cells of the human body and could produce cancer and other chromosome damage.

4. Precautions you must observe when working with ionizing radiation

If you work with ionizing radiation, you must:

a. Get approval to bring radioactive materials or radiation producing devices onto JSC, Sonny Carter Training Facility, Ellington Field, and White Sands Test Facility. No one, whether NASA employees, contractors, visiting scientists, post-doctorate researchers, etc., is allowed to bring any radioactive materials or radiation producing devices onto JSC-, Sonny Carter Training Facility-, Ellington Field-, or White Sands Test Facility-controlled property until he or she gets approval from the NASA/JSC Radiation Safety Officer.

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b. Make sure you have been authorized by the Radiation Safety Committee (RSC) to work with radioactive materials or radiation-producing equipment. See specific authorization procedures described in Part 3 of JHB 1860.2, "Radiological Health Manual."

c. Wear appropriate protective clothing whenever you or your clothing could be contaminated.

d. Wear personnel-monitoring equipment (usually dosimeters) if you work in a "Radiation Area." The JSC Radiation Safety Officer (JSC RSO) may require you to have a bioassay to check your level of radiation contamination.

e. Make sure that you don't expose yourself or anyone else to radiation unnecessarily or beyond the permissible exposure levels contained in Part 3.9 of JHB 1860.2.

f. Keep contamination levels as low as possible. Make sure that you don't carry contamination beyond restricted areas. See Part 3.6 of JHB 1860.2 for specific procedures on personnel and area contamination and maximum permissible contamination levels.

g. Have written emergency response plans for both major and minor spills and releases as required by the RSC. Report to the JSC RSO and the Facility Manager as soon as possible any incident where:

- Someone could have been overexposed to radiation.
- Government equipment could have been damaged due to a spill or loss of control of a radiation source.

h. Use appropriate signs to mark restricted, radiation, high-radiation, or very-high-radiation areas. Mark any area that requires personnel-monitoring equipment. Standard signs with the radiation CAUTION symbol are available from the JSC RSO. Part 3.6 of JHB 1860.2 describes specific sign requirements.

5. Controlling radioactive materials and radiation-producing equipment

You control radioactive materials and radiation-producing equipment by tracking when and where it comes on site, where it is stored and used, how it is transferred, and how it is disposed of. Follow these precautions:

a. The JSC RSO or designee must approve all purchase requests for radioactive material or radiation-producing equipment. They will survey new packages containing radioactive material promptly (usually at logistics receiving) for contamination and radiation levels. See Part 3.5 of JHB 1860.2 for specific procedures.

b. The JSC RSO must approve all storage and use areas for radioactive material. You must:

- Mark each room or area in which radioactive material is used or stored as containing radioactive material.

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- Label each container of radioactive material as such. Part 3.5c of JHB 1860.2 describes specific marking and labeling procedures.

c. Document all transfers of licensed material, making sure that the material is properly identified and the radiation levels are controlled. The JSC RSO or designee must:

- Approve and keep a record of all radioactive material shipments.
- Certify that materials are properly classified, described, packaged, marked, and labeled under applicable regulations (both Nuclear Regulatory Commission and Department of Transportation). Part 3.5d of JHB 1860.2 describes specific procedures for transferring licensed material.

d. Request disposal through the JSC RSO. Only a licensed radioactive waste disposal contractor may dispose of radioactive wastes. There are limited exceptions. Don't release radioactive gases or particulate radioactive material into the air. Part 3.13 of JHB 1860.2 describes specific procedures for disposing of waste.

6. Special requirements for off-site contractors doing radiographic work on site

If you are doing any kind of work involving radiation on site at JSC, you must follow all requirements in this handbook as well as in JHB 1860.2. In addition, you must notify the JSC RSO 24 hours before beginning work or before bringing radioactive materials or equipment on site.

Requirements for non-ionizing radiation

7. What is non-ionizing radiation and why is it harmful?

Non-ionization radiation includes any of the following from the electromagnetic radiation spectrum: ultraviolet rays, visible light, Lasers (for Laser controls see Chapter 6.2 of this Handbook), infrared radiation, radar, radio waves, microwaves, and hertzian waves. Equipment that produces non-ionizing radiation includes radio frequency (RF) and microwave devices such as radar, telemetry, communications systems, and test equipment; laser systems and optical devices; and microwave ovens.

Non-ionizing radiation is classified as a physical agent and can be harmful because it produces thermal and other effects that damage cells in the body. Radio frequency and microwave devices may cause these effects through electric and magnetic fields and induced currents. For more information on hazards from non-ionizing radiation at JSC, contact the JSC Radiation Safety Office.

8. Exposure limits for non-ionizing radiation

The exposure limits for non-ionizing radiation depend on frequency. JSC uses limits found in the American Conference of Governmental Industrial Hygienists (ACGIH) publication

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"*Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*" (latest version). You can find additional information on exposure limits for radio frequency radiation in the ANSI/IEEE C95.1 Standard, "*IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz*." Remember, as with all hazardous physical agents, keep the exposure as low as reasonably achievable. Contact the JSC Radiation Safety Office for assistance in determining the specific exposure limit for the non-ionizing radiation from your equipment, process, procedure, or application.

9. Approvals for using equipment that produces non-ionizing radiation

You must receive approval from the JSC RSO before using any non-ionizing radiation source that can cause health or biological damage. UL-listed commercial off-the-shelf equipment that isn't modified is exempt from this requirement.

10. Information you must provide and precautions you must observe to get approval for using equipment that produces non-ionizing radiation

You must:

a. Describe the potential non-ionizing radiation hazards and their controls to all personnel within the area.

b. Make sure everyone in the area knows your emergency procedures.

c. Make sure everyone who uses the equipment has demonstrated a thorough knowledge of the system operations and safety precautions.

d. Immediately notify the JSC RSO and the area supervisor of any known or suspected mishap from your non-ionizing radiation source.

e. Notify the JSC RSO and the area supervisor of modifications to previously authorized non-ionizing radiation systems. Don't operate the modified system without prior JSC RSO approval. Your modification may require approval by the JSC RSO or the RSC.

11. Precautions you must observe when working with non-ionizing radiation

Follow these precautions when working with non-ionizing radiation:

a. Don't look into waveguide horns, antennas, or open waveguides when any microwave equipment is on.

b. Don't stay around high-frequency radiation over 25 milliwatts/square centimeter.

c. Ask the Radiological Safety Office to measure and evaluate the X-ray hazard posed by all equipment with voltages over 15,000 volts.

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d. Don't wear metal jewelry or eyeglasses near electronic equipment radiating RF energy, even if the level is below the established safe value. Jewelry or eyeglasses may act as a conductor and cause a shock or burn.

e. Follow Chapter 6.2 of this Hanbook, "Laser safety and health," for using and controlling Lasers.

12. Requirements for RF interference

Make sure that the operation of industrial, scientific, medical, and other equipment generating RF energy doesn't interfere with authorized radio, radio-navigation, and telecommunication systems.

Treat equipment generating RF energy between 30 hertz and 30,000 MHz as a cause of interference unless you provide the equipment with power line filters, shielding, bonding, and grounding. Keep RF energy within the limits in Chapter 7 of the Manual of Regulations and Procedures for Federal Radio Frequency Management.

13. For more information on radiation protection

You can find more information on radiation protection in these documents:

a. 10 CFR, U.S. Nuclear Regulatory Commission, Rules and Regulations

b. 21 CFR 1000 - 21 CFR 1040, Food and Drug Administration, Rules and Regulations

c. 29 CFR 1910.1096, "Ionizing Radiation"

d. 29 CFR 1910.97, "Nonionizing Radiation"

e. 49 CFR 177, "Carriage by Public Highway"

f. ANSI C95.1, "Electromagnetic Fields, Safety Levels With Respect to Human Exposure to Radio Frequency," American National Standards Institute, 1982

g. JHB 1860.2, "Radiological Health Manual"

h. JPD 1860.4, "Radiological Protection Policy"

i. JPR 1107.1, "The JSC Organizations," Paragraph 4.5, "JSC Radiation Safety Committee"

j. JPC 1152.15, "Medical Isotopes Subcommittee of the JSC Radiation Safety Committee"

k. "Manual of Regulations and Procedures for Federal Radio Frequency Management," U.S. Department of Commerce, Chapter 7: "Authorized Frequency Usage," National Telecommunications and Information Administration, Washington, D. C., 1989

l. "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indicies (TLVs® and BEIs®)," American Conference of Governmental Industrial Hygienist, latest edition

Verify this is the correct version before you use it by checking the on-line version.

m. ANSI/IEEE C95.1 Standard, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz."

n. Presidential Guidelines for Diagnostic X-Rays at Federal Installations, approved January 16, 1978

14. Responsibilities for radiation safety

a. As a ***supervisor***, you must:

- Make sure your employees participate in the JSC Radiation Protection Program.
- Train your employees in their radiation tasks and procedures.
- Assure that all JSC issued Personal Radiation Dosimetry Devices are returned to the Radiation Safety Office in conjunction with all employment termination.

b. As the ***JSC RSO***, you must:

- Implement JSC's radiation protection program.
- Supervise the Radiation Safety Office.
- Answer to the JSC Radiation Safety Committee.
- Be appointed by the Director, Space and Life Sciences.
- Follow your specific JSC RSO responsibilities described in Part 2.4 of JHB 1860.2.

c. The ***Director of the Space and Life Sciences*** must:

- Make sure that the radiation protection program is developed and carried out.
- Secure licenses or permits where required.
- Establish a Radiation Safety Committee.

d. The ***Radiation Safety Committee*** must:

- Coordinate the requirements for controlling radiation among the various agencies that regulate radiation.
- Approve all uses of radiation on site.

e. The ***Radiation Safety Office*** must:

- Review procedures.
- Monitor operations.
- Educate personnel in radiation protection and in the safe handling of radioactive materials and radiation-producing equipment.
- Issue radiation dosimetry equipment such as thermo-luminescent dosimeters, pocket dosimeters, warning signs, and labels for radiation or radioactive materials.
- Make sure that all operations meet Nuclear Regulatory Commission requirements.

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Chapter 7.4
Biosafety and bloodborne pathogens

This could be you . . .

A janitor was stuck by a hypodermic needle left in a trash can.

An employee found blood drops around his work area.

1. Who must follow this chapter

You must follow this chapter if you work with or may be exposed to biohazards including blood, and "other potentially infectious materials" as a part of your job. JSC has adopted the recommendations found in the Center for Disease Control and Prevention and National Institute of Health "Universal Precautions" and "Biosafety in Microbiological and Biomedical Laboratories" for controlling biohazards in the workplace.

If you don't work with blood or body fluids, but find them in your work area, follow Paragraph 2 below. If you are a supervisor, Paragraph 20 lists your responsibilities for biohazards.

2. What to do if you discover blood or other potentially infectious body fluids

If you find blood or other potentially infectious body fluids around your work area:

a. Leave it alone. Without the proper training and equipment, you risk getting a bloodborne disease.

b. Block off the area to prevent others from contacting it.

c. Report it to Emergency Operations Center Security Dispatcher at (281) 483-4658 and to your facility manager. They will send janitorial personnel trained in bloodborne pathogens to clean it up.

d. If the incident is an emergency, call extension 33333, JSC's emergency number

3. Biohazards and bloodborne pathogens

The following definitions apply to this chapter:

a. **Biological hazards or biohazards** are those infectious agents that present a risk of death, injury or illness to employees. Bloodborne pathogens and other potentially infectious materials (Subparagraphs b and c below) are considered biohazards.

b. **Bloodborne pathogens are** pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV).

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c. **Other potentially infectious materials** is an Occupational Safety and Health Administration (OSHA) definition which includes:

- The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids
- Any unfixed tissue or organ (other than intact skin) from a human (living or dead)
- HIV-containing cell or tissue cultures, organ cultures
- HIV- or HBV-containing culture medium or other solutions
- Blood, organs, or other tissues from experimental animals infected with HIV or HBV.

4. OSHA requirements for bloodborne pathogens

If your job description includes possible exposure to blood or "other potentially infectious materials," you must follow the OSHA 29 CFR 1910.1030, "Bloodborne Pathogens."

5. How to determine if you work in a job that exposes you to biohazards or bloodborne pathogens

a. JSC Space and Life Sciences has a Biosafety Control Board that evaluates the use of any new potential biohazardous or pathogenic materials. The Biosafety Control Board periodically audits laboratories for safe handling of Bloodborne Pathogens and Biological Materials. Anyone, employees or visitors, who brings biohazard materials onto JSC or who plans to implement a process using biohazardous materials, must have approval from the Biosafety Control Board before use or implementation.

b. The Occupational Health Branch evaluates all areas where civil service or contract workers could be exposed to bloodborne pathogens. Your management must help in evaluating these areas.

6. Biosafety levels and precautions you must take for each

You must never bring any Biosafety Level (BSL) 2 materials on site without the prior approval of the Biosafety Control Board. BSL 3 or 4 materials are prohibited on site.

You must classify all biohazards or biological materials as Biohazard 1,2 3, or 4. You must also follow the requirements in the table below for the biosafety level that matches the biohazard classification when working with any biohazardous material in a laboratory or clinical setting.

Bio-safety level . . .	***Involves these agents . . .***	***Follow these practices . . .***	***Use this safety equipment (primary barriers) . . .***	***Use these facilities (secondary barriers) . . .***
1	Not known to cause disease in healthy adults	Standard micro-biological practices	None required	Open bench top sink required
2	Associated with human disease, hazard = auto-inoculation, ingestion, mucous membrane exposure	BSL-1 practice plus: Limited access; biohaz-ard warning signs; "sharps" precautions; biosafety manual defining any needed waste decon-tamination or medical surveillance policies	Class I or II BSCs or other physical containment devices used for manipulating any agents that cause splashes or aerosols of infectious materials PPE: laboratory coats; gloves; face protection as needed	BSL-1 plus: Autoclave available
3	Indigenous or exotic agents with potential for aerosol transmission; disease may have serious or lethal consequences	BSL-2 practice plus: Controlled access; decontaminate all waste; decontaminate lab clothing before laundering; baseline serum	Class I or II BSCs or other physical contain-ment devices used for manipulating any agents PPE: protective lab clothing; gloves; respira-tory protection as needed	BSL-2 plus: Physical separation from access corridors; self-closing, double-door access; exhausted air not recirculated; negative airflow into lab
4	Dangerous or exotic agents which pose high risk of life-threatening disease, aerosol-trans-mitted lab infections; or related agents with unknown risk of transmission	BSL-3 practice plus: Change clothing before entering; shower on exit; decontaminate all material when exiting facility	Conduct all procedures in Class III BSCs or Class I or II BSCs with full-body, air-supplied, positive-pressure personnel suit	BSL-3 plus: Separate building or isolated zone; dedi-cated supply and exhaust, vacuum, and decon systems; other requirements outlined in the test

BSL- Biosafety Level
BSC- Biosafety Cabinet

7. Exposure control plan

Any organization or company whose employees may be exposed to blood and "other potentially infectious materials" must have a written exposure control plan that is tailored to the work area and designed to minimize worker exposure. The plan must contain the items listed in 29 CFR 1910.1030(c). This exposure control plan will include but is not limited to:

a. Exposure determination and hazard analysis, which describe the occupation and tasks with exposure.

b. Methods to comply with applicable requirements.

c. Communicating hazards to exposed employees.

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d. Record-keeping.

e. The procedures to follow after an exposure to blood or other infectious materials.

f. Hepatitis B vaccination option

You must update the written exposure control plan yearly.

8. Precautions you must observe when working with blood or other potentially infectious materials

If you work with any blood or body fluids listed above, you must observe these "Universal Precautions":

a. Treat all blood and body fluids as infectious. Urine, feces, saliva, breast milk, and vomit are not considered a potentially infectious material unless they are visibly contaminated with blood.

b. Always wear appropriate personal protective equipment (PPE) such as gloves, lab coats or aprons, and eye or face shields for the task at hand.

c. Wash your hands with biocidal soap immediately after removing your PPE or coming in contact with blood or body fluids.

d. Remove all PPE before leaving the work area and place in the appropriate container for storage, decontamination, or disposal.

e. Don't eat, drink, smoke, apply cosmetics or handle contact lenses in the work area.

f. Don't store food and drink in refrigerators or freezers where blood or other infectious materials are stored.

g. Minimize splashing and spraying blood or other infectious materials while handling them, while cleaning equipment, or during any other clean-up procedure.

h. Don't pipet or suction with your mouth.

i. Make sure all ventilation hoods and biological safety cabinets are inspected at least every year.

9. Precautions you must observe when using needles

If you use needles with blood or other infectious materials, observe these precautions:

a. Don't shear, bend or break used needles.

b. Don't recap or resheath by hand.

c. Don't remove used needles from disposable syringes.

d. Dispose of used needles in an approved biohazard container.

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10. Housekeeping precautions

Housekeeping is an important part of your protection so observe these requirements:

a. Disinfect all work surfaces with an appropriate biocide at the end of each work shift or when they are contaminated.

b. Replace protective coverings such as foil or plastic wrap used to protect equipment at the end of the work shift or when they become contaminated.

c. Disinfect all waste containers labeled biohazard on a regular schedule and clean them when they are visibly contaminated.

d. Don't pick up broken glassware with your hands. Use tongs or a brush and dustpan. Dispose of broken glassware in a puncture-proof biohazard container so it won't injure other workers.

e. Place all specimens in a closeable, leakproof container and label the container before storing or transporting.

f. Use a secondary container if the first is likely to be damaged.

11. Disposal precautions

Disposal is an important part of protecting others so observe these requirements:

a. Place all infectious waste in closeable, leakproof containers that are color-coded or labeled as described in Paragraph 12 below.

b. Keep infectious waste separate from other waste.

c. Wear protective gloves when handling infectious waste.

d. Make sure that infectious waste is picked up and transported by trained personnel only and that it is disposed of in a biological incinerator. In emergencies, first responders may take properly bagged waste to the JSC Clinic for disposal during working hours.

e. Minimize handling laundry that is contaminated. Bag it at the site in a properly labeled container and take it to a laundry for cleaning.

12. Labeling requirements for blood and body fluids

Labels must be fluorescent orange or orange-red and include the word BIOHAZARD and the biohazard symbol in a contrasting color. Place this warning sign on all containers of infectious waste, and on refrigerators or freezers that contain infectious materials. You may use red bags or containers in addition to labels for containers of infectious waste.

13. Protective clothing and equipment you must use when working with blood and potentially infectious materials

You must wear the following protective equipment:

a. Gloves, latex or another type if you are allergic to latex

b. Lab coat or apron and eye and face protection if splashing or spraying is possible

14. Hepatitis B virus vaccination

The JSC Clinic provides HBV vaccine to all on-site contractor and civil service employees in the job classifications listed in the exposure control plan for your area. The Occupational Health Officer must concur before you get the vaccine. This vaccine must be offered to you at no cost within 10 working days of being assigned duties that could expose you to blood or other potentially infectious materials. You may decline this vaccine when it is offered by signing a declination form, which is available at the JSC Clinic. If you later change your mind, you can still get the vaccine from the JSC Clinic.

15. Training you must have to work safely with blood and body fluids

You must be trained within 10 working days of being assigned duties that could expose you to blood or other potentially infectious materials and yearly thereafter to handle blood and body fluids listed in the "Universal Precautions" of the Center for Disease Control and Prevention safely. Your training must include:

a. A copy of 29 CFR 1910.1030 and an explanation of its contents.

b. A general explanation of the epidemiology, symptoms, and modes of transmission of bloodborne diseases.

c. An explanation of how to recognize activities that may involve exposure to blood and other potentially infectious material.

d. An explanation of the use and limitations of practices that will prevent or reduce exposure, including appropriate engineering controls, work practices, and PPE.

e. Information on the types, selection, proper use, location, removal, handling, decontamination or disposal of PPE.

f. Information on the HBV vaccine, including information on its effectiveness, safety, the benefits of being vaccinated, and that the vaccination will be offered to you free of charge.

g. Information on the appropriate actions to take and persons to contact if you or someone else are exposed to blood or body fluids.

h. An explanation of the procedure to follow if an exposure incident occurs, including how to report the incident and the medical follow-up that will occur.

i. Information on the post-exposure evaluation and follow-up that will be provided for you after an exposure incident.

j. An explanation of the signs, labels, and color-coding system.

k. An opportunity to ask questions of the person conducting the training session. Training is available through the Occupational Health Branch.

l. Information on the Center for Disease Control Prevention's Communicable Hotline (1-800-342-2437) to receive personal, confidential, and reliable information.

See Chapter 4.1, "Program Description," for safety and health training, of this handbook for more information on training.

16. What to do if you are exposed to blood or other infectious materials

If you are exposed to blood or body fluids, get medical treatment immediately. Getting proper treatment within two hours of exposure might prevent you from contracting a bloodborne disease. If you are treated at an outside medical facility, go to your site Clinic as soon as possible for a follow-up visit. Follow the table below:

If the exposure is . . .	***Then . . .***
An emergency where you need an ambulance	• Call x33333 at JSC and the Sonny Carter Training Facility, x44444 at Ellington Field, 911 at any off-site location, or x5911 at White Sands Test Facility.
To the eye, mouth, other mucous membrane or non-intact skin	• Flood the area with water for 15-20 minutes or wash with soap. • Go to the JSC Clinic or emergency room if the Clinic is closed for post-exposure follow-up.
To intact skin	• Immediately and thoroughly wash the affected area with biocidal soap. • Go to the JSC Clinic or emergency room if the Clinic is closed for post-exposure follow-up.

17. Clinic actions for exposure

For JSC employees, the JSC Clinic will provide a confidential medical evaluation to you if you have been exposed and will:

a. Document the:

- Route(s) of exposure.
- HBV, HCV, and HIV antibody status of the source individual, if known.
- The circumstances under which the exposure occurred.
- Any "first aid" or "prophylactic" measures that you received.

b. Collect and test the source individual's blood to determine the presence of HIV, HCV, or HBV infection, if the source individual can be identified, and permission given. You will

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be informed of applicable laws and regulations about disclosing the identity and infectious status of the source individual.

c. Collect blood from you as soon as possible after the exposure incident to determine your HBV, Hepatitis C, and HIV antibody status.

d. Follow-up on you, including the following:

- Antibody or antigen testing
- Counseling
- Evaluation of reported illnesses
- Safe and effective post-exposure treatment under standard recommendations for medical practice

18. Medical records JSC must keep

a. The JSC Clinic keeps all medical exposure records for the duration of your employment plus 30 years.

b. These medical records are available to you and anyone with your written consent.

c. You must file an injury report (JSC Form 340) for any exposure. The Safety Office will send a copy to your supervisor or company.

19. For more information on biohazards and bloodborne pathogens

You can find more information on bloodborne pathogens in these documents or contact the JSC Clinic:

a. 29 CFR 1910.1030

b. "Universal Precautions" guidelines from the Center for Disease Control and Prevention

c. "Bio Safety in Microbiological and Bio medical Laboratories," published by the Center for Disease Control and Prevention and the National Institute of Health

20. Responsibilities for bloodborne pathogen safety

As a ***supervisor***, you must:

a. Control all exposures to bloodborne pathogens through a written exposure control plan designed to minimize worker exposure.

b. Make sure your employees follow the requirements of this chapter and your exposure control plan.

c. Make sure your employees are trained in protecting themselves from bloodborne pathogens.

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d. Provide adequate PPE.

e. Offer to all employees the Hepatitis B vaccination and training within 10 working days of being assigned to a job in which they could be exposed.

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Part 8
Safety and health practices for manufacturing, installation, repair, and maintenance

This could be you . . .

A worker punctured his hand with a scraper.

An electrician was shocked, but suffered no injury. She thought the equipment was de-energized, but there was another source of power to the equipment.

1. Who must follow Part 8

You must follow Part 8 if you do any of the jobs listed below at JSC or a JSC field site. The following table tells you which chapters from Part 8 apply to what jobs.

If you . . .	***Then you must follow . . .***
Design, install, or work on electrical equipment or if your work exposes you to the hazards of electricity	Chapter 8.1, "Electrical safety"
Do any work that requires lockout/tagout to prevent injury from an energy release	Chapter 8.2, "Lockout/tagout practices"
Work in machine shops, woodworking shops, paint shops, sheet metal shops, and electronics fabrication shops	Chapter 8.3, "Shop safety"
Do any welding, cutting, and brazing	Chapter 8.4, "Welding, cutting, and brazing safely"
Do any lifting operations	Chapter 8.5, "Lifting operations and equipment safety"
Work with any power or hand tools	Chapter 8.6, "Power and hand tool safety"
Work on any ladders, scaffolds, and elevated platforms	Chapter 8.7, "Ladders, scaffolds, and elevated platforms: how to work with them safely"

2. How to use Part 8

Part 8 provides you with safe work practices for the hazardous operations listed above. Find the chapters that apply to your job from the table above and follow the requirements they contain.

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Chapter 8.1
Electrical safety

This could be you . . .

During a late-night shift when no electrical technician was available, a mechanical technician was instructed to work on a live electrical panel in a test area. He was shocked by 480 volts, but received only minor burns to the thumb.

A worker suffered flash burns when his scraper was vaporized by high-voltage electricity while scraping a louvered duct for painting. The duct contained a power buss and the scraper entered a louver and shorted the buss to the duct.

1. Who must follow this chapter

You must follow the requirements in this chapter if you design, install, maintain, or work on electrical equipment or if your work exposes you to the hazards of electricity.

2. What this chapter covers

This chapter covers the minimum requirements for work on power generation, transmission, and distribution systems, motors, transformers, rectifiers, voltage regulators, batteries, battery chargers, and associated components. There are additional requirements for working with batteries in Chapter 6.1, "Battery safety," of this Handbook.

Working on electrical equipment safely

3. Electrical hazards that must be controlled

You must control the following electrical hazards:

If you work on . . .	*Then you must control the hazards associated with . . .*
Energized equipment	Electrical equipment operating above 50 volts alternating current. All federal and NASA safety requirements apply.
High voltage	Operations at or above 600 volts nominal or 600 root mean square. These are classified as SAFETY CRITICAL (your supervisor or contractor safety officer must approve your written procedures and your supervisor must be present during operations).

4. Limitation for working on electrical equipment

You must follow the limitations listed below:

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When you are . . .	*You must . . .*
Maintaining electrical equipment	• Work only on de-energized equipment. • Get an exception to this limitation only after an investigation and documentation on a case-by-case basis from the appropriate authority. Your company or directorate must have policies for working on energized equipment that clearly defines the "appropriate authority." Only designated "qualified electricians" or "electronic technicians" may work on energized equipment. • Verify equipment cannot be re-energized by attempting a re-start using the normal operating controls (where possible) to make sure the equipment or system will not operate. You may need to request a remote restart. • Follow these limitations for covers, barriers, housings, or containment devices.
Doing maintenance, repair, or construction on overhead line or in a substation, where the wiring is congested, and you are exposed to or must handle energized equipment	• Have at least one additional employee who watches the other workers and warns them if they get near live conductors or helps them if there is an accident. • Assign enough qualified workers to perform the work safely if you are a supervisor.
Doing potentially hazardous operations	• Limit access to the work area to authorized personnel only if you are the person in charge.

5. Controls for working more safely on electrical equipment

You must implement the following controls:

If you are . . .	*Then you must . . .*
Doing an inspection or maintaining equipment	• Be qualified to inspect and maintain the electrical equipment. • Inspect the equipment at certain intervals that depend on the type of equipment and the severity of conditions it is used under.
Adjusting equipment	• Never adjust any part of electrical or electronics equipment if you can contact unprotected energized equipment. • Get approval from the cognizant supervisor and the Safety and Test Operations Division if you must work near high voltages.
Working around energized electrical circuits	• Never wear rings, watches, or other metallic objects that are electrical conductors.
Repairing or testing electronic equipment on a work bench	• Keep work benches clean at all times. • Ground all metal work benches.

Table continues on next page.

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If you are . . .	*Then you must . . .*
Working on poles	• Follow the requirements in 29 CFR 1910.268, "Telecommunications," 29 CFR 1910.269, "Electric Power Generation, Transmission, and Distribution," and 29CFR 1926.950-960; Power Transmission and Distribution • Inspect all poles before climbing them to do line work, and pike or support them before climbing if they are rotten or weak. • Make sure facility equipment and employees are isolated. • As a pole climber (lineman), firmly set your spurs and fasten your safety belt before working on pole-mounted electrical lines or equipment. • As the first of two linemen working on the same pole, be in the working position (safety belt fastened) before the second lineman climbs the pole. • Complete all work on one line or phase before working on another, never work on two lines or phases simultaneously when on a pole. • Never intentionally drop anything from a pole to the ground or allow anything to be tossed up to you. • Turn your head away to diminish the risk injury from an arc blast when opening primary disconnects or cutouts. • Use disconnect poles when possible.
Working on microwave equipment	• Know about radiation hazards before working on microwave equipment to avoid possible tissue injury, particularly the eyes. • Never examine or adjust radiators, waveguide openings, or horns during transmission. • Post warning signs that follow 29 CFR 1910.97 if someone may inadvertently enter the path of a microwave beam greater than 10 mw/cm^2.
Grounding equipment	• Ground noncurrent-carrying metal parts exposed to contact by personnel with a continuous conductor from the device to a grounded receptacle. • See National Fire Protection Association (NFPA) 70, "National Electric Code" (NEC), Article 250, "Grounding," and 29 CFR 1910.302 through 308, "Subpart S, Electrical," for requirements. • Ground semi-portable equipment such as floodlights and other types of work lights mounted on non-conducting supports. • Maintain the protective ground on the metal enclosures during movement, unless the supply circuits are de-energized.
Cleaning electronic equipment	• Use only approved and authorized solvents to clean electronic equipment. • Provide adequate ventilation and PPE as required by the Material Safety Data Sheet for the solvent (see Part 9 of this Handbook for details on hazardous materials).
Working on High Voltage systems	• Have at least 2 persons trained in CPR per work crew
Locking or tagging out equipment	• Follow the requirements of 29 CFR 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)," and Chapter 8.2, "Lockout/tagout practices," of this Handbook. • Lock out and tag out the equipment before service or maintenance to avoid an unexpected energization of circuits, the startup of equipment, or the release of stored energy, which could injure you or someone else. • Wear PPE appropriate when working on locked and tagged out equipment with the

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assumption that the equipment could become energized unexpectedly.

6. Requirements, besides this chapter, to follow for working safely with electrical equipment

You must follow the regulations listed below:

If you are . . .	*Then follow . . .*
Locking or tagging out an electrical energy source	Chapter 8.2 of this Handbook that implements 29 CFR 1910.147
Working on communications equipment	29 CFR 1910.268
Working on high voltage transmission and distribution equipment	29 CFR 1910.269
Working on common facility wiring and equipment	• 29 CFR 1910, Subpart S (all), "Electrical" • NFPA 70, NEC

Designing and installing electrical equipment

7. Safety design requirements for JSC electrical equipment

You must design permanent JSC electrical equipment to meet MIL-STD 454, "Standard General Requirements for Electrical Equipment," and with the following safety features:

For . . .	*You must . . .*
Equipment in ordinary occupancies	Use equipment: • Listed by Underwriters Laboratories (UL), Factory Mutual (FM), or other recognized testing laboratories. • That meets design requirements in NFPA 70.
Equipment in hazardous locations	Meet the design requirements in NFPA Standard 70, NEC, especially Chapter 5, "Special Occupancies," and 29 CFR 1910.307, "Hazardous Locations"
Safety mechanisms	Meet the requirements listed in Paragraph 6 above to ensure personnel and equipment safety.
Minimizing accidental contact	Locate or guard control boards, switches, transformers, and other hazardous equipment operating at 50 volts or more with grounded railings, barriers, or enclosures.

On your equipment design documents, you must show voltage, frequency, number of phases, type of raceways, type, number, and size of conductors, and all data pertinent to personnel and equipment safety. The Safety and Test Operations Division must review electrical systems design.

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8. Grounding JSC electrical equipment

You must ground permanent JSC electrical equipment to meet the following safety requirements:

a. Follow NFPA 70, NEC Article 250, and 29 CFR 1910.302 through 29 CFR 1910.308.

b. Show grounding points and grounding details on project drawings and diagrams.

c. Protect the grounds from physical damage.

d. Test newly installed grounding systems and document the tests.

e. Provide an effective separate ground for metal parts that don't carry current in:

- Generators, switches, or motor controller cases.
- Fuse boxes, distribution cabinets, frames, tracks, and motors of electrically operated cranes.
- Electrical equipment of elevators, metal frames of non-electric elevators that have electrical conductors attached to them, and metal enclosures.

9. Electrical safety requirements for temporary JSC equipment

JSC temporary equipment must meet the following requirements:

For . . .	***You must . . .***
Temporary lines	• Limit service to 90 days unless approved by the Safety and Test Operations Division. • Guard or elevate open wiring with 600 volts or less 10 feet above walkways to prevent accidental contact by workers who may be carrying construction materials or tools.
Cords and connections	• Use portable power tool cords that have an identified grounding conductor connected to the frame or are double-insulated with a UL label. • Use cords that are connected to the grounding contact of an approved plug and UL-listed for the intended use. • Use an appropriately sized ground fault circuit interrupter (GFCI) near the power source on temporary circuits that power tools
Temporary wiring in tanks or confined spaces	• Provide an FM- or UL-listed switch, properly identified and marked, at or near the entrance to allow you to cut off the current in an emergency. • Protect all circuits by GFCIs and use the lowest voltage possible to accomplish the task.

10. How must I install transformers and service?

If you install or service transformers, you must:

a. Control access to ground level, outdoor transformers by:

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- Completely enclosing them with grounded chain-link fences or nonconductive barriers.
- Locking entrances not under constant observation.
- Posting warning signs for high voltage that prohibit unauthorized entry.
- Maintaining an access list of personnel qualified to enter.

b. Provide for the safe removal of oil spilled during routine maintenance around all outdoor transformers.

c. Make sure that transformers do not contain any traceable amounts of polychlorinated biphenyls (PCBs).

d. Test for PCBs. If you suspect them, take all precautions as if they were present (see Chapter 9.1, "Hazardous materials safety and health," of this Handbook). Contact the Safety and Test Operations Division or the Occupational Health Officer for additional information and instructions.

e. Never place liquid-filled transformers indoors without permission from the Center Operations Directorate.

11. Requirements for installing lighting systems

You must install systems that meet NFPA 70.

12. Features to include when designing an emergency lighting or power system

You must follow NFPA 101 and the requirements listed below when you design emergency lighting systems:

a. Provide an independent source of energy to light work areas, corridors, tunnels, exits, and stairways during a power failure.

b. Provide a visual alarm system to warn of improper operation.

c. Never use circuits or outlets that power emergency lighting chargers for other lights or appliances.

d. Make sure that emergency lights automatically activate when the primary lighting system fails or during a power failure. A failure of any one component in the emergency system must never leave any critical space in total darkness.

e. Make sure that emergency power circuits have an emergency supply source to which the load will be switched automatically when the primary source fails.

f. Provide a switch for testing the emergency lighting system. The test switch must be clearly marked and accessible from the normal working level.

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g. Make sure that generators used to supply emergency power are started, brought up to speed and frequency, and put on line as soon as emergency switching operations can be done safely.

13. Requirements for operating emergency power and lighting systems

You must follow NFPA 30, NSS 8719.11, and the requirements listed below:

a. Put multipurpose dry chemical or carbon dioxide extinguishers next to generators.

b. Store generator fuels in approved containers in a protected location if you must store reserve fuel for a mobile power source.

c. Refuel generators using approved containers and fuel dispensers.

d. As the immediate supervisor, you must make sure that:

- Servicing, operating, or maintaining of emergency power equipment is performed by qualified and certified personnel.
- The maintenance crew is proficient in administrating CPR, familiar with pertinent safety regulations, and supplied with appropriate safety equipment.

e. Use approved plans to do maintenance on emergency lighting and power systems.

f. Have the Electrical Operations Branch, Plant Engineering Division, approve repairs on or modifications to emergency lighting and power systems.

g. Ground portable generators with a grounding rod per 29 CFR 1926.404 (f)(2) & (5).

Requirements for tags and stickers

14. Defective electrical equipment

Remove power from defective electrical equipment immediately. If the equipment could cause personal injury and cannot be repaired immediately, you must attach *DO NOT OPERATE* tags, JSC Form 19A (Appendix 8A). (Note: JSC Form 19A is different than the Lockout/Tagout Tag, JSC Form 1291.) Electrical equipment with these defects requires tags:

a. Poor ground impedance

b. Energized ground wires

c. Exposed wiring

d. Loose receptacle housings

e. Broken receptacles

f. Reversed polarity in shop areas

g. Failure to function unless the cause is known to be non-hazardous.

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15. Who may remove a *DANGER*, *CAUTION*, and *WARNING* tag or sticker

Normally, only you can remove a tag or sticker that you attached. However, when defective electrical outlets are repaired, the repair electrician may remove the tag or sticker and **must notify the person who attached it and the facility manager**.

Requirements for controlling static electricity

16. How to prevent hazardous static discharges

You must bond and ground all systems designed to transfer, store, or handle flammable gases or liquids.

17. Specific design and installation requirements for bonding and grounding these systems

You must follow the requirements listed below to bond and ground systems mentioned in Paragraph 16:

If you are working with . . .	***Then you must . . .***
Flammable gases or liquids	• Use a bond or ground wire with adequate strength, corrosion resistance, and flexibility for the service intended (you may use insulated or non-insulated wire). • Follow NFPA 77, "Static Electricity," for the design of ground systems unless the NASA design standards are more restrictive.
Storage tanks, equipment, and piping	• Ground them in hazardous locations. • Use No. 8 or larger wire. • Make sure the resistance of the tank, piping, or equipment to ground is 1 ohms or less. • Use a grounding cable and a bonding cable between a tank and a filling source to equalize the electrical potential.
Submerged filling lines	• Use lines of a size and construction that minimize turbulence in and velocity of the liquid during filling operations. • If possible, keep the linear velocity of liquid in the pipe at or below 3.3 ft/sec.
Grounding or bonding connections	• Weld, braze, or bolt connect permanent bonding and grounding connections. • Use battery clamps or screw clamps for temporary connections. • Never use a power circuit neutral wire as a static bond or ground line, even if it is the right size.

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18. Specific operational requirements for bonding and grounding temporary storage vessels

You must ground transport vessels, portable containers, and other types of temporary storage vessels while transferring flammable liquids or gases. Visually check the grounding and bonding system before each transfer operation to make sure that all connections are good and there is a continuous path to ground. Periodically check the grounding system with the appropriate test equipment.

19. Hazards of static discharges

You could be seriously injured if exposed to the following hazards:

a. An explosion could occur in a flammable atmosphere by a spark from a charged object near a ground line or another charged object.

b. A large enough static discharge could set off igniter circuits.

c. Although static electricity is not lethal, your reaction to a shock may be enough to cause you injury or cause you to damage equipment.

Other electrical safety requirements

20. Precautions for reconnecting or restarting critical equipment after an electrical maintenance or a power outage

You or your organization must check to make sure that voltage, phase, polarity, current-limiting capability, etc. are correct. Contact the Electrical Operations Office for help.

21. Training for working on electrical equipment

You must be either a trained and authorized electrician, or electrical tradesmen to install, maintain, and operate electrical facilities and power lines. You must also have lockout/tagout training described in Chapter 8.2 of this Handbook.

To maintain electrical equipment or work with exposed energized circuits, you must be fully trained in electrical safe work practices, emergency procedures, first aid, and CPR. This includes periodic refresher training.

To work on energized equipment, you must be a qualified and authorized electrician. To work on high-voltage systems, you must be certified and have a Hazardous Operations Permit.

See Chapters 4.1, “Program description” (for safety and health training) and 5.8, “Hazardous operations: safe practice and certification,” of this Handbook for more requirements on training and certification.

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22. PPE for electrical work

You must follow these requirements for PPE and use any other PPE identified in a Job Hazard Analysis. See Chapter 5.6, "Personal protective equipment," of this Handbook for more requirements on PPE:

For . . .	***You must . . .***
All PPE	• Inspect PPE before each use to make sure the insulating qualities provide adequate protection.
Electrically insulating rubber equipment	• Use equipment that is classified and marked Class 0-4, and that meets the design requirements of 29 CFR 1910.137(a), "Electrical Protective Devices." • Inspect and test equipment to meet the requirements of 29 CFR 1910.137(b).
Safety gloves	• Use gloves designed for electrical work and inspect them for cuts, punctures, or signs of wear before beginning work. • Never use gloves with an insulation rating less than the working voltage. • Wear leather gloves over the safety gloves to avoid cutting or tearing them. • Make sure the gloves have been inspected and tested at least every 6 months as described in 29 CFR 1910.137(b).
Lineman's spurs	• Use spurs that are at least 1-1/4-inch long. • Make sure they have safety covers to cover the gaffs when not in use.
Safety belts	• Use belts for climbing to over 4 feet above the ground (see Chapter 5.6 for specific requirements).
Ladders	• Use nonconductive ladders that meet 29 CFR 1910.25, "Portable Wood Ladders,", 29 CFR 1910.268(H), 29 CFR 1910.269-1(H), and American National Standards Institute (ANSI) standards if doing maintenance on or near electrical equipment (see Chapter 5.7, "Ladders, scaffolds, and elevated platforms: how to work with them safely," of this Handbook for specific requirements).

23. What you must do in an electrical emergency

You must take the following actions for these emergency situations:

a. For ***electrical shock*** you must:

- Switch the power off and free the worker from the power source if he or she gets a disabling electrical shock (the primary hazard).
- Use protective clothing or a long, dry, non-conducting board to remove the victim if you can't de-energize the power circuit. Then give first aid or CPR as needed.
- Call your emergency number as soon as possible.

b. For a ***fire*** you must:

- Evacuate the area.
- Call your emergency number immediately.

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- Use a carbon dioxide or multipurpose dry chemical extinguisher to fight the fire only if you are trained to use an extinguisher properly. See Chapter 3.8, "Emergency preparedness," of this Handbook.

Remember your emergency number: x33333 at JSC and SCTF, x44444 at Ellington Field, 911 at any off-site location, and x5911 at WSTF.

24. Your responsibilities as an electrical supervisor

You must make sure that:

- A lockout/tagout program is in place and that your employees are using it.
- All electrically powered tools are in good working condition.
- All safety devices, cinching locks, and tags are available, maintained, and properly used.
- All assigned personnel follow safety requirements.
- No employee performs any work unless he or she is certified through experience or is under the direct supervision of a foreman or other qualified person.
- Whenever possible, the same electrician removes and reinstalls electrical equipment.

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Chapter 8.2
Lockout/tagout practices

This could be you . . .

An electrician received a shock from a 480-volt alternating current source while modifying a motor controls panel. The hot junction was an undocumented change to the panel. The electrician could have been electrocuted but only suffered injury since the current passed through the arm only.

An operator failed to turn off and lockout a pipe-cutting machine after it stalled. As a result, he lost a finger because he touched the chain and sprocket drive when the machine unexpectedly restarted.

Employees that were not certified to service or operate a crane violated a Do Not Operate tag and operated the crane. They damaged highly valued equipment.

1. Who must follow this Chapter

You must follow this Chapter if you work at JSC, including Ellington Field or Sonny Carter Training Facility, whether a civil service or contactor employee. If you work at a JSC field site, you must follow local requirements that meet the intent of this Chapter. Specific categories of employees under this Chapter are:

a. **Authorized employee**: A person who locks out or tags out machines or equipment to service or maintain those machines or equipment.

b. **Affected employee**: An employee whose job requires him or her to operate or use a machine or equipment on which is being serviced or maintained under lockout/ tagout, or whose job requires him or her to work in an area in which the servicing is being done. An affected employee becomes an authorized employee when the employee's duties include servicing or maintenance covered under lockout/tagout.

c. **Other employee**: An employee whose work operations actually is or potentially may be in an area during the period when energy control procedures will be used.

d. **Task Group Representative (TGR)**: A person that is responsible for the identification and locking/tagging of the energy isolation points during group lockout/tagout. This individual maintains control of the group lock box during the entire duration of the maintenance or service task. A TGR is required for any group lockout tagout (LOTO).

2. JSC's Lockout/Tagout Program

This Chapter is JSC's Lockout/Tagout Standard, designed to implement compliance at JSC, with 29 CFR 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)." It provides a consistent and uniform policy and minimum requirements for locking out and tagging out

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energy isolating devices during maintenance, service, or repairs on machinery, equipment, or systems. The intent of this Chapter is to ensure that machines, equipment and or systems are properly and uniformly locked out and tagged-out, throughout JSC and that **ALL** employees are protected from exposure to an unexpected energy release.

Each project, contractor, or organization may take this basic lockout/tagout standard and add addendums to meet their particular operations and procedures, as long as the intent of the standard is met or exceeded, followed by all employees and strictly enforced.

Projects, contractors, and organizations must develop, document, and use procedures for controlling potentially hazardous energy unless specifically exempted under 29 CFR 1910.147(c)(4)(i). These procedures must meet the requirements in this chapter and must clearly and specifically outline the scope, purpose, authorization, rules, and techniques you will use for controlling hazardous energy, and the means to enforce compliance including, but not limited to the following:

a. A specific statement of the intended use of the procedure.

b. Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy.

c. Specific procedural steps for placing, removing, and transferring lockout/tagout devices or tagout devices and the responsibility for them.

d. Specific requirements for testing a machine or equipment to verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

3. Other Special Conditions

This Chapter does not apply to the following:

a. Work on cord and plug connected electrical equipment where the hazard of unexpected energizing or start up of the equipment is controlled by the unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.

b. Hot tap operations involving transmission and distribution systems for substances such as gas, steam, water or petroleum products on pressurized pipelines, provided that the project, contractor, or organization demonstrates that all of the following are true:

- Continuity of service is essential.
- Shutdown of the system is impractical.
- You follow documented procedures and use special equipment to provide proven effective protection for employees.

4. Contractors

There will be no exceptions to lockout/tagout requirements for work done at JSC facilities.

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If you contract or sub-contact for services; you are responsible for notifying contractors or sub-contractors of this requirement, and must provide a copy of this Chapter to the contractor or sub-contractor. All contractors must make sure that their employees understand and follow this JSC lockout/tagout standard.

Requirements and procedures for Lockout/Tagout

5. General Requirements and Enforcement

The following requirements apply to all employees, machines, and equipment at JSC:

a. If you see a piece of equipment that is locked out or tagged out, you **must never** attempt to start, energize or use that machine or equipment except as required to verify isolation in paragraph 6.g. below.

b. If you are an "authorized employee," you must follow the procedures listed below when locking out or tagging out a component or system.

c. If you violate lockout/tagout, you are subject to disciplinary measures by your employer as described in Chapter 3.7, "Disciplinary System," of this Handbook.

d. When installing new machines or equipment or when replacing, doing major repairs on, renovating, or modifying existing machines or equipment, you must design the energy isolating devices to accept a lockout device."

6. JSC's Basic Lockout/Tagout Requirements

You must follow these steps when maintaining, servicing, or repairing equipment:

a. Prepare for shutdown. Determine the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

b. Notify "affected employees" who operate the equipment you will be working on.

c. Shut down equipment using procedures established for that machine or equipment.

d. Isolate all energy sources.

e. Attach lockout/tagout isolation devices as described in paragraphs 7 and 8 below. Also note the requirements for group lockout and shift changes in paragraphs 12 and 13 below.

f. Release all potential or stored energy, as described in paragraph 9 below.

g. Verify the Isolation, including testing, see paragraph 10.

h. Service, repair, or maintain the equipment.

i. Inspect the work to ensure that all nonessential items have been removed and to ensure that machine or equipment components are operationally intact. Make sure that all employees have been safely positioned and are not in operational area before re-energizing the equipment.

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j. Notify "affected employees" that lockout or tagout devices will be removed.

k. Remove lockout/tagout isolation devices as described in paragraph 11 below.

l. Restore the equipment to operation.

Note: If the equipment you will be working on has another lock or tag, such as the "WARNING" DO NOT OPERATE tag, or another employee's lock and tag, you must still lockout and tagout the equipment per this Chapter before you work on it.

7. Hardware (Locks and Lockout Devices)

Attaching locks, tags and other necessary hardware will ensure that the energy isolation device cannot be inadvertently switched or changed during maintenance or repair activities. To get locks for Lockout, you must follow the "Policy on issuing locks and tags" in Attachment 8.2B, Appendix 8B. The following requirements apply to locks and lockout devices:

a. ***Locks.*** **You must only use locks provided by JSC for isolating, securing, or locking equipment from all potential energy sources.** Dedicated lockout padlocks at JSC must be "RED" in color and individually keyed and numbered. You must never use a RED lock for any other purpose.

b. ***Other lockout devices.*** These include, but are not limited to, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware for isolating, securing or blocking of machines or equipment from energy sources. Your company or organization will provide these devices. They must be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.

8. Lockout Tagout Tags

If you are going to personally work on a system, you must only use the red Lockout Tagout (JSC Form JF1291) and attach them by putting the lockout through the grommet or by using a nylon cable ties provided by JSC. To get tagout tags, you must follow the "Policy on issuing locks and tags" in Attachment 8.2B, Appendix 8B. The following requirements apply to tags:

a. Tags are essentially **informational devices** attached to the lockout devices Tags do not provide the physical restraint provided by a lock. If you use a tag without a lockout device, you must also use other methods to isolate all sources of energy such as block and bleed, blinds, valve hand-wheel removal, etc. These other methods must be at least as effective as a lockout device would have been, if it were used.

b. If an energy-isolating device is not capable of being locked out, you must use a tagout instead. You must also use all reasonable means to make sure that the energy-isolating device is not operated.

c. When a tag is attached for energy isolation, no one may remove it without authorization

of the person responsible for the tag. It must never be bypassed, ignored, or otherwise defeated. The system must not be energized when a tag is in place except under specific conditions per written procedure outlined in this chapter (testing system to ensure there is no power, etc.).

d. You must attach tags either to the padlock or to the same point as the padlock. For energy isolating devices not capable of being locked out, you must attach the tag to the device or as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

e. Tag information must be legible and understandable.

f. You must never use the red LOCKOUT TAGOUT tag as a WARNING, DO NOT OPERATE tag. The LOCKOUT TAGOUT JF 1291 tag means one thing and one thing only: you are personally working on the system.

Note. JSC tags contain log and tag number spaces, which you may use as best fits your needs, but you must address the log and tag numbers in any LOTO procedures you develop.

9. Releasing stored energy

After attaching lockout or tagout devices to energy isolating devices, you must relieve, disconnect, restrain, and render safe all potentially hazardous stored or residual energy. Stored or residual energy could include, but is not limited to electrical capacitors, batteries, contained hydraulic or pneumatic pressure, springs, and suspended weights.

If the stored energy could re-accumulate to a hazardous level, you must continue to verify isolation until the servicing or maintenance is completed, or until the possibility of the energy accumulation no longer exists.

10. Verifying Isolation

Before starting work on the machinery, equipment, or system that has been locked out or tagged out, you as an authorized employee must verify that the equipment has been isolated and de-energized by the following:

a. Verify that personnel are not exposed to potential danger.

b. A qualified person must "Test" the isolation of the equipment by **attempting to energize it, using the normal operating controls** (where possible), to make certain the machinery, equipment, or system will not operate.

c. A qualified person using the appropriate equipment must verify that when previously energized parts that are exposed are free of energy, before removing electrical PPE, or exposing any unprotected persons. If the circuit to be tested is over 600 volts, you must test the test equipment tested for proper operation immediately after the test

d. If pressure sources are involved, verify on a gauge, open a vent valve, or use other positive verification methods.

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Caution: Return operating controls to neutral or off position after attempting to start.

11. LOTO Lock release or removal

Only one key is authorized for each red LOTO lock and LOTO tag and only the person who attached the lock is authorized to remove the lock, and maintains custody of the key. The Task Group Representative is the only person that is authorized to release and remove the LOTO lock and tag from their assigned group lock box.

Special condition to this rule: If the employee who attached the red LOTO lock and LOTO tag is not at the facility, and is unavailable to remove the lock, the supervisor is authorized to remove the lock, after following the procedure below. If you need a red LOTO lock removed, you must contact the employee's supervisor.

If you, as a supervisor, are asked to remove a red LOTO lock with a LOTO tag, you must follow these steps:

a. Confirm that the employee who attached the lock is not at the facility and not available to remove the lock.

b. Attempt to contact the employee. Call, home phone, cell phone, or pager. Document all attempts to contact the employee.

c. Make sure all work is completed and that no employees are exposed to any type of hazards created by removing the lockout/tagout device(s).

d. Notify all affected employees that you will be removing the lock.

e. Have a qualified employee test and visually inspect the equipment, as necessary, to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment can be safely energized.

f. Remove the lock. Avoid destroying the lock if possible by cutting the chain, hasp or other restraining device.

g. Immediately inform the authorized employee whose lock you removed that the lock has been removed when he or she returns to the facility or becomes available, **and before** he or she returns to the task or system where the lockout was in effect. You may need to notify co-workers, leave a phone voice message, an email, or use other means to notify him or her to report to you **before** going to the task or system where the lockout was in effect. You message must say that their lock has been removed and the system is now live or dangerous if work is resumed.

h. Return an undamaged lock to the employee with an explanation of circumstances as soon as possible.

12. Group Lockout

A LOTO application may involve more than one maintenance, repair, or servicing employee

and/or more than one point of energy isolation. Several options exist for "group" LOTO procedures. The primary requirement is that the process used must provide the employee protection equivalent to using a personal lockout/ tagout. This would include use of "controlled key locks" and appropriate tags per a written procedure for the task.

An important element of "Group LOTO" is to enable the TGR to initially lockout and tagout the system and place all LOTO keys and tag tabs in a group lockbox. Then the TGR hangs a LOTO tag with a red LOTO lock on the lock box. The TGR controls the key while they are working the task. Each authorized person must install his or her individual red LOTO lock and LOTO tag on the lockbox. The energy isolation devices must never be released until all authorized personnel and the TGR have removed all locks and tags from the lockbox. The task group representative is responsible for control of the lock box and key. The control responsibility of the task group representative may be transferred between shift changes and job reassignments.

The following two examples for Group LOTO illustrate the range of approaches. These examples are not intended to represent the only acceptable procedures for group LOTO.

a. Single Energy Source & Multiple Maintenance & Servicing Personnel:

- **Single Point with use of multi-lock adapter (Figure 8.2-1)**
  If the equipment operation is the responsibility of a system operator or user, then that individual may configure the equipment without any tag or lock. Each authorized person that will be performing the maintenance or service task must install individual red LOTO lock and LOTO tag at the de-energized single energy control point before starting work. This will often require the use of multi-lock adapter to accommodate the numerous locks. If energy isolation is required during periods where the work area may be unattended by authorized personnel, then a Task Group Representative [TGR] installs a separate red LOTO tag and red LOTO lock at the single energy control point at the time of isolation. The TGR must maintain control of the key throughout the maintenance or service task period.

- **Single point with use of lockbox:**
  An alternate procedure is to use a lockbox when the number of locks and tags are to numerous to be supported by the single energy control point. If the equipment operation is the responsibility of a system operator or user, then that individual may configure the equipment without any tag or lock. The Task Group Representative must attach a red LOTO tag marked or stamped with the words "for Group LOTO" and a red LOTO lock at the de-energized single energy control point at the time of isolation. The key is then placed in the lockbox. The TGR must install a red LOTO tag and a red LOTO lock on the lockbox. The TGR must maintain control of the key throughout the maintenance or service task period until all work is completed and the equipment is safe to reactivate. This provides energy isolation during periods where the work area may be unattended by authorized personnel. The authorized personnel that will be performing the maintenance or service task must each install individual red LOTO lock and LOTO tag on the lockbox before working.

Verify this is the correct version before you use it by checking the on-line version.

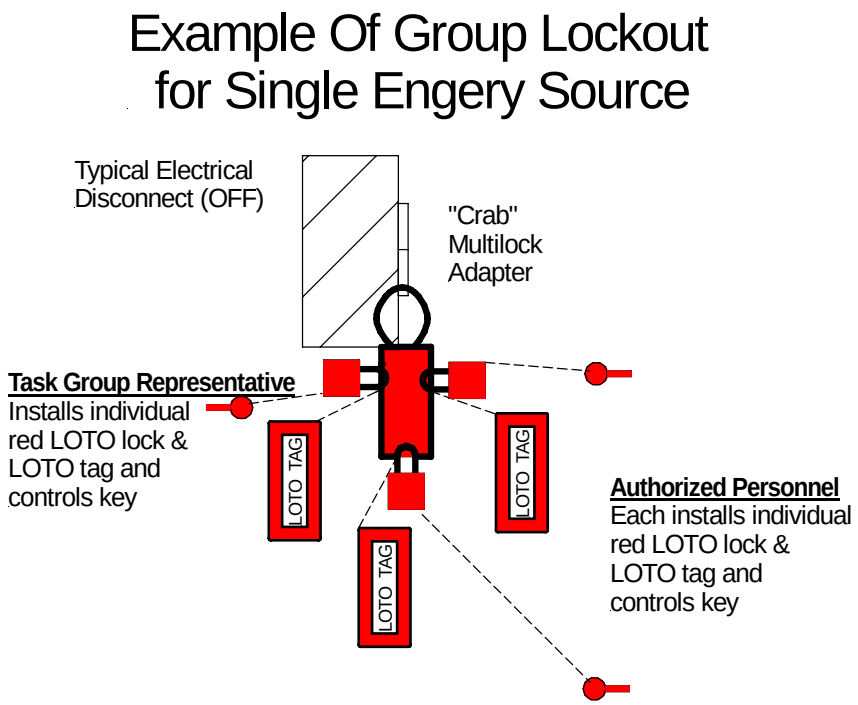

Figure 8.2-1 Group Lockout Tagout Concept For Single Energy Control Point

b. Multiple Energy Sources & Multiple Maintenance & Servicing Personnel:

- **Multiple point sources using lockbox (Figure 8.2-2):**
  An alternate procedure is to use a lockbox when there are multiple energy control points. This alternate procedure applies regardless of requirements by other parties such as control of the equipment operation by a system operator or user and the use of other tags and locks (such as a Do Not Operate tags with appropriate shop or craft locks). The Task Group Representative must attach a red LOTO tag marked or stamped with the works "for Group LOTO" and a red LOTO lock at each energy control point at the time of isolation. The keys are then placed in the lockbox. The TGR must install a red LOTO tag marked or stamped with the words "for Group LOTO" and a red LOTO lock on the lockbox. The TGR must maintain control of the key throughout the maintenance or service task period until all work is completed and the equipment is safe to reactivate. This provides energy isolation during periods where the work area may be unattended by authorized personnel. The authorized personnel that will be performing the maintenance or service task must each install individual red LOTO lock and LOTO tag on the lockbox before working. This option requires the least number of locks and ensures that each person has control of the total system when he or she is working on the system.

Verify this is the correct version before you use it by checking the on-line version.

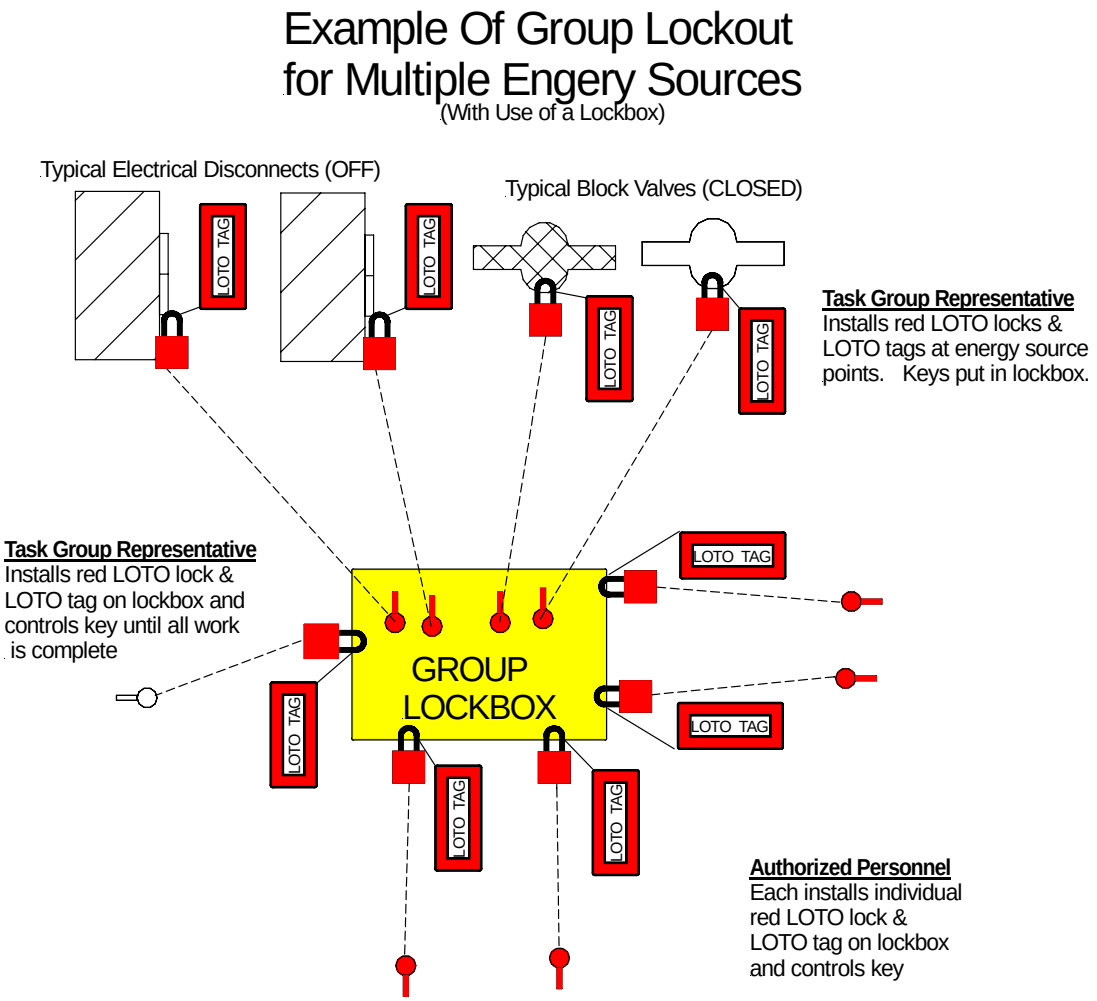

Figure 8.2-2, Group LOTO Multiple Energy Source Control Points

- **<u>Multiple point sources using multilock adapters:</u>**
  If the equipment operation is the responsibility of a system operator or user, then the user or operator may have to use other tags (such as the "Do Not Operate tag") with appropriate shop or craft locks. Each authorized personnel that will be performing the maintenance or service task must install individual red LOTO lock and LOTO tag at each of the multiple energy control points before starting work. To accommodate multiple objectives, this will often require the use of multi-lock adapter to accommodate the numerous locks. The Task Group Representative must attach a red LOTO tag marked or stamped with the words "for Group LOTO" and a red LOTO lock at each energy control point at the time of isolation. This provides ongoing, uninterrupted lockout during periods where the work area may be unattended by authorized personnel. The TGR must maintain control of the keys throughout the maintenance or service task period.

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13. Lockout/tagout during Shift Changes

During the course of work, work crews may take turns working on the locked out equipment. If a new authorized person or crew of authorized persons carries on the work started by an earlier crew, arriving employees must attach their own locks and verify energy isolation and departing employees must remove their locks. Each authorized person must use his or her own red LOTO locks. When multiple shifts work on a locked out system, the Task Group Representative will be responsible to make sure all authorized personnel have either installed individual red LOTO locks and tags at all energy sources or the appropriate group lockbox. Arriving employees must verify energy isolation.

a. When a system must be handed over to a new crew to continue the work and there is equipment already locked and tagged out, this constitutes a shift change and you must follow these steps:

- Inform the arriving shift or crew of the devices, hazards and other employees that are involved in this particular lockout/ tagout operation.
- The employees on arriving shift or crew attach their lockout and tagout devices on the isolation device(s) that are currently locked and tagged.
- The employees on the departing shift remove their lockout and tagout devices.
- The Task Group Representative for the departing group will be the last person of the departing group to remove his or her lock; this ensures energy isolation at all times until the new Task Group Representative is ready to accept the responsibility. Similarly, the arriving Task Group Representative will be the first person of arriving group to attach his or her lock prior to or immediately after the previous Task Group Representative removed his or her lock. Both Task Group Representatives will witness the transfer of energy isolation control and note the transfer in task documentation.
- The current TGR must verify energy isolation for the system.

b. When lockout/tagout is to be handed over from one Task Group Representative to another while the work is continued by the same authorized employees, this does not constitute a shift change. However, the task documentation must be annotated to document this transfer of energy isolation control.

- Inform all authorized personnel working on the system of the impending transfer of lockout/tagout authority.
- The departing Task Group Representative will remove his or her lock and the new Task Group Representative will attach his or her lock prior to the previous Task Group Representative removing his or her lock. Both Task Group Representatives will witness the transfer and note the transfer in task documentation.

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Training and Audits

14. Training for Lockout/Tagout

A competent person must conduct lockout/ tagout training and the training must follow the requirements of Chapter 4.1 of this handbook for conduct and documentation.

a. ***Initial Training.*** Each employee involved in Lockout/Tagout or Energy Control as described in the bullets below must be trained in the purpose and scope of the lockout/tagout program, recognizing hazardous energy sources, methods and means necessary for energy isolation, and using the lockout/tagout procedures. Training for the three types of employees (***authorized, affected, and other***) is based on the relationship of that employee's job to the equipment being locked out or tagged out as follows:

- If you are an ***authorized employee*** (you lockout/tagout and service or maintain equipment), your training must cover details about the type and magnitude of the hazardous energy sources present in the workplace and methods and means necessary to isolate and control energy sources.
- If you are an ***affected or other employee*** (you operate or use the machines), your training must cover: recognizing when the control procedure is in place, understanding the purpose of the procedure, and understanding the importance of not attempting to start up or use equipment that has been locked out or tagged out.

b. ***New-hire training.*** If you are a new employee, you must attend lockout/tagout training before doing any tasks that could expose you to energy hazards. Your supervisor must tell you if you require lockout/tagout training when you are first assigned to work.

c. ***Retraining.*** As an authorized employee, you require retraining at least every 2 years or:

- When there is a change in lockout/tagout or energy control procedures.
- Whenever a periodic inspection reveals, or whenever the employer has reason to believe, there are deviations from or inadequacies in your knowledge or use of the lockout/tagout or energy control procedures.

15. Periodic audits of JSC's Lockout/Tagout program

Each organization or contractor is responsible for continuously monitoring and periodically auditing (at least annually) its Lockout/Tagout and Energy Control programs. The audit must follow the requirements of 29 CFR 1910.147 (c) (6) and must be documented.

The Safety and Test Operations Division will audit JSC's lockout/tagout program at least annually by inspecting organization and contractor documentation to ensure that all effected employees understand and are following the program. The Responsible Account Executive will review any deviations noted on the audit and forward them to the responsible organization or contractor for correction.

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Chapter 8.3
Shop safety

This could be you . . .

A wood shop worker was cut by a band saw that was left running without supervision.

A paint shop worker felt dizzy while spray painting with poor ventilation.

1. Who must follow this chapter

You must follow this chapter if you work with general shop equipment in machine shops, model shops, woodworking shops, paint shops, sheet metal shops, and electronics fabrication shops and other areas where shop equipment may be used.

2. What this chapter covers

This chapter tells you the safe procedures you must use when working with shop equipment, spray painting equipment, and compressed air equipment.

Requirements for working in machine shops

3. Machine safeguards to be aware of when using shop equipment

You must make sure that the appropriate machine safeguards are properly in place and secured before operating power tools. Never remove or disable machine safeguards or other safety devices while the equipment is in operation. You must use the lockout/tagout practices in Chapter 8.2, "Lockout/tagout practices," of this Handbook when removing guards, except for minor adjustments and setup. You are encouraged to use the "buddy system" when working in a machine shop – it is best to have two people in the shop when work is being done. To safeguard machines, you may:

a. Use guards such as:

- Fixed
- Interlocked
- Adjustable
- Self-adjusting

b. Use safeguarding devices such as:

- Presence-sensing devices
- Pullbacks

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- Restraints
- Safety trip controls
- Two-hand controls
- Two-hand trips
- Gates

c. Safeguard machines by location, distance, and feeding and ejection methods.

4. Safety practices to follow when using grinding wheels

If you use grinding wheels, then you must follow these requirements and those in 29 CFR 1910.215, “Abrasive Wheel Machinery”:

a. Only the point of the grinding wheel you use for grinding may be left open. Keep grinding wheel guards in place and adjusted at all times.

b. You must secure grinding wheels to spindles by flange nuts, and you must firmly fix all mountings to the tool.

c. You must never operate a grinder without the wheel guards in place.

d. One-eighth inch is the maximum clearance for a tool rest from the abrasive wheel.

e. One-fourth inch is the maximum clearance for a tongue guard from the abrasive wheel.

f. You must mount abrasive wheels between flanges (with blotters) not less than one-third the diameter of the wheel, except those which contain a mounting device as an integral part of the assembly.

g. You must visually inspect the wheels before mounting them for defects and other deformities that would make the wheels unsafe for use.

h. Never operate grinding wheels at speeds in excess of the manufacturer safe speed rating.

i. You must care for, use, and protect abrasive wheels for portable power tools in accordance with 29 CFR 1910.243, "Guarding of Portable Powered Tools."

j. Keep combustible or flammable materials away from grinding wheels to prevent ignition from sparks.

5. When to anchor shop equipment

You must securely anchor machines made for a fixed location. For example:

a. Pedestal grinders and buffers

b. Band saws

c. Drills

d. Mills

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e. Lathes

f. Power cutters

g. Table top and floor-mounted equipment

h. Other similar equipment

6. Safety practices for doing maintenance work

You must never repair machinery while it is in operation. You must always follow the lockout/tagout practices in Chapter 8.2, "Lockout/tagout practices," of this Handbook before any maintenance work starts. If you fail to follow these practices, you may expose yourself or a worker to serious bodily harm. Don't clean or lubricate machinery while in operation unless it has a remote oil receiver.

7. How to clean shop equipment

When at all possible, you must use brushes or vacuum equipment to remove chips, burrs, and metal particles from machines. Don't use your hands to remove debris from the equipment.

You may use shop air to clean equipment and work surfaces only when these conditions are met:

a. Air pressure at the nozzle is less than 30 pounds psi.

b. The air nozzle contains a protective screen.

c. Protective guarding is in place for the operator and bystanders from projectiles and hazardous chemicals.

d. You use appropriate personal protective equipment (PPE) to include gloves and goggles.

8. When to release energy sources in equipment

To prevent injury from the sudden release of energy, you must:

a. Release the energy that is built up in equipment when you are through working with the equipment. You may encounter energy sources such as the following:

- Hydraulic pressure
- Compressed air
- Spring energy
- Potential energy in suspended parts
- Mechanical movement you don't expect

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b. Always follow lockout/tagout practices and test to see if there is any energy in the equipment before you start any maintenance work. See Chapter 8.2, "Lockout/tagout practices," of this Handbook.

9. How to secure your work

You must secure work by jigs, clamps, or other devices made to secure work.

10. Safely adjusting machines

You must remove chuck keys, wrenches, and drifts from a machine to a safe location before starting the machine. Spring-loaded chuck keys are commercially available for lathes and are recommended. Never attempt to make adjustments using these devices while the machinery is in motion or when the power source is on.

11. Supervising operating machinery

You must always supervise operating machinery. Never leave machinery running while you aren't with it. Computer Numerical Control machinery that has enclosure guards with integrated safety locks may be left alone with minimal supervision.

12. Controlling combustible dusts or ignitable fibers or flyings

You must make sure that machines producing combustible dusts or ignitable fibers or flyings have exhaust hoods and an exhaust system that efficiently remove them. This system must prevent the accumulation of combustible dusts or ignitable fibers or flyings in the exhaust ducts. Electrical equipment must meet NFPA 70, National Electric Code.

Requirements for using paint spray booths

13. Safely caring for paint spraying equipment and paint containers

To prevent flammable or toxic vapors you must:

a. Tightly seal the lids on all paint, thinner, and solvent containers except when transferring the liquid from one container to another.

b. Ground the dispensing container and bond the receiving container when dispensing flammable or combustible liquids from one metal container to another container. This will prevent sparks of static electricity from discharging that could ignite the vapors.

c. Release the air pressure from spray paint pots before removing lids. You must securely fasten the lids before pressurizing the containers.

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14. Caring for exhaust duct filters

To care for filters you must:

a. Clean or change exhaust duct filters frequently to ensure proper airflow (normally an open-face velocity of 100 linear feet-per-minute). You can determine the proper airflow through training and by using flow manometers—either handheld or mounted on the booth.

b. Remove the used filters to a safe place and properly dispose of them as hazardous waste.

15. Where to safely use cleaning solvents

If you use solvents with a flash point less than 100°F for cleaning or thinning, you must use them in a paint spray booth. You may use solvents with a flash point of 100°F or greater outside of a paint spray booth. (You can find the flash point on the Material Safety Data Sheet.) Be careful that rubbing the surface to be cleaned with a cloth doesn't cause friction, which could ignite the vapors.

16. Storing painter's clothing

Store painter's clothing in a clothing storage locker or container designed to store painter's clothing. Clothing you store for future use must be in good condition and reasonably free of undried paints or solvents (other than water). Dispose of wet or torn clothing in appropriate waste containers.

17. Smoking in a paint shop

You must never smoke in a paint shop. NO SMOKING signs must be visible in all spray-painting buildings or rooms and on the doors of paint storage rooms and cabinets.

18. safety precautions for using spray booths

You must conduct spray-painting in a booth enclosure, if at all possible, and observe the following requirements:

a. Follow Chapter 9.1, "Hazardous materials safety and health," and Chapter 9.2, "Hazard communication," of this Handbook.

b. Follow NFPA 33, NFPA 91, 29 CFR 1910.107, and the ACGIH Industrial Ventilation Manual of Recommended Practices.

c. Turn on ventilation equipment before starting operations.

d. Leave the ventilation equipment on for a sufficient length of time after operations are complete to prevent buildup of explosive mixtures in the booth and vent stack.

e. Never point spray guns at other personnel.

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f. Always spray-paint in the direction of air flow to minimize the buildup of harmful mists in the booth.

g. Never allow your body to come between the ventilation exhaust and your work.

h. Never use the same spray booth for different types of coating materials if their combination may cause spontaneous combustion.

i. Never store more than one day's worth of volatile (flammable) liquids in spraying rooms.

j. Remove empty containers from spraying rooms immediately.

k. Only use proper electrical equipment made for flammable atmospheres in spraying rooms or booths when working in hazardous locations as found in the National Fire Protection Association (NFPA) 70, NEC, Article 500, "Hazardous Locations."

19. Storing paints and chemicals

You must follow these requirements:

a. Limit the amount of combustible paint you have outside of an approved paint storage room or cabinet to what you would anticipate using in one day or to 25 gallons, whichever is less.

b. Never store more than 60 gallons of combustible paint in a paint storage cabinet. Always check the maximum capacity for the storage cabinet you are using and never exceed its maximum rating.

c. Never have more than two such paint storage cabinets in any paint shop.

d. Locate paint storage cabinets at least 5 feet from doorways.

e. Store chemicals in proper locations as required by JSC regulations and the manufacturer's recommendations.

20. Where to locate fire extinguishers

You must keep a suitable fire extinguisher near each door of each paint shop with clear access to the extinguisher.

21. Safety valves on compressed air equipment

You must install a pressure-reducing valve on the air line between the compressor and the container on all spraying equipment. Install an additional safety relief valve and pressure gauge between the reducing valve and the paint container.

22. Safe housekeeping practices

You must follow these requirements:

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a. Keep all spraying areas clean and as free from deposits of combustible residues as practical. If necessary, you must clean daily.

b. Avoid the accumulation of paint residue on all safety devices. You must protect sprinkler heads from paint residue with thin paper sacks loosely tied over them.

c. Keep both clean and dirty rags, paper, paint, and other waste materials in covered metal cans. You must:

- Label the cans to identify the contents of each container.
- Deposit rags with paint, thinner, or other flammable substances on them in the dirty rag container immediately after use.
- Dispose of the contents of the dirty rag container at the end of each shift, or more frequently if necessary.

d. Use only an approved (Underwriters Laboratories [UL] and Factory Mutual [FM]) metal container, to reduce the chances of spontaneous combustion.

23. Protecting against static charges

You must effectively ground or bond all metal- and fabric-covered objects that may produce static charges before spray-painting. The grounding or bonding must be a metal-to-metal contact to be effective. Do continuity checks periodically on the bonding or grounding clamps and wire to make sure they remain effective.

24. Controlling vapors

You must dry painted or lacquered objects under conditions that minimize all risk of fire, explosion, and occupational illness. Evacuate, condense, or destroy vapors from drying objects. If you evacuate the vapors to an outside area, make sure no ignition sources are nearby.

Other requirements

25. Safety practices for using portable compressed air equipment

You must use pressure vessels, regulators, valves, etc., that meet the American Society of Mechanical Engineers codes and standards and Occupational Safety and Health Administration (OSHA) requirements. You must also:

a. Guard air hoses laid across aisles, floors, or doorways with a bridge or floor molding or by suspending them overhead.

b. Visually inspect all equipment before use. You must test pressure regulators, safety relief valves, and pressure vessels as described in JPR 1710.13, “Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems,” (current version). Tag damaged hoses “Do Not Use” and remove them from service.

Verify this is the correct version before you use it by checking the on-line version.

c. Use only manufacturers' approved connectors and hose attachments, to ensure long life and reduce hose damage.

d. Never direct a jet of air at another person. Never clean personal clothing with compressed air at any time. You must never lock open air supply control valves at any time. They must always be free for immediate hand control.

e. Have enough personnel to safely operate large, heavy-duty compressed air tools.

f. Turn air off at the base control valves and release pressure before changing or disconnecting any pneumatic tool. You must:

- Turn off the main operating valves of the pneumatic tools before connecting compressed air supply lines to the tools.
- Connect safety chains to tool housings or between hose connectors on those tools using a ½-inch or larger hose.
- Secure pneumatic power hand tools to the hose by some positive means to prevent their accidentally disconnecting.

g. Make sure that nearby personnel and passersby are clear of potential hazards before you start using compressed air equipment.

h. Never operate air compressors at speeds greater than the manufacturer's recommendation. Do not allow the equipment to overheat. You must install safety clips or retainers on pneumatic impact tools. Regulate shop air used for cleaning or drying purposes to 30 psi or less.

i. Spray air only through air nozzles that contain a protective screen and regulate the air to pressures no greater than 30 pounds psi-gauge.

26. Required safety analyses for operating shop equipment

You must do a Job Hazard Analysis for all new and existing shop equipment. See Chapter 2.4, "Hazard analysis," of this Handbook for guidance and risk acceptance. You must review and update all Job Hazard Analyses annually.

27. Training for operating shop equipment

You must have the proper training and authorization specific to each piece of equipment to operate shop equipment. You may supervise other employees who don't have the proper training or authority if you have the proper training and authorization to the equipment. You must be familiar with the Job Hazard Analysis for each machine you use. See Chapter 4.1, "Program description" (for safety and health training) of this Handbook for more requirements on training.

28. Personal protective equipment

See Chapter 5.6, "Personal protective equipment," of this Handbook for more requirements on PPE. You must:

a. Wear face shields and goggles or safety glasses with side shields, when operating shop equipment. Your eye protection must meet American National Standards Institute (ANSI) Z87.1.

b. Wear close-fitting apparel and avoid wearing loose clothing and jewelry.

c. Qualify under your respiratory protection program if you must wear any type of respiratory protection. See Chapter 7.2, "Respiratory protection," for information.

29. Other standards

In addition to the requirements of this section, you must follow the applicable woodworking and machine shop standards of OSHA:

a. 29 CFR 1910.211, "Definitions"

b. 29 CFR 1910.212, "General Requirements for All Machines"

c. 29 CFR 1910.213, "Woodworking Machinery Requirements"

d. 29 CFR 1910.215, "Abrasive Wheel Machinery"

e. 29 CFR 1910.217, "Mechanical Power Presses"

f. 29 CFR 1910.219, "Mechanical Power Transmission Apparatus"

g. 29 CFR 1910.107, "Spray Finishing Using Flammable and Combustible Materials"

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Chapter 8.4
Welding, cutting, and brazing safely

This could be you . . .

A welder was welding on a pressure vessel suspended from a chain hoist when the hook on the hoist turned cherry red hot. The welder had forgotten to ground his work piece. The arc welding system had found its own ground path through the vessel, through the hook on the hoist, through the building structure, and back to the welding machine. No one was injured, but the work was delayed for extra inspections, because of the improper weld.

Two welders were welding on an overhead bridge crane when sparks fell approximately 40 feet into a titanium and magnesium scrap metal container below, causing a fire in the container. No one was hurt, but time was lost in the machine shop due to the evacuation of the building and the clean up required by the fire.

1. Who must follow this chapter

You must follow this chapter if you do arc or heliarc welding, gas welding or cutting, or brazing.

2. General requirements for welding, cutting, or brazing

You must follow the general requirements given below:

a. Have a copy of the Material Safety Data Sheet (MSDS) in your shop for every type of welding rod used.

b. Have a valid JSC Form 1475, “Hot Work-Welding-Cutting Permit,” for all burning, cutting, or welding operations in all areas other than welding shops. See Chapter 5.8, “Hazardous operations: safe practices and certification,” Paragraph 12, of this Handbook for more information. To create a permanent welding or hot work area, follow the procedure in Chapter 5.8, Paragraphs 9 – 11.

c. Complete and get approvals on a JSC Form 992, “Confined Space Entry Procedure,” and JSC Form 1476, "Confined Space Entry Permit," for all welding operations done in confined spaces. (See Chapter 6.10, “Entering confined spaces,” of this Handbook.)

d. Observe the requirements of Chapter 5.6, “Personal protective equipment,” for fall protection and Chapter 8.7, “Ladders, scaffolds, and elevated platforms: how to work with them safely,” of this Handbook when working at heights of 4 feet or more above adjoining surfaces.

e. Keep welding cable and other equipment clear of all areas where others may be working.

f. Have helmets, shields, aprons, gloves, gauntlets, and other personal protective clothing required for each individual on the job.

Verify this is the correct version before you use it by checking the on-line version.

g. Never weld, cut, or braze painted surfaces. The paint may contain lead, chromium, or other hazardous compounds that will cause significant exposures when heated or burned. The paint must be properly removed before painting. The Occupational Safety and Health Administration (OSHA) has regulations governing the proper removal of paint containing lead, chromium, and other metals. If you are not sure about the compounds in the painted surfaces, contact Occupational Health Services, (281) 483-6726. They will analyze the paint and provide recommendations for the safe removal of the paint before cutting, welding, or brazing.

3. Fire precautions for welding, cutting, and brazing operations

You must take the following fire precautions:

a. Observe the requirements of Chapter 5.1, "Fire safety," of this Handbook.

b. Provide and maintain suitable fire extinguishing equipment for instant use.

c. Provide a properly trained fire watch for all welding or cutting where other than a minor fire may develop. A fire watch must stay at the work site for at least 30 minutes after the burn operation. See Chapter 5.8, "Hazardous operations: safe practices and certification," Paragraph 9, of this Handbook for more information.

d. Before starting the job, remove, guard, or cover all materials or structures that might catch fire with a fire-resistive covering.

e. Where practicable, move all combustible materials at least 35 feet from the work site.

f. Take precautions to prevent sparks or slag from falling through floor openings or cracks that can't be covered onto combustible material below.

g. Don't weld, cut, or braze any unidentifiable material.

h. Have all areas and vessels that could have flammable or explosives materials present checked out by the Occupational Health Branch.

i. Don't weld, cut, or braze near flammable or explosives materials.

4. When to use mechanical ventilation for welding

You must have mechanical ventilation if you weld in a:

a. Room with less than 10,000 cubic feet per welder.

b. Room with ceilings less than 16 feet high.

c. Confined space.

d. Room in which it is recommended by Occupational Health Services to control exposures to welding fumes.

5. General requirements for welding, cutting, or brazing in a confined space

You must follow the general requirements given below:

Verify this is the correct version before you use it by checking the on-line version.

a. Observe the requirements of Chapter 6.10 “Entering confined spaces,” of this Handbook.

b. Leave the gas cylinders and welding machines outside the confined space.

c. Remove all welding electrodes and torch valves when you are not in the confined space.

6. Local ventilation for welding on specific metals

You must have adequate local ventilation such as an exhaust hood or snorkel, if you weld or cut on the following materials:

a. Beryllium

b. Cadmium

c. Fluorides

d. Lead

e. Mercury

f. Stainless steel

g. Zinc

7. General requirements for gas welding

You must:

a. Never use acetylene at pressures over 15 pounds psi-gauge pressure.

b. Use the special T-wrench to open the cylinder and leave it close to the cylinder for emergency use.

c. Handle the cylinders carefully.

d. Always use the cylinders in the upright position. Never store an acetylene cylinder on its side.

e. Have flash back protection on the cylinder.

f. Close and cap all cylinders not in use.

g. Avoid all oil and grease contact with oxygen cylinders.

8. Caring for hoses

You must properly care for your hoses by:

a. Protecting the hoses from damage.

b. Visually inspecting the hoses for leaks.

c. Repairing or replacing hoses that have damage.

d. Using only standard ferrules or clamps on all hoses.

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e. Not using tape or wire for holding hoses onto attachment points.

f. Regularly operate any relief valves to make sure that they work.

9. Storing cylinders

You must store your cylinders upright at all times during use, storage, and transportation. When not in use, store oxygen cylinders separately from fuel gas cylinders or combustible materials (especially oil and grease) by a minimum distance of 20 feet or by a ½-hour fire wall at least 5 feet high.

10. Requirements for arc welding

You must observe the following:

a. Ground all motor-generators and electrical equipment properly.

b. Ground the work piece properly.

c. Check connections before starting the welding machine.

d. Wear appropriate personal protective equipment (PPE) as called out on the MSDS and by your supervisors.

e. Make sure that your helper also wears appropriate PPE.

f. Use helmets, shields, and appropriate clothing to protect against flash burns and sparks.

g. Protect terminals for welding leads against accidental electrical contact by personnel or metal objects.

11. Certification required for welding at JSC

For the safety of all personnel, you must be certified for the welding process, material, and hardware type you will weld. Use the certification requirements in the following publications that are appropriate to what you are welding:

a. Flight Hardware – AMS-STD-1595, Qualification of Aircraft, Missile, and Aerospace Fusion Welders

b. Structural Hardware – AWS B2.1, Standard for Weld Procedure and Performance Qualification

c. Pressure Systems – ASME Section IX, Welding and Brazing Qualifications

12. For more information on welding, cutting, and brazing

You can find more information on welding, cutting, and brazing in these documents:

a. 29 CFR 1910, Subpart Q, “Welding, Cutting, and Brazing”

Verify this is the correct version before you use it by checking the on-line version.

b. NIOSH 75-115, “Engineering Controls for Welding Fumes”

c. NIOSH 78-138, “Safety and Health in Arc Welding and Gas Welding and Cutting”

d. NIOSH 77-131, “Welding Safety”

e. NIOSH 79-125, “Assessment of Selected Control Technology Techniques for Welding, Fumes”

Chapter 8.5
Lifting operations and equipment safety

This could be you . . .

A crane load fell 3 feet from a 20-ton overhead crane hook. The operator was concentrating on the load itself and not the path of travel. A section of the hoist rope hung-up on an air handler pulley cover in the path of travel. The hoist rope unseated itself and dropped the load. The crane had to be shut down, maintained, and inspected before it could be used again.

1. Who must follow this chapter

You must follow this chapter if you manage, operate, service, or maintain lifting equipment as described in Paragraph 2 below. Paragraph 15 lists the responsibilities of organizational directors, program managers, contract project managers, the Facilities Engineering Division, the Center Operations Directorate, the Logistics Division , the Safety and Test Operations Division, and Program Offices.

2. What this chapter covers

This chapter covers minimum safety requirements for operating any mechanical device designed for lifting or lowering, where there is an increased risk to people or hardware that are in addition to the requirements in NASA-STD 8719.9, " Standard for Lifting Devices and Equipment" and JPD 8719.1, "JSC Material Handling Policy." It applies to overhead and mobile cranes, powered industrial forklift trucks, manually operated material handling equipment, and commercially owned cranes used at JSC.

Requirements for lifting operations and equipment safety

3. Requirements for lifting equipment and operations

All lifting equipment and operations must at least meet the requirements for "non-critical lifts" in NASA-STD 8719.9, " Standard for Lifting Devices and Equipment," JPD 8719.1, "JSC Material Handling Policy," and other requirements listed in this chapter. NASA-STD 8719.9 covers requirements for design, testing, inspection, maintenance, operational, personnel certification and marking requirements for lifting devices and associated equipment used to support NASA operations.

Use the pre-lift checklist in JPD 8719.1, JSC Form 941, "Pre-Lift Checklist." to plan and evaluate your lifting operations.

Verify this is the correct version before you use it by checking the on-line version.

4. Requirements for critical lifts

Critical lifts involve lifting and lowering special high-dollar items, such as spacecraft, one-of-a-kind articles, or major facility components, whose loss would have serious program impact. Critical lifts also include operations with personnel and equipment safety concerns beyond normal lifting hazards.

Critical lifts must also follow the requirements for "critical lifts" in NASA-STD 8719.9. Safety personnel must monitor critical lifts to ensure they follow NASA-STD 8719.9. Critical lift requirements include:

5. Commercially owned cranes

Commercially owned cranes are contractor or subcontractor owned, rented, or leased cranes. These cranes must meet Occupational Safety and Health Administration (OSHA) requirements and American Society of Mechanical Engineers (ASME) B30.5, "Mobile and Locomotive Cranes." Before using a crane for a lift, you must provide the Safety and Test Operations Division with the following information:

a. Type of crane and capacity.

b. The kind of lift (critical or non-critical) the crane will make. Critical lifts must meet the requirements in Paragraph 4 above.

c. The item to be lifted, the weight of the item, and location of the lift.

d. The purpose of the lift (task).

e. The schedule, estimated start and completion.

f. Any other pertinent information to include the crane's load chart and a pre-lift checklist as described in JPD 8719.1, JSC Form 941, "Pre-Lift Checklist.".

6. Requirements for powered industrial forklift trucks

Forklift trucks must meet the design and construction requirements established in the ASME) B56.1, "Safety Standard for High Lift and Low Lift Trucks," and 29 CFR 1910.178, "Powered Industrial Trucks." Chapter 12 of NASA-STD 8719.9 lists safe operating requirements for powered industrial trucks (forklifts).

If you use a forklift, you must follow these requirements:

a. Inspect the forklift per paragraph 12.4 of NASA-STD 8719.9 and document periodic inspections per sub-paragraph 12.4.7.

b. Never allow motors to idle for a long period of time in enclosed or semi-enclosed areas.

c. Charge batteries only in well ventilated areas that meet ASME 56.1 and NFPA 505. Keep vent caps in place to avoid electrolyte spray when charging batteries of electric forklifts. Make sure that vent caps are functioning.

d. If you use forklift extensions; you must:

Verify this is the correct version before you use it by checking the on-line version.

- Follow ASME 56.1.
- Have the forklift manufacturer approve them for use on that forklift.
- Follow the manufacturer's recommendations.
- Uniquely identify the extensions.
- Modify the forklift's load chart.
- Never make extensions in house, without approval from the forklift manufacturer.

7. Requirements for other lifting equipment

Use other lifting equipment such as low-lift pallet trucks, hand trucks, man lifts, aerial platforms, and dollies only for the purpose intended by the manufacturer. Never operate this equipment unless you have been trained and certified to use it properly. You must follow manufacturer's instructions and appropriate chapters of NASA-STD 8719.9.

8. Possible issues during lifting operations

If you will handle anything on this list, make sure you follow the requirements given before you start you lifting operations.

For handling and storing . . .	***Follow this standard . . .***
Hazardous materials	Chapter 5.1, "Fire safety," and Part 9, "Safety and health practices for hazardous materials," of this Handbook.
Flammable liquids and gases	Material Safety Data Sheets (MSDSs) and other procedures found in Chapter 5.1 of this Handbook.
Cryogenic materials	Chapter 6.5, "Cryogenic materials and gases: how to work with them safely," of this Handbook.
Explosives and propellants	Chapter 9.5, "Explosives and propellants safety," and Chapter 9.1, "Hazardous materials safety and health," of this Handbook. Appropriate paragraphs of NASA-STD 8719.9.

9. Requirements for slings and rigging equipment

Slings and rigging equipment must meet the requirements in NASA-STD 8719.9. This includes:

a. Testing per paragraph 10.3.

b. Inspection per paragraph 10.4 and supporting documentation per sub-paragraph 10.4.7.

10. Precautions for moving or operating a mobile crane

If you are in charge of traveling or operating mobile cranes, you must follow these requirements as well as the requirements in NASA-STD 8719.9, paragraph 5.7:

Verify this is the correct version before you use it by checking the on-line version.

c. Determine the path of travel and inspect it for hazards before the operation begins. Make sure clearances along the path of travel are adequate. Pay special attention to the following:
   - Power lines: keep them clear of the crane at all times
   - Personnel or objects in the crane's path of travel
   - Weight limits for the roadway or bridges

d. Appoint a person responsible for determining and controlling the safety of the operation. These responsibilities include positioning of the crane and the load, boom extension and radius, ground support, travel route, and speed of movement.

e. Hold a pre-departure crew safety meeting. Discuss the route and any hazards or conditions that the crane might encounter such as proximity of overhead power lines, close vertical or horizontal clearances, speed limits, planned stops, escort positions, and other special instructions. Make sure that no one other than required operating personnel are permitted on the equipment being moved.

f. Make sure that safe load capacities, operating speeds, and other essential data are posted in or on equipment being driven or transported.

g. Take these actions when moving a crane:
   - Use flags and warning signs on the crane or vehicle before moving it with a secondary vehicle such as a flatbed trailer.
   - Avoid sudden starts and stops to keep control of the crane.
   - Stop if you encounter overhead power lines and make sure you can clear them. Treat all overhead wire as energized until you are certain it is safe to proceed.

h. Maintain at least a 2-foot clearance between the crane boom or jib and nearby walls, overhead trestles, columns, or other structures.

11. Requirements for working under a suspended load

OSHA requirements prohibit putting people under suspended loads. The Department of Labor approved an alternate standard for NASA to allow employees to work under suspended loads if certain conditions are met. However, you are discouraged from putting workers under suspended loads unless absolutely necessary to fulfill NASA's mission. This includes multiple load lifts (Christmas tree loads) because this practice requires personnel to work under or near suspended loads.

You must follow the requirements in Appendix A of NASA-STD 8719.9 if working under a suspended load is necessary. The Director, Safety & Mission Assurance (S&MA), must approve all work under a suspended load. To get approval, send your request and all documentation required by Appendix Aof NASA-STD 8719.9 to the Safety and Test Operations Division.

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Other requirements and responsibilities

12. Variances to lifting requirements

To get a variance to any lifting requirement, including equipment design requirements, submit a variance request as described in Chapter 1.4, "Written Safety and Health Program," of this Handbook. The S&MA Office will forward your request to the Center Director or NASA Headquarters as needed.

Paragraph 1.7 of NASA-STD 8719.9 lists NASA's policy for getting a variance (waiver or deviation) to lifting requirements. JSC's Center Director may approve some variances to NASA-STD 8719.9. For critical lift operations that don't meet NASA-STD 8719.9, follow Attachment 1 of JPD 8719.1, "JSC Process for Critical Operations Not Conforming to NASA-STD 8719.9."

13. Training and certification requirements for operating lifting equipment

You must meet the training and certification requirements in NASA-STD 8719.9 and Chapter 5.8, "Hazardous operations: safe practice and certification," of this Handbook. You may arrange training through the JSC Safety Learning Center or arrange training on your own as described in Chapter 4.1, "Program Description" (for safety and health training), of this Handbook. Contact Transportation Branch, mail code JB7, for certification.

14. Other requirements

You must follow these requirements as well as this chapter:

a. NASA-STD 8719.9

b. JPD 8719.1, "JSC Material Handling Policy."

c. 29 CFR 1910 Subpart N, "Material Handling and Storage"

d. JSC 07877, "Certification of Operators and Crew Members in Lifting Program Hardware"

e. NSTS 5300.4, "Safety, Reliability, Maintainability, and Quality Provisions for the Space Shuttle Program"

f. JSC 08114 "Shuttle Program Requirements for Periodic Certification of Material Handling Equipment and Operating Personnel"

15. Other responsibilities for lifting operations and equipment safety

The following organizations have responsibilities for lifting operations:

a. As a ***director, program manager, or contract project manager***, you must:

Verify this is the correct version before you use it by checking the on-line version.

- Evaluate all lifting operations in your organization and make informed decisions on the risks they pose.
- Determine which lifting operations in your organization are critical. You may delegate the authority for determining critical lifts, but you must do it in writing.

b. The ***Facility Engineering Division*** must:

- Prepare and maintain up-to-date lists of all overhead cranes and fixed hoists.
- Develop detailed inspection and test procedures, and test criteria for each item listed.
- Carry out a program to periodically inspect existing and permanently installed handling and lifting equipment.
- Supervise the adjustment or modification of all cranes and hoists.
- Keep inspection and recertification records as described in this chapter.
- Keep records of all material handling equipment used for critical lifts as defined in NASA-STD 8719.9.

c. The ***Center Operations Directorate*** must:

- Evaluate the adequacy of newly purchased handling and lifting equipment for permanent installation. This includes coordinating a review of design specifications, manufacturing controls, and operational acceptance testing to make sure the equipment meets with NASA-STD 8719.9.
- Develop processes to identify critical lifting operations, lifting devices, and equipment that must meet critical lift requirements. Get input from facility, program, user, safety, and quality assurance personnel. Document the results of the process and have it approved as a minimum, by the Director, S&MA.
- Make sure JSC has documentation, procedures, and controls to ensure that leased, owned, or rented special purpose mobile equipment is adequate for its intended use and meets requirements that apply.

d. The ***Logistics Division*** must:

- Coordinate with the Safety and Test Operations Division to implement a qualification and certification program for operators, riggers, and flagmen (crew handlers). The program must follow Chapter 5.8 of this Handbook and follow NASA-STD 8719.9.
- Appoint an examining officer to review the qualifications and skills of operators, riggers, and flagmen.

e. The ***Safety and Test Operations Division*** must appoint a Center Certification Officer who will:

- Establish and approve formal personnel certification requirements.
- Approve individual certifications.

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f. ***Program Offices*** must make sure contracts require contractor-directed lifting operations to meet:

- JSC 08114, “Shuttle Program Requirements for Periodic Certification of Material Handling Equipment and Operating Personnel”
- NASA-SD 8719.9

Verify this is the correct version before you use it by checking the on-line version.

Chapter 8.6
Power and hand tool safety

This could be you . . .

A maintenance worker was severely burned while using a power tool in a flammable atmosphere.

A machine shop worker wasn't wearing eye protection and received an eye injury from flying metal chips.

1. Who must follow this chapter

You must follow this chapter if you use any type of power or hand tool for any reason.

2. Training requirements for this chapter

You must have training in safe operating practices for each power tool you use. See Chapter 4.1, "Program Description," (for safety and health training) of this Handbook for more requirements on training.

3. Personal protective equipment (PPE) for use with power and hand tools

You must wear eye protection when operating power and hand tools. Use other PPE as required by the Job Hazard Analysis. See Chapter 5.6, "Personal protective equipment," for more requirements on PPE.

4. Safety devices for using power tools

To prevent injury you must:

a. Never remove equipment guards and other safety devices for any purpose other than necessary maintenance and only with de-energized equipment.

b. Shield power tool switches against accidental tripping or activation. Use "Dead man" switches that require continuous pressure for operation as required by 29 CFR 1910.243, "Guarding of Portable Powered Tools," Paragraphs (a)(2), (i) and (ii).

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5. Protection from fire or explosion hazards

To prevent fire or explosion:

a. Never use electrically powered tools near flammable or combustible materials or in explosive atmospheres unless they are approved by the National Fire Protection Association (NFPA) 70, "National Electric Code" (NEC) for the atmosphere where the tools are to be used.

b. Use only non-sparking hand tools when working in hazardous locations found in NFPA 70, NEC, Article 500.

6. Safely using cords, hoses, and cables and preventing electrical shock

To protect cords, hoses, and cables and prevent electrical shock, you must:

a. Place cords, hoses, and power supply cables for portable power tools in overhead or floor trenches, or cover with molding to reduce trip hazards.

b. Use only power cables that have a third wire unless the tool is double-insulated.

c. Use only double-insulated (2-layered) rubber-sheath cords, portable electric tools, and extension lamps that:

- Meet NFPA 70, NEC, Article 400, "Flexible Cords and Cables."
- Are Underwriters Laboratories (UL)-listed.

d. Never raise or lower power tools by their electric cords.

e. Never use power tools with the grounding prong missing.

f. Use heavy-duty plugs with a strain relief device separate from the electrical connectors to secure the cord to the plug to replace a factory-installed plug.

g. Ground all exposed metal parts on portable electric tools with exposed metal parts according to NFPA 70, NEC, Article 250-45, "Equipment Connected by Cord and Plug." The only exception to this requirement is that you may use UL-listed double-insulated power tools that with a double wire system.

h. Use ground fault circuit interrupters (GFCIs) to protect circuits, receptacles, or extension cords if you use electrical power tools for construction work. Also use GFCIs if your employer must follow the requirements in 29 CFR 1926.404(b)(1)(iii), "Assured Equipment Grounding Conductor Program."

7. Inspecting power tools

If your organization owns power tools, you must develop a written process to ensure that the power tools are inspected before each use. The process must also include provisions to tag damaged or unsafe tools "Out of Service" (JSC Form 1243) for repair or disposal.

Verify this is the correct version before you use it by checking the on-line version.

Inspections must cover the following and any specific items in the manufacturer's instructions:

a. Check the general condition of tool for any obvious defects or lack of maintenance.

b. Make sure that the grounding prong is intact, that the cord is intact, and that the outer insulation of the cord is free of damage.

c. Check grounds to ensure continuity.

d. Make sure guards are in place and working.

e. Make sure any accessories to the tool are in good working order.

8. Transporting hand tools

You must only transport tools in tool pouches, trays, tool bags, or toolboxes. Don't carry hand tools in your pockets. Never attempt to carry tools or materials in your hands while climbing a ladder. You must use a hand line with a spring-loaded keeper on the hook or other lifting apparatus when you need to lift or lower tools or material to another level. The load must be attended at both levels of the line to allow for warning other employees of the hazard above them.

9. Using insulated hand tools

You must use only properly insulated or UL-approved nonconductive tools when you work on or near live electrical parts. This restriction applies to tools such as the following:

a. Fuse pullers

b. Screwdrivers

c. Pliers (all types)

d. Wire cutting devices

e. Wire strippers

f. Connector and lug crimping tools

10. When to stop using striking hand tools

Never use hammer-struck or striking tools that are cracked, chipped, spalled, or "mushroomed." You must immediately remove these tools such as punches, chisels, metal stencils, stone drills, or hammers from service and repair or replace them. Only use hammers designed for use with striking tools. Don't use carpenter hammers in the place of striking hammers. You must remove hammers and other tools from service if they have wood or fiberglass handles that are split, cracked, loose, or defective in any way.

Verify this is the correct version before you use it by checking the on-line version.

11. Other standards to follow

In addition to the requirements of this section, you must follow hand and portable powered tools and equipment requirements in the following OSHA standards that apply:

a. CFR 1910.241, “Definitions”

b. CFR 1910.242, “Hand and Portable Powered Tools and Equipment, General”

c. CFR 1910.243, “Guarding of Portable Powered Tools.”

d. CFR 1910.244, “Other Portable Tools and Equipment”

e. 29 CFR 1926.300 - 307 (for construction)

Verify this is the correct version before you use it by checking the on-line version.

Chapter 8.7
Ladders, scaffolds, and elevated platforms: how to work with them safely

This could be you . . .

A worker was seriously injured when he fell about 20 feet from a ladder. He was the only person in a remote facility and no one knew that he was there inspecting some pipes. He walked the ladder along the elevated piping to see additional sections and caused the ladder to fall. He had to crawl to a nearby area to get help.

Two workers miraculously survived but were permanently injured when the suspended scaffolding that they had improperly set up fell approximately 40 feet with them on it. They had the manufacturer's instruction and operation manual, but failed to read or apply it in the setup. They weren't experienced with suspended scaffolding, but had been given the task to assemble and use it.

1. Who must follow this chapter

You must follow this chapter if you are a JSC civil service, contractor, or subcontractor employee who constructs, maintains, or uses:

a. Ladders

b. Scaffolds

c. Safety nets

d. Elevated platforms

Fall protection is required whenever you work over 4 feet off the ground doing general industry work, 6 feet off the ground doing construction work, or 10 feet off the ground on scaffolding. For more information, see Chapter 5.6, "Personal protective equipment," of this Handbook.

2. What this chapter covers

This chapter covers the minimum requirements for constructing, erecting, testing, assembling, using, disassembling, lowering, maintaining, or storing ladders, scaffolds, safety nets, or elevated platforms in your job.

Verify this is the correct version before you use it by checking the on-line version.

Requirements for ladders

3. Requirements for using portable ladders

Ladders are a means of allowing you to get from one work level to another. They aren't designed as a platform to work from for long periods of time. You may do short-term or quick jobs, such as changing a light bulb or adjusting an air conditioning ducting-mixing chamber from a ladder. You must do longer-term, or more complex jobs, such as changing out an air conditioning ducting-mixing chamber, from standard work platforms such as scaffolding or man-lifts. If you must do any of these longer-term jobs with a ladder, you must document the reason you can't use a standard work platform. You must also get approval from the appropriate safety representative and the Safety and Test Operations Division. You must also describe the specifics of the fall protection system that you will use to protect yourself on a ladder.

You must always follow the manufacturer's recommendations when working with ladders, including Type I industrial stepladders, Type II commercial stepladders, and extension ladders. You must:

a. Follow 29 CFR 1910.25, "Portable Wood Ladders," 29 CFR 1910.26, "Portable Metal Ladders," 29 CFR 1926.1053, "Ladders" (for construction).

b. Maintain 3 points of contact with the ladder when ascending or descending (one hand and two feet or two hands and one foot) and keep your belly button between the ladder rails.

c. Place ladders to prevent slipping, tie them off, or have someone hold the ladder in a steady position.

d. Never have more than one person on a ladder unless it is specially designed with larger dimensions.

e. Adjust extension ladders while standing at the base of the ladder and make sure that the locks are properly engaged. Don't make adjustments while standing on the ladder.

f. Erect two-section extension ladders so that the upper section is resting on the bottom section. The minimum overlap for the two sections are listed below:

Size of Ladder (feet) . . .	***Overlap (feet) . . .***
Up to and including 36	3
Over 36 up to and including 48	4
Over 48 up to and including 60	5

f. Extend the ladder a minimum of 3 feet above the point of support when you need to access a roof or other top surface.

g. Never:

- Use them in a horizontal position as platforms, runways, or scaffolds.

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- Place them in front of doors opening toward the ladder unless the door is blocked, locked, or guarded. Don't lock an EXIT door.
- Place the ladder on boxes, barrels, or other unstable bases.
- Splice together short ladders to make long sections.
- Use ladders made by fastening cleats across a single rail.
- Use them as guys, braces, skids, or for other than their intended purpose.
- Use the tops of stepladders as a step.
- Use portable stepladders longer than 20 feet.
- Climb on the bracing on the back legs of stepladders.
- Use a closed stepladder as a vertical ladder.
- Use metal ladders in close proximity to areas containing electrical circuits.
- Use the middle and top sections of sectional or window cleaner ladders unless you equip them with safety shoes.

h. Use care in safely placing, securing, or holding a ladder being used on oily, metal, concrete, or slippery surfaces. Non-slip bases may not be adequate.

4. Ladder inspection

You must inspect ladders before each use and inspect and test any ladder involved in an incident such as tipping over or one exposed to extreme heat (fire) for deflection and loss of strength. In addition, supervisors or designees must also inspect each ladder at least yearly. You must document each yearly inspection on an inspection tag that shows the inspector's initials and date for next inspection. You may use either a JSC-supplied inspection tag or off-the-shelf inspection tags that fit into holders that are attached to the ladder. Take any ladders out of service that have defects with an "Out of Service" tag (JSC Form 1243). Make sure defective ladders are repaired or destroyed. Ladder inspections must cover the following and any additional items in the manufacturer's instructions:

a. Overall condition and maintenance.

b. Tight joints between the steps and side rails

c. Securely attached fittings

d. Movable parts – must move freely.

e. All rung and hardware connections and rivets for shearing.

f. Loose or broken steps or rungs.

g. Excessively dented rungs.

h. Broken, split, or cracked uprights, braces, steps or rungs.

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i. Rail dents or bends.

j. Loose nails, screws, bolts, rivets, rung to-side-rail connections, or hardware connections.

k. Missing, broken, or damaged safety shoes, non-slip bases, casters/wheels, or locking devices.

l. Loose, bent, or broken hinges or spreaders on stepladders.

m. Defective locks on extension ladders.

n. Deteriorated or broken ropes or sheaves on extension ladders.

o. General serviceability.

5. How to keep portable ladders safe

You must always follow the manufacturer's recommendations when working with ladders. You must also:

a. Follow 29 CFR 1910.25, 29 CFR 1910.26, and 29 CFR 1926.1053 (for construction).

p. Lubricate metal bearings of locks, wheels, and pulleys frequently.

q. Equip bases of portable ladders with nonskid material or safety shoes of strong design.

r. Keep rungs free of grease, oil, or other foreign materials.

s. Apply a protective coating such as varnish to ladders that are subjected to certain acid or alkali solutions. Don't apply opaque paint to ladders.

t. Use portable rung ladders within reinforced rails only with metal reinforcement on the underside. You must use this kind of ladder with great care near electrical conductors.

6. Requirements for working with fixed ladders

You must always follow the manufacturer's recommendations when working with fixed ladders. You must design, build, use, and maintain fixed ladders as described in 29 CFR 1910.27, "Fixed Ladders." Also, you must:

a. Face the ladder when climbing or descending.

b. Raise or lower tools or other equipment with lanyards, tool belts or aprons. Don't carry tools in your hands when ascending or descending a ladder.

Verify this is the correct version before you use it by checking the on-line version.

Requirements for scaffolds

7. Description of, and standards that apply to, scaffolds

A scaffold is any **temporary** elevated platform (supported or suspended) and its supporting structure (including points of anchorage) used for supporting employees or materials or both. Two Occupational Safety and Health Administration (OSHA) standards apply to scaffolds:

a. 29 CFR 1926, Subpart L, "Scaffolding," applies to scaffolds used in construction work. Construction work is any work for construction, alteration, or repair, including painting and decorating.

b. 29 CFR 1910.28, "Safety Requirements for Scaffolding," applies to any non-construction work.

8. Inspecting and maintaining scaffolds

You must design, build, erect, and maintain scaffolds as described in 29 CFR 1910.28, and 29 CFR 1926, Subpart L (for construction). Also, you must:

a. Have trained Scaffolding Competent Persons designated by the scaffold manufacturer or employer. Never inspect, repair, or maintain scaffolds used in construction unless you are trained as described in Subparagraph 18.d of this chapter.

b. Maintain scaffolds and other devices in a safe condition. Correct any defects, unsafe conditions, or noncompliance immediately before further use. Never use any broken, bent, excessively rusted, altered, or otherwise structurally damaged frames or accessories.

c. Never use scaffolding components from different manufacturers or systems together, unless specifically authorized to do so by the scaffolding manufacturer.

d. Inspect scaffold equipment for defective parts and structural integrity at least twice a year, before each assembly, and daily during use. Your supervisor, safety representative or the Safety and Test Operations Division may help you in these inspections. You must record, date, and maintain the inspection reports in the office of the responsible organization.

e. Inspect wire ropes, fiber ropes, slings, hangers, platforms, and other supporting parts for defects before each installation and daily during use.

f. Periodically inspect all welded frames and accessories. Also inspect any maintenance, such as painting or minor corrections, authorized by the manufacturer before further use.

g. Remove defective equipment from service immediately. Your designated Scaffolding Competent Person, safety representative or supervisor must put a DO NOT OPERATE tag (JSC Form 19A) on the equipment until it is repaired or destroyed.

Verify this is the correct version before you use it by checking the on-line version.

9. Erecting scaffolds

Observe the requirements as described in 29 CFR 1910.28, 29 CFR 1926, Subpart L (for construction), the manufacturer's recommended work practices, and the following requirements for operations involving scaffolds:

a. Use only designated competent experienced personnel to erect scaffolds, or supervise the erection of scaffolds. Never erect, disassemble, or move scaffolds used in construction unless you are trained as described in Subparagraph 18.d of this chapter.

b. Make sure the footing or anchorage for scaffolds is sound, rigid, and capable of supporting the maximum intended load without settling or displacement. Never use unstable objects such as barrels, boxes, loose brick, or concrete blocks to support scaffolds or planks.

c. Overlap all planking or platforms (minimum 12 inches) or secure them from moving.

d. Provide an access ladder or equivalent safe access on scaffolds that have built-in ladders that decrease in width.

e. Extend scaffold planks over their end supports not less than 6 inches not more than 18 inches.

f. Make sure the poles, legs, or uprights of scaffolds are plumb, and securely and rigidly braced to prevent swaying and displacement.

g. Make sure materials being hoisted onto a scaffold have a tag line.

h. Provide overhead protection for personnel on or near a scaffold exposed to overhead hazards.

i. Install guardrails and toe boards at all open sides on all scaffolds more than 10 feet above the ground or floor. Provide scaffolds with a screen between the toe board and the guardrail, extending along the entire opening, consisting of No. 18-gauge U.S. Standard Wire ½-inch mesh or the equivalent where persons are required to work or pass under the scaffolds.

j. Set independent pole scaffolds as near to the wall of the building as practical.

k. Separate the area under scaffolding or elevated work from other areas by suitable barricades to prevent personnel travel under the platform and to protect from falling objects.

l. Install outriggers on scaffolding as directed by the manufacturer, or whenever the height of the scaffold system exceeds 4 times the minimum base width.

10. Requirements for working on any scaffold

To use scaffolding you must follow the manufacturer's recommended work practices as well as 29 CFR 1910.28 or 29 CFR 1926, Subpart L (for construction).

You must NEVER:

Verify this is the correct version before you use it by checking the on-line version.

a. Work on a scaffold used in construction unless you are trained as described in Subparagraph 18.c of this chapter.

b. Operate scaffolds used in construction unless you are trained as described in Subparagraph 18.d of this chapter.

c. Alter or move a scaffold horizontally while in use or occupied unless it is specifically intended for that purpose.

d. Exceed the intended working load for the scaffold.

e. Work on scaffolds during storms or high winds or if the scaffold is covered with ice or snow. Remove ice and snow and sand from the planking to prevent slips.

f. Accumulate tools, materials, and debris in quantities that could cause a hazard.

g. Use shore- or lean-to-type scaffolds.

11. Requirements for working with suspended scaffolding

Observe the manufacturer's recommended work practices; 29 CFR 1910.28; 29 CFR 1926, Subpart L (for construction); and the following requirements for operations involving suspended scaffolding:

a. If you erect, or supervise the erection of suspended scaffolding, you must be trained and designated by the scaffolding manufacturer or employer as a suspended scaffold-competent person. Never erect, disassemble, move, or operate scaffolds used in construction unless you are trained as described in Subparagraph 18.d of this chapter.

b. Use wire or fiber rope for scaffold suspension that is capable of supporting at least six times the intended load. Use thimbles in ropes attached to securing points to support the scaffold (both primary and secondary supports).

c. Use wire rope-supported scaffolding when acid solutions are used for cleaning buildings over 50 feet in height. Use only treated or protected fiber rope for or near any suspended scaffold work involving the use of corrosive substances or chemicals.

d. Inspect all ropes, slings, hangers, platforms, and other supporting parts for defects, corrosion, or rusting before each installation and use. Replace wire ropes with six or more broken wires in any one lay of the wire rope. A "lay" is the distance it takes one strand to make a 360-degree wrap around the rope. Also replace damaged ropes or ropes in a deteriorated condition.

e. Protect yourself while working in a suspended scaffold with a harness attached to an independently supported lifeline through a fall arrest device (rope grab). You must attach the lifeline to substantial members of the structure that are independent of the scaffolding.

f. Secure all suspended scaffolding portable components that support the scaffold (such as parapet clamps or hooks) with secondary tiebacks to substantial members of the structure.

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g. Allow only two workers (with their tools) on a suspension scaffold rated at a working load of 500 pounds and only three workers (with their tools) on a suspension scaffold rated at 750 pounds.

h. Setup all suspended scaffolding portable components that support the scaffold (primary and secondary tiebacks) so that only one device is attached to a preformed exposed aggregate facade panel section.

Requirements for elevated platforms

12. Requirements for working with power-operated platforms

You must install, operate, use, maintain, and inspect power-operated platforms for exterior building maintenance as described in 29 CFR 1910.66, "Powered Platforms for Exterior Building Maintenance." The requirements of this section don't apply to firefighting equipment or to the vehicles with mounted aerial devices, except that the vehicle must be a stable support for the aerial device. Also, you must:

a. Never move, operate, repair, maintain, or inspect power-operated platforms used in construction unless you are trained as described in Subparagraph 18.e of this chapter.

b. Never disable any required safety device or electrical protective device, except when necessary during tests, inspections, and maintenance. Restore the devices to their normal operating condition immediately after completing such tests, inspections, and maintenance.

c. Never operate powered platforms during severe adverse weather conditions as determined by your supervisor or the Safety and Test Operations Division.

d. Make sure that each employee on the working platform has and uses safety belts and lifelines as described in Chapter 5.6 of this Handbook.

e. Make sure that all powered platforms have an acceptance test to determine that all parts meet 29 CFR 1910.66, and that all safety and operating equipment functions as required. Make a similar inspection and test after any major alteration to an existing powered platform installation.

13. Requirements for work with other elevated platforms

You must design, construct, test, operate, and maintain aerial devices, aerial ladders, articulating boom platforms, extensible boom platforms, and other types of vehicle-mounted elevating and rotating work platforms as described in 29 CFR 1910.67, "Vehicle-Mounted Elevating and Rotating Work Platforms." Also, you must:

a. Never move, operate, repair, maintain, or inspect elevated platforms used in construction unless you are trained as described in Subparagraph 18.e of this chapter.

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b. Consider the following when operating aerial lifts close to, under, over, by, or near electric power lines:

- For lines rated at 50 kV or less, the minimum clearance between the lines and any part of the aerial lift must be at least 10 feet.
- When the lines are rated over 50 kV, the minimum clearance between the lines and any part of the aerial lift must be at least 10 feet plus 0.4 inch for each kilovolt over 50 kV, or twice the length of the line insulator, but never less than 10 feet.
- These requirements don't apply if the work is performed from an aerial device insulated for the work, and the work is performed by either telecommunications employees, line-clearance tree-trimming employees, or electric utility employees; or where the electric power transmission or distribution lines have been de-energized and visibly grounded at the point of work, or where insulating barriers, not a part of or an attachment to the aerial lift, have been erected to prevent physical contact with the lines.

c. Treat any overhead wire as energized until the person owning the line, his/her representative, or the electrical utility authorities tell you that it isn't energized.

d. Use proximity warning devices, but not instead of meeting the requirements contained in Subparagraph a above.

e. Notify the owner of the lines or his or her authorized representative and provide them with all pertinent information before beginning operations near electrical lines. In the case of JSC, the JSC Plant Engineering Division must notify the Houston Lighting and Power Company before starting work near electrical lines. In the case of other JSC locations, notify the owner of the electrical lines before starting work.

14. Requirements for working with ladder and tower trucks

Before you move the truck for highway travel, lower aerial ladders in the traveling position. You must do this by locking the device above the truck cab and the manually operated device at the base of the ladder. You may also use other equally effective means such as cradles that prevent rotation of the ladder in combination with positive acting linear actuators.

15. Requirements for working with extensible and articulating boom platforms

Observe the manufacturers recommended work practices and the following requirements when operating extensible and articulating boom platforms.

You must:

a. Never move, operate, repair, maintain, or inspect extensible and articulating boom platforms used in construction unless you are trained as described in Subparagraph 18.e of this chapter.

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b. Immediately test lift controls of extensible and articulating boom platforms before use to determine that the controls are in safe working condition.

c. Make sure that only trained persons operate an aerial lift.

d. Never belt off to an adjacent pole, structure, or equipment while working from an aerial lift.

e. Always stand firmly on the floor of the basket. Never sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.

f. Wear a body belt and a lanyard attached to the boom or basket.

g. Never exceed boom and basket load limits specified by the manufacturer.

h. Set brakes and position outriggers on pads or a solid surface. Install wheel chocks before using an aerial lift on an incline.

i. Never move an aerial lift truck when the boom is elevated in a working position with workers in the basket, unless the equipment is specifically designed for this operation as described in 29 CFR 1910.66.

j. Make sure that articulating boom and extensible boom platforms, primarily designed as personnel carriers, have both platform (upper) and lower controls. Upper controls must be in or beside the platform within easy reach of the operator. Lower controls must provide for overriding the upper controls. Controls must be plainly marked as to their function. Never operate the lower level controls unless you have permission from the employee in the lift, except in case of emergency.

k. Never wear pole climbers while doing work from an aerial lift.

l. Never alter the insulated portion of an aerial lift in any manner that might reduce its insulating value.

m. Inspect each boom before moving an aerial lift for travel to see that it is properly cradled and outriggers are in a stowed position, except for equipment specifically designed for this type operation in accordance with the manufacturer's recommended work practices or 29 CFR 1910.66.

16. When and how to use a safety net

You must follow 29 CFR 1926.502, "Fall Protection Systems Criteria and Practices," or the following requirements for safety nets.

Provide a safety net for workplaces where other means of fall protection such as scaffolding, ground-supported personnel-lifting devices, lifelines, or safety harnesses cannot protect a worker due to the conditions of the elevated work area. These conditions may include:

a. Structural ironwork where there is no tie off.

b. Working above water surfaces.

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c. The height of the work area is such that using ladders or erecting scaffolding would be a greater risk.

d. The area isn't accessible with ground-supported personnel-lifting devices.

You may also use safety nets where there is a danger of items dropping from the workplace and endangering people below.

Other requirements for working at heights

17. Personal protective equipment (PPE) and clothing to use when using ladders, scaffolding, or elevating work platforms

You must wear PPE consistent with the guidelines below. For more information on personal protective equipment, see Chapter 5.6 of this Handbook.

If . . .	***You must wear . . .***
Objects could fall on your head, you could bump your head, or you could come in contact with electrically energized equipment	Hard hats.
Objects could fall into or be blown into your eyes	Safety glasses with side protection, goggles, or a face shield.
You must lift sharp or pointed objects by hand	Gloves.
You must lift heavy objects over your feet, or you may step on sharp or pointed objects	Industrial work shoes; safety toed or equipped with metatarsal protection (as needed).
You could fall	All items specified by the manufacturer's recommended work practices. NOTE: Going from one level to another level on portable ladders does not require fall protection equipment.
You are working in a suspended scaffold	A harness with a rope grab device attached to an independently supported lifeline.
You are working in a boom lift, scissor lift, or aerial platform	A harness secured to the platform, unless specifically waived by the manufacturer's recommended work practices. NOTE: While on powered platforms with hand or guardrails in place, you must be secured in the platform and keep your feet on the desk to prevent fallout in case the platform tips.
You are using a ladder as a work platform for longer-term or more complex jobs (short-term jobs like changing a light bulb or adjusting an air conditioning ducting mixing chamber are acceptable)	A fall protection system and document the reasons why you can't do the work on a standard platform. (This includes jobs like installing or replacing an air conditioning ducting - mixing chamber.)

Table continues on next page.

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If . . .	*You must wear . . .*
You work 4 feet above grade (6 feet in construction) without a fall protection system in place	Independently supported lifelines properly connected to an anchorage rated at 5,000 pounds or more, harness, and shock absorber (if needed to limit impact force to 1,800 pounds), or a work positioning system.

18. Required training before using ladders, scaffolding, or elevated work platforms

Your training must cover the requirements recommended by the manufacturer of the equipment that you intend to use. See Chapter 4.1, "Program Description" (for safety and health training), of this Handbook for more requirements on training. If you:

a. Supervise the construction, erection, testing, assembly, use, disassembly, lowering, maintenance, or storage of ladders, scaffolds, or work platforms or do these functions unsupervised, you must be trained in the safe work practices described in this chapter and the referenced OSHA standards.

b. Do any of the functions listed in a above, you must be specifically designated and classified by your employer as being competent and qualified due to your:

- Knowledge and experience.
- Awareness of the hazards associated with the specific equipment in the specific environment.

c. Work on any kind of scaffold used in construction, you must have the Scaffold Users Training.

d. Erect, disassemble, move, operate, repair, maintain, or inspect scaffolds used in construction, you must be trained in the requirements of 1926.454(b), "Training Requirements," and Appendix D, Subpart L, of 29 CFR 1926.

e. Move, operate, repair, maintain, or inspect any kind of aerial lift used in construction, you must be trained in the requirements of 1926.453, "Aerial Lifts." Aerial lifts include the following:

- Power-operated platforms
- Other elevated platforms
- Extensible and articulating boom platforms

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Appendix 8A

Forms

The forms listed in this appendix are not available electronically. Contact Forms (Supply and Distribution) at extension 36164 to get a copy or copy one from this appendix.

JSC Form 19A	Do Not Operate Tag
JSC Form 1243	Out of Service Tag
JSC Form 1291	Lockout/Tagout Compliance Tag

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JSC Form 19A Do Not Operate Tag

Current form will be included

Verify this is the correct version before you use it by checking the on-line version.

JSC Form 1243 Out of Service Tag

Current form will be included

Verify this is the correct version before you use it by checking the on-line version.

JSC Form 1291A Lockout/Tagout Tag

Current form will be included

Verify this is the correct version before you use it by checking the on-line version.

Appendix 8B

Miscellaneous guidelines and instructions

This appendix contains the following attachments:

8.2A [Reserved.]

8.2B Policy for issuing locks and tags

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Attachment 8.2A
[RESERVED.]

1.

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Attachment 8.2B
Policy for issuing locks and tags

1. Policy and procedures

This attachment is JSC's policy issuing lockout/tagout (LOTO) locks, LOTO tags and energy control tags, which will be called "equipment." Issuing LOTO equipment will be as follows:

a. The JSC LOTO "Center Issuer" (LOTO-CI) issues the equipment. The JSC LOTO-CI is provided by the Safety and Test Operations Division, mail code NS. The LOTO-CI will issue equipment to designated contractor safety representatives, or their designee (such as a shift supervisor), whose organization conducts LOTO operations at JSC, Ellington Field or the Sonny Carter Training Facility.

b. As a designated contractor safety representative, you must submit the normal request for LOTO equipment to the LOTO-CI for the amount of equipment you expect your organization would normally need to conduct LOTO operations. Request forms are available from the LOTO-CI. The LOTO-CI will process requests during daytime work hours.

c. The LOTO-CI will issue equipment to the contractor requestor, and maintain a record of the equipment issued. If there is a need for additional equipment by the contractor after normal work hours (i.e. nights, weekends, or holidays), you—as a contractor safety representative—or your designee (shift supervisor) can get equipment on an emergency basis from the on-duty Fire Protection Specialist (temporary Center Issuer) at building 25. If the on-duty Fire Protection Specialist is not available at building 25, you will find a phone number (security dispatcher) and instructions on the LOTO equipment storage locker to contact the Fire Protection Specialist, who will return to the site and issue the equipment.

d. Ellington Field and Sonny Carter Training Facility will also have an inventory of equipment available during normal work hours. As the designated contractor safety representative, you must maintain the inventory and be responsible for issuing equipment during normal hours for scheduled LOTO work including work scheduled for non-normal hours. If emergency work or work not previously scheduled requires additional equipment, you or your designee must get additional equipment from the Fire Protection Specialist (temporary Center Issuer) at JSC.

2. Responsibilities

a. As the ***LOTO-CI,*** you are responsible for:

- Submitting purchase orders for LOTO equipment as needed to maintain a working inventory.
- Issuing LOTO locks, LOTO tags and energy control tags (equipment) during normal work hours.
- Maintaining a record of the equipment issued.
- Making sure an adequate amount of replacement equipment is available at JSC,

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Ellington Field, and Sonny Carter Training Facility by contacting the designated safety representatives periodically.

b. As a ***Fire Protection Specialist (Temporary LOTO Issuer),*** you are responsible for:

- Assuming the duties of the LOTO-CI during his absence, after normal hours, weekends, and holidays.
- Issuing equipment as needed on an emergency basis and recording the issue.

c. As a ***Designated Safety Representative,*** **you** are responsible for:

- Determining a realistic amount of LOTO equipment that your organization will need.
- Obtaining the determined amount of equipment from the LOTO-CI and issuing as needed to your organization involved in LOTO operations. Whenever possible, contact the LOTO-CI in advance to ensure that an adequate supply of equipment will be on hand to meet your request, and request your replacement equipment as needed from the LOTO-CI.
- Supporting JSC annual inventories and periodic audits of the JSC LOTO program as required by JSC implementation of 29 CFR 1910.147.

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Part 9
Safety and health practices for hazardous materials

This could be you . . .

A worker spilled a hazardous chemical on himself. He was wearing safety goggles, gloves, and an apron. He quickly washed the chemical off in the safety shower and is okay.

1. Who must follow Part 9?

You must follow Part 9 if you work at JSC or a JSC field site. The following table tells you which chapters from Part 9 apply to what jobs.

If you . . .	*Then you must follow . . .*
Work with any hazardous materials	Chapter 9.1, "Hazardous materials safety and health"
Work with any hazardous materials	Chapter 9.2, "Hazard communication"
Work with pesticides	Chapter 9.3, "Pesticide control"
Work with any materials that contain lead	Chapter 9.4, "Materials that contain lead: how to work with them safely"
Work with any explosives or solid propellants	Chapter 9.5, "Explosives and solid propellant safety"

2. How do I use Part 9?

Part 9 provides you with safe work practices working with hazardous materials. You must follow Chapters 9.1 and 9.2 for any hazardous materials. Follow any of the other chapters in Part 6 that apply to your job.

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Chapter 9.1
Hazardous materials safety and health

This could be you . . .

A diesel spill occurred in a parking lot when a personal diesel container in the back of a pickup truck tipped over and leaked.

Two workers cleaning an oxidizer storage tank were killed when the tank exploded due to a reaction between the cleaning agent and residual oxidizer.

Workers released a cloud of oxidizer that drifted outside the downwind safety zone because they unknowingly released too much oxidizer.

1. Who must follow this chapter

You must follow this chapter if you purchase or handle hazardous materials or control areas where hazardous materials are used or stored at JSC or JSC field sites.

2. What this chapter covers

This chapter covers the purchase, use, handling, transporting, and restrictions of hazardous materials.

3. What are hazardous materials?

A hazardous material is anything that can be a danger by contact, inhalation, or consumption. JSC has defined hazardous materials as including those found in the following sources:

a. Materials defined as “highly hazardous chemicals” in 29 CFR 1910.119, “OSHA Process Safety Management Regulation,” regardless of quantity

b. “Extremely hazardous substances” that must follow emergency planning requirements in 40 CFR 355, “Emergency Planning and Notification,” regardless of quantity

c. Those “hazardous substances” subject to the release notification requirements under 40 CFR 302.4, “Designation of Hazardous Substances,” regardless of quantity

d. Materials regulated in 29 CFR 1910, “Occupational Safety and Health Standards, General Industry” and 29 CFR 1926, “Occupational Safety and Health Standards, Construction Industry”

e. Flammable liquids—National Fire Protection Association Class IA flammable liquids—flash point below 73°F (23°C) and boiling point below 100°F (38°C)

f. Radioisotope material or device that produces ionizing radiation

g. Class II, III, or IV laser, as defined by the American National Standards Institute No. Z136.1, “Safe Use of Lasers,” 1986

Verify this is the correct version before you use it by checking the on-line version.

h. Explosives or any pyrotechnics

i. Pesticides

j. Prohibited materials

Requirements for safely handling hazardous materials

4. What you must do when you need to use a hazardous material that is a risk to health, safety, or the environment

You must:

a. Try to find a less hazardous material that will do the job within your quality standards.

b. Review hazardous waste disposal requirements of residual, used, or contaminated material to determine the cost impacts, environmental impacts, or regulatory restrictions. Regulations may require substitution of certain materials. For example, stratospheric ozone-depleting chemicals should be phased out under the Clean Air Act of 1990. See Chapter 5.8, "Hazardous operations: safe practices and certification," of this Handbook for more information on permits. See Chapter 4.1, "Program description" (for safety and health training), for more information on training.

c. Use proper work practices and handling procedures. This will reduce the quantity of new material you must buy, reduce spillage and evaporation losses, reduce cost, reduce quantity of waste generated, and increase the overall safety.

d. Use proper waste handling practices such as labeling and segregation and avoiding the mixing of different hazard waste streams. This will further reduce waste generation. Regulatory requirements mandate waste-reduction goals for all materials and especially banned materials.

5. Recycling

Recycling hazardous materials is another method of reducing cost and minimizing wastes while conserving natural resources. Before recycling hazardous materials, contact the Environmental Office to determine environmental requirements.

6. Planning to handle hazardous materials

You must do a hazard analysis for each process that you control or that is in your area, which uses toxic, reactive, flammable, radioactive, or corrosive chemicals. The hazard analysis will help to establish precautionary measures and help to determine the need for an emergency action plan (EAP). Start your planning by writing a hazard analysis. The hazard analysis must contain a listing of chemicals used in the process. You must update the hazard analysis whenever quantities increase or processes change.

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Use the instructions found in JSC 17773, "Instructions for Preparing Hazard Analysis for JSC Ground Operations," for the analysis. One failure mode that the hazard analysis must include is the spontaneous release such as a container failure without operations in progress. Follow 29 CFR 1910.119 for process safety management of highly hazardous chemicals.

7. What to do with a completed hazard analysis

If your analysis shows hazards with a risk assessment code (RAC) of 1, 2, or 3 as described in Chapter 3.5, "Hazard Correction Tracking," of this Handbook, you must:

a. First have a hierarchy of control measures. For example, engineering controls, work practices, personal protective equipment (PPE), and administrative measures.

b. Send a list of the hazards to Occupational Health Services (SD33) for review.

c. Develop or modify your EAP to cover the actions that must be taken to ensure employee safety during fires, hazardous material releases, or other emergencies that might occur in your area. Your EAP must follow the requirements in Chapter 3.8, "Emergency Preparedness," of this Handbook.

8. Requirements for hazardous materials

If your civil service or contractor work area uses or stores hazardous materials, you must:

a. Develop and maintain a hazardous material inventory listing the identity and quantity of hazardous materials stored or used in the work area. See Chapter 9.2, "Hazard communication," of this Handbook.

b. Make sure that you and your other employees are properly trained in the use and hazards of these materials before using them.

c. Notify Occupational Health Services before you use any hazardous materials for the first time or before using a hazardous material in a new or different way.

d. Make sure that all hazardous materials are used properly and that necessary precautions are taken so that no harm is done to humans or the environment.

e. Make sure that your subcontractors who use hazardous materials on site follow the requirements of this chapter if you are a prime contractor.

9. Safely handling hazardous materials

If you have hazardous materials in your work areas you must also:

a. Review the quantity of hazardous materials in your work area to:

- Substitute less hazardous materials if possible.
- Reduce the chance of a fire, spill, or accidental release.
- Reduce hazardous waste.

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b. Request material safety data sheets (MSDSs) from the supplier whenever you first order a hazardous material and:

- Send a copy of the MSDS to Occupational Health Services to get a JSC MSDS index number.
- Keep MSDSs up to date by having procedures for filing revised or newly acquired MSDSs from the JSC MSDS repository or supplier.
- Keep MSDSs readily available for employees in the area.
- See the requirements in Chapter 9.2 relating to MSDSs

c. Take steps to eliminate or reduce risks of hazardous materials. This includes writing work requests, as necessary, to install required engineering controls.

d. Keep the proper fire extinguishers in the area. Contact the Safety and Test Operations Division for more information.

e. Review proposed purchases against the list of restricted and prohibited materials before starting a purchase request or supply requisition. NOTE: It may be necessary to obtain a copy of the MSDS in advance to substantiate compliance with this requirement. You can contact the Occupational Health Services ((281) 483-6726) for assistance. You must get a waiver before using any prohibited material or materials with a restricted use as described in Paragraph 11 below.

f. Contact the JSC Radiation Safety Officer before purchasing radioactive materials (see Chapter 7.4 of the Handbook).

g. Store hazardous materials in a manner consistent with manufacturer's recommendations and the Chemical Segregation and Storage Guide found on the Total Health webpage.

h. Post appropriate warning signs within your work areas, and make sure that tanks and piping are labeled per ASME - A13.1, "Scheme for the Identification of Piping Systems."

i. Label all containers of hazardous materials within your work area as described in 29 CFR 1910.1200, "Hazard Communication Standard" (see Chapter 9.2 of this Handbook).

j. Keep a current and accurate list of MSDSs for all hazardous materials used within each room or work area. Your listing must be readily (and remotely) accessible should a fire or other emergency occur within a particular room or area. You must maintain a hard copy of your MSDS(s) in the work area.

k. Use proper waste-handling practices, including waste segregation and disposal, for all processes that use hazardous materials per the Waste Segregation and Storage Guide found in JPR 8500.1, "Environmental Compliance Procedural Requirements."

l. Make sure you have appropriate fire protection systems and fire extinguishers for the hazardous materials.

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m. Make an assessment for the need for escape respirators in areas where hazardous materials are stored.

n. Make sure chemical alarms and warning lights are operational as described in Chapter 6.12, “Local Hazard Chemical Alarms,” of this Handbook

o. If the supplier did not provide the MSDS for your hazardous material, contact them immediately for a copy. You may not use the material until you have an MSDS and addressed the identified hazards.

Restricted and Prohibited materials

10. Restricted and prohibited materials at JSC

JSC has decided that some products are too hazardous to handle and are prohibited for purchase, storage or use. Other products are toxic or highly regulated and may only be used in limited applications or restrictions may apply. See Attachment 9.1A, Appendix 9B for the list of restricted and prohibited chemicals.

JA15/Project Management Office must maintain JSC SPECSINTACT to conform to the policy on restricted materials that may be used in construction, modification, or repair of facilities, specifically asbestos-containing materials (ACMs), polychlorinated biphenyls (PCBs), chlorofluorocarbons (CFCs) and hydro-chlorofluorocarbons (HCFCs), and mercury. If you are responsible for maintaining facilities or equipment, you must specify "non asbestos" products, undetectable concentrations of PCBs, "non-CFC" containing equipment, or non-mercury equipment.

JSC is continuously evaluating the restricted and prohibited materials list. Before purchasing or using a material, check the most current list in Attachment 9.1A, Appendix 9B.

11. Waivers to use a restricted or prohibited material

You may request a temporary waiver if use of a specific restricted or prohibited material is required to achieve JSC’s mission. You must submit your waiver request in writing to JA131/Environmental Office. The Environmental Office will coordinate review of the waiver request, as appropriate, with the Occupational Health Branch or the Safety and Test Operations Division.. The following requirements apply:

a. Your temporary waiver request must include the following information:

- Name and phone number of requestor
- Organization name and mail code if NASA
- Contract Name and Number if contractor
- Name and CAS number of chemical
- Location(s) of proposed use (Building and Room Number)

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- Description of proposed process using chemical
- Estimated quantity of the chemical you expect to store and use per year for each location
- Justification for use of the restricted or prohibited chemical. If no alternative is available for the chemical, you must provide documentation of your efforts to locate an alternative. If a specification, standard, or contract line item requires the use of this specific chemical; you must provide a reference to that requirement (contract name and number and contract line item or procedure name and number) and a copy of the requirement.
- A copy of the hazard analysis and trade studies (if applicable) for the proposed activity or process that will use the chemical. Include any assessments of alternative materials.

b. The Environmental Office and the Occupational Health Branch must approve and sign your temporary waiver before you may use the restricted or prohibited chemical. If a new chemical is placed on the restricted and prohibited chemical list, you have 6 months to re-evaluate the process and find an alternative or request a temporary waiver.

c. Temporary waivers stay in effect for a designated time period between 1 and 5 years, depending on the safety, health, and environmental characteristics of the chemical. You must apply for a new waiver and have it approved before the expiration date of an existing waiver to continue using the chemical.

12. Other material restrictions

The following materials, in concentrations specified in the standards listed below, are subject to certain restrictions under 40 CFR 61, "EPA National Emission Standards for Hazardous Air Pollutants" (NESHAP) or under the Occupational Safety and Health Administration (OSHA) substance-specific standards. These materials must follow:

a. NESHAP restrictions found in this table.

For . . .	***Follow this subpart of 40 CFR 61 . . .***
Asbestos	M
Beryllium	C
Mercury	E
Vinyl chloride	F
Radionuclides	I
Benzene	J, Y, BB and FF

b. OSHA restrictions in 29 CFR 1910, General Industry Standards:

For . . .	***Follow 29 CFR 1910 . . .***
Asbestos	1001
4-nitrobiphenyl	1003
Alpha-naphthylamine	1003
Methyl chloromethyl ether	1003
3,3-dichlorobenzidine and salts	1003
Bis-chloromethyl ether	1003
Beta-naphthylamine	1003
Benzidine	1003
4-aminodiphenyl	1003
Ethyleneimine	1003
Beta-propiolactone	1003
2-acetylaminofluorene	1003
4-dimethylaminoazobenzene	1003
N-nitrosodimethylamine	1003
Vinyl chloride	1017
Inorganic arsenic	1018
Lead	1025
Cadmium	1027
Benzene	1028
1,2-dibromo-3-chloropropane	1044
Acrylonitrile	1045
Ethylene oxide	1047
Formaldehyde	1048
Methylenedianiline	1050
1,3 Butadiene	1051
Methylene Chloride	1052

c. OSHA restrictions in 29 CFR 1926, Construction Industry Standards:

For . . .	***Follow 29 CFR 1926 . . .***
Asbestos	1101
Cadmium	1127
Lead	62
Methylenedianiline	60

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Transporting hazardous materials

13. Requesting transportation of hazardous materials

You must use the following procedure for requesting transportation of hazardous materials:

a. Contact Transportation Work Control ((281) 483-6563) as much in advance as possible. Transportation resources are limited and different kinds of hazardous materials cannot be transported together. Schedule transportation of compressed gas cylinders in advance since they must be transported on a cylinder truck.

b. Identify the hazardous material, the amount, the weight, the type of container, and locations for transport. Have an MSDS for the material available at the time of pickup.

c. The dispatcher will prepare a work order and the pickup will be scheduled, usually within 3 days. Depending on workload and availability of equipment, work stoppage and rush shipments may be accommodated. Small amounts of certain hazardous materials may be moved by the Quick Dispatch Service within a few hours.

d. Handle gas cylinders as described in JPR 1710.13, "Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems."

14. Transporting hazardous materials

You must follow these requirements:

a. Never transport hazardous materials on site in your car, truck, any other privately owned vehicle, or NASA administrative aircraft. This includes hazardous materials for personal use with the exception of household concentrations in quantities less than 5 gallons that you purchase at a retail store. You may be denied access to the site if you try to transport hazardous materials outside of the above exception on site.

b. You may transport only materials that are unopened and packaged in the original Department of Transportation (DOT)-approved shipping containers and only in Government or official company vehicles. You must not travel public roads.

c. Route all other hazardous materials JSC through the Transportation Branch for appropriate handling per 49 CFR, Subchapter C, "Hazardous Materials Regulations."

d. Route any hazardous materials leaving JSC, EFD, or SCTF that will travel on public roads through the Transportation Branch for appropriate handling per 49 CFR, Subchapter C, "Hazardous Materials Regulations." This includes any materials transported between JSC ("in the fence"), SCTF, and EFD.

e. The Center Operations support services contractor is the only organization authorized to transport hazardous waste.

f. The Radiological Health Officer or his or her designee is the only person authorized to transport radioactive materials.

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g. Craftsmen may transport hazardous materials that are specific to their craft and are essential to their work in a government or official company vehicle designed for that task and must not travel on public roads. Examples include welders who transport compressed gas cylinders, custodial workers who transport cleaning fluids, and pesticide applicators who transport pesticides to application sites.

h. Individuals may deliver chemicals for analytical purposes in a government or official company vehicle only and must not travel public roads.

15. Reporting an accident while transporting hazardous materials

In general, contracted commercial carriers are responsible by law for reporting all accidents involving transportation of hazardous materials. If you are transporting hazardous materials using JSC equipment and have an accident in the public domain, you must report the accident by:

a. Calling the DOT Accident Hotline (800-424-8802) if it involves any of the following:

- A fatality
- A person requiring hospitalization as a result of injuries received
- Estimated property damage exceeding $50,000
- Possible existence of radioactive contamination
- A continuous danger existing at the site, such as a spill or leakage of hazardous material

b. Notifying the JSC Safety and Test Operations Division ((281) 483-4900) and the JSC Transportation Branch ((281) 483-2301). They will help you meet other requirements.

   At White Sands Test Facility (WSTF), you must notify the NASA Safety Officer (Quality Assurance, Reliability, and Safety Office) and the Chief, Engineering Office. The WSTF Safety Officer will notify the JSC Director, Safety and Mission Assurance (S&MA), for you.

c. Follow Chapter 2.7, “Mishap and incident investigation,” of this Handbook for further guidance on mishap reporting and investigation.

The Director, S&MA, must notify the NASA Headquarters Safety and Risk Management Division of the accident and will make sure that DOT has been notified. He or she must send a written follow-up report to the Associate Director for Hazardous Materials Regulations, DOT, Washington, D.C. 20590, within 15 days as stated in 49 CFR 171.16, “Detailed Hazardous Materials Incident Reports.” He or she must also send copies to the NASA Safety Division, Office of the Chief Engineer, NASA Headquarters.

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Other requirements and responsibilities

16. For more information on handling hazardous materials

a. 29 CFR 1910, OSHA General Industry Standards

b. 29 CFR 1926, OSHA Construction Industry Standards

c. Clean Air Act of 1990, 42 U.S.C. Section 7401, et seq.

d. 49 CFR Parts 171-174, "Hazardous Materials Regulations" (DOT)

e. "DOT Emergency Response Guidebook" (latest edition)

f. 40 CFR Part 61, "National Emission Standards for Hazardous Air Pollutants" (EPA)

g. 40 CFR Parts 240-281, "Solid and Hazardous Waste Regulations" (EPA)

h. 40 CFR Parts 370-372, "Emergency Planning and Community Right-to-Know" (EPA)

i. *Hazardous Materials, Managing the Incident*, Noll, G. G., Hildebrand, M. S., Yvorra, J. G., Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma, 1995

j. NPR 8715.3, "NASA Safety Manual"

k. NPD 1820.1, "NASA Environmental Health Program"

l. NPD 8800.16, "NASA Environmental Management"

m. JPR 8500.1, "Environmental Compliance Procedural Requirements."

17. Additional responsibilities for hazardous materials

The following have responsibilities for hazardous materials:

a. As a ***supervisor*** you must:

- Make sure that a quarterly hazardous material inventory is completed and provide inventory information to the Occupational Health Branch in the format specified. (See Chapter 9.2 of this Handbook) Making additions and deletions to your hazardous material inventory as they occur will make it easier to keep current.
- Provide PPE to control the hazards of the materials being handled. The Occupational Health Branch will help you select PPE.
- Follow all requirements for restricted and prohibited materials.
- Develop and maintain a hazard analysis for your processes which use hazardous materials per JSC 17773.
- Make sure that hazardous materials in your control have adequate evacuation and response procedures for a release or spill. You must coordinate your procedures with your facility manager to ensure a unified emergency action plan for the facility.

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b. As a ***facility manager***, you must make sure that emergency action procedures you develop for your facility consider inputs from any supervisors in your facility who control hazardous materials which, if released, could result in evacuation of your facility.

c. As the ***person (civil service or contractor) who is responsible for managing operations*** and who has stated decision making authority and control over operations and activities involving hazardous materials, you must:

- Make the following certification at least once per calendar year: "I certify that I have personally examined and am familiar with this list or inventory and that based on my inquiry of those individuals immediately responsible for obtaining the information, it accurately reflects the materials used and stored within the defined work area under my authority. I also certify that each of these hazardous materials is necessary for the successful performance of activities within my area of responsibility; that no prohibited materials are on the list unless approval to use them has been granted in writing by the JSC Hazardous Materials Working Group; and that periodic evaluations are conducted and documented in order to ensure that less hazardous materials have been substituted whenever possible to do so."

- Sign the certification and attach it to the hazardous materials list or inventory. You may need to make inquiries of more than one person to validate the accuracy and sign the certification. JSC's safety, health and environmental staff will periodically audit certification and backup documentation to ensure that the lists are accurate and that evaluations for prohibited materials and substitutions have occurred.

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Chapter 9.2
Hazard communication

This could be you . . .

A laboratory worker spilled an unknown chemical and the facility was evacuated causing lost work time for several employees.

An employee was exposed to a hazardous material and a material safety data sheet (MSDS) wasn't immediately available for hazard information causing medical treatment to be delayed. .

1. Who must follow this chapter

You must follow this chapter if you work at JSC or a JSC field site. You must follow this chapter if you store, use, or dispose of hazardous materials at JSC. If you work at White Sands Test Facility (WSTF), you must follow WSTF requirements that meet the intent of this chapter.

2. What this chapter covers

This chapter is JSC's written hazard communication program to meet the Occupational Health and Safety Administration (OSHA) 29 CFR 1910.1200, "Hazard Communication Standard." This standard requires JSC to inform workers of the hazards of the materials they work with or exist in their work areas.

Determining hazards

3. How JSC uses supplier information to determine hazards

JSC doesn't normally make hazardous materials. We rely almost entirely on MSDSs from suppliers and give them a unique JSC index number. JSC organizations do hazard assessments as necessary to identify and control risks. Supervisors must give the information on any new hazards to their employees through training, instructions, safety alerts, etc. Also, through the Government-Industry Data Exchange Program JSC will pass information to our customers and suppliers. Additionally, Safety Alerts will be used to pass on information about newly identified hazards from the supplier community.

4. Assessing the hazards of hazardous materials

JSC determines hazards through hazard assessments using system safety techniques as described in Chapter 2.4, "Hazard analysis," in this Handbook. This includes any hazards unique to all uses of hazardous materials in your work areas.

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The Safety and Test Operations Division, the Occupational Health Branch, and the Environmental Office recommend appropriate policies, actions, and remedies for hazardous materials issues. You must follow these basic ground rules for hazard assessments for the purpose of this written program:

a. Classify all hazards as physical or health hazards (see definition in the Glossary).

b. Consider a material hazardous if any scientifically valid study exists which supports its classification as hazardous.

c. Include any studies that establish materials as being nonhazardous.

d. Use, as baselines, any technical information from the supplier including MSDSs (OSHA Form 174, "Material Safety Data Sheet Form," or equivalent, appendix 9A), and any pertinent information from the sources in 29 CFR 1910.1200.

5. Reporting additional hazards you identify with hazardous materials

When you identify a hazard that isn't in the MSDS, you must submit a report detailing the hazard in question, the source of the information, an analysis of potential impacts, and what you recommend to reduce risk. Also, include any specific information that may refute your hazard determination. When you have conflicting information, attempt to compare the technical merits. Your management may submit the report without a conclusion to the following organizations within 30 days of completing the hazard assessment.

a. Safety and Test Operations Division

b. Occupational Health Branch

6. Mixing hazardous materials

When you mix "as-received" hazardous materials with other materials for later use, you must do a hazard assessment as described in Paragraph 4 of this chapter to assess the possible hazards of the mixtures.

7. Assessing the hazards of a mixture

You may test the mixture as a whole to determine its hazardous characteristics. You must base all hazard assessments on positive data that either establishes or refutes the mixture as hazardous. You must follow these requirements:

a. If you don't test the mixture as a whole, you must:

- Assume the mixture has the same health hazards as its hazardous components present in concentrations greater than 1.0% by weight or volume for non-carcinogens.
- Assume the mixture has the same health hazards as its hazardous components present in concentrations greater than 0.1% by weight or volume for known or suspected

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carcinogens. You must still identify known reaction products not present in the original components.

- Use relevant and scientifically valid data in place of testing to support any assessment of the physical hazards of the mixture.
- Indicate in the hazard assessment the lack of this information.

b. You must document the results of the hazard assessment so you can later share it with all potential users. If you create the mixture, you are responsible for a complete and accurate hazard assessment.

c. The Occupational Health Branch, the JSC Environmental Office, and the Safety and Test Operations Division must review and approve initial shipments and accompanying documentation of such hazardous materials. You must provide the percentage of each component in the mixture and an MSDS for each component with each shipment.

d. You must assume that the mixture poses the same hazards as each component, regardless of any prior or existing hazard assessments or test results, if someone using the mixture could be exposed to concentrations of any hazardous component above the OSHA or the American Conference of Governmental Industrial Hygienists permissible exposure limits.

8. Investigating and studying material exposures

The Occupational Health Branch must conduct investigations and studies of material exposures you need in your work area. This includes sampling the concentration in the atmosphere to determine employee exposure levels.

Hazardous materials inventory

9. Why JSC must have a hazardous materials inventory

The hazardous materials inventory allows JSC to periodically review all hazardous materials on site. The JSC Hazardous Materials Inventory meets the similar requirements of both Superfund Amendments and Reauthorization Act (SARA) and the hazard communication standard. The Occupational Health Branch maintains JSC's inventory with inputs from the organizations.

10. How to use the hazardous materials inventory

This inventory reflects the hazardous materials in your work area. All employees in your work area must have access to the inventory. You may use the inventory as a guide to make sure that all MSDSs you need are available. You must keep the hazardous materials inventory at specific worksites in accordance with directorate instructions. Someone in your area must be responsible for updating the inventory whenever you get a new product, when

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you remove an old product, or when there is a significant change in the quantity of the product. You must enter new materials into the inventory when you first receive them.

11. Contents of a hazardous materials inventory

Your inventory must include, as a minimum, the identity of the material, as written on the label; the JSC MSDS index number; the location of the material; the amount usually kept on hand; the largest amount ever present in the workplace; and the quantity used annually. You must specify the locations in enough detail to allow someone to find it quickly such as to a specific room. If you run out of materials meant for replenishment, they must remain on the inventory. If you don't anticipate replacing them, you must remove the material from the inventory before the next annual update. The inventory must include all hazardous materials under the control of your area.

12. What you should do if you are responsible for entering your area's items into the inventory

Each area must have someone responsible for evaluating the hazardous materials inventory for that location. If you are responsible for maintaining hazardous materials inventory for your work area, you must:

a. Contact the Occupational Health Services office to get a user code and password for your inventory.

b. Enter all items into the on-line inventory available on the Total Health Homepage.

c. Continue to list on the inventory any materials you run out of but plan to replenish or continue to use. Delete items no longer in-stock that you no longer plan to use.

d. If a material has not been used during the past year, you should consider excessing the item.

e. Get JSC MSDS index numbers for all items and record the numbers in your inventory.

f. Review and correct the inventory at least yearly or whenever quantities or locations change significantly.

g. Compare incoming materials with the hazardous materials inventory to screen for new chemicals.

h. Update your inventory quarterly, as required.

You can find additional directions for updating the hazardous materials database in the HazMat Inventory Users' Guide located at:
http://www4.jsc.nasa.gov/scripts/org/sd/hazmat/recsearch.cfm

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13. Access to the inventory

Each directorate decides how its employees receive the inventory and corresponding MSDSs and must document its approach. Each directorate must make sure that:

a. All directorate activities, facilities, and employees related to hazardous materials are completely addressed.

b. All employees have access to hazardous materials inventory, MSDSs, and a copy of this chapter during their shift.

c. Employees keep their area hazardous materials inventory up to date in the on-line master site inventory.

Exempted materials

14. Products that are exempt from this chapter

You must be familiar with the products and materials listed in the table below.

For . . .	***Regulated by . . .***	***Covering . . .***
Pesticides	29 CFR 1910.1200	All aspects of pesticides with the exception of labeling requirements.
	Environmental Protection Agency	Labeling requirements.
	Occupational Health Branch	Facilities handling pesticides including insecticides, fungicides, rodenticides, and herbicides. NOTE: Only facilities designated by the Environmental Office as qualified to use pesticides should have pesticides stored on their premises. This ban includes even small amounts of pesticides, such as wasp and ant killer. The only exception is personal-use items such as "Off".
Hazardous Wastes	29 CFR 1910.120, "Hazardous Waster Operations and Emergency Response," through the Environmental Office	Using hazardous chemicals or mixtures to treat hazardous waste are within the extent of hazard communication. • While hazardous waste is exempt from JSC's hazard communication program, hazardous waste workers must have access to all the services and benefits of JSC's hazard communication program. • Once you identify a material as a hazardous waste, the material is no longer under JSC's hazard communication program (see JPR 8500.1, "Environmental Compliance Procedural Requirements")).
Consumer Products	Consumers Product Safety Act and the Federal Hazardous Substances Act	Substances that must be packaged and labeled for the consumer market and their use in the workplace. • They must be used in a manner similar to that of

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For . . .	*Regulated by . . .*	*Covering . . .*
		consumer use to be in the scope of this exemption. • You must show that your use is similar to consumer use, which is usually obvious. • This exemption does not include paints or WD40. If you have any doubt, contact the Occupational Health Branch or Occupational Health Services for help.
Foods, Drugs, Cosmetics	Food and Drug Administration	Foods, food additives, fragrances, flavors, color additives, drugs, cosmetics, and medical or veterinary devices in all respects. They are exempt from this program when they are meant for human consumption. This includes drugs which are in solid, final form for a patient to take such as pills or tablets or are in retail establishments and packaged for sale to consumers.
Beverage Alcohol	Federal Alcohol Administration Act	Distilled spirits including beverage alcohol, wine, or malt beverage intended for non-industrial use in all respects
Tobacco Products	Federal Alcohol Administration Act	Tobacco products in all respects
Medical Supplies	Occupational Health Branch	Drugs, narcotics, and controlled substances
Radioactive or nuclear materials	Space and Life Sciences Directorate	All radioactive or nuclear materials and their use (see JPD 1860.4, “Radiological Protection Policy”)
Pyrotechnic (explosive) materials and devices	Energy Systems Test Branch and the Aircraft Operations Division (Ellington Field)	Pyrotechnic materials and devices located at JSC and Ellington Field (see JMI 4500.1, “Pyrotechnics, Logistics Management”)

15. Exemption of wood and wood products

Wood and wood products are exempt in full from this chapter.

16. Articles other than raw chemicals

You must follow these steps to determine if an article will be considered as a hazardous material:

a. First determine if the item meets the definition of an “article” under 29 CFR 1910.1200. If any item meets all these criteria it is an “article” and exempt from the requirements of the Hazard Communication Standard:

- It has a specific shape or design as a result of its manufacture.

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- It has end use function(s) that depend in whole or in part upon its shape or design during end use.
- It doesn't release, or otherwise result in exposure to a hazardous chemical under normal conditions of use.

b. Assess the hazard potential for articles that fail to meet one or more of the criteria listed above.

c. Consider the entire lifetime of the article, including initial fabrication, test, end use, maintenance, storage, demolition, and disposal. Review the results of these assessments at the appropriate review activities such as design reviews or test readiness reviews. You must have safety concurrence on the results of these assessments.

Examples of articles that clearly fall under JSC's hazard communication program are welding rods, metal stock, and many construction materials (other than wood). Also included are components that require shaping or deforming such as crimping, flaring, or bending before being assembled.

Labeling and other forms of warning

17. Labeling storage and transportation containers

Follow these requirements for labeling storage and transportation containers:

a. You must label all storage containers, tanks, vessels, drums, etc., meant for holding any quantity of hazardous materials for any period of time. The label must include the following:

- The identity of the hazardous material, identical to the trade name on the MSDS
- Hazard warnings

The Occupational Health Branch will provide guidance in the design and use of hazardous materials labels or other means to warn users of physical and health hazards.

b. When you use containers for transporting hazardous materials to or from JSC, you must identify the containers. The Department of Transportation (DOT) requires placards on containers (for example, truck, train car, etc.) of hazardous goods meeting certain type and weight requirements that are transported within the United States or on U.S. waterways. The identification must include the following:

- The name of the authorizing official, the assigned office or element
- The address of the organization authorizing the shipment

You may only use shipping containers with DOT approval specific for the material to be shipped.

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18. Transfer containers

You don't need to label the containers you use to quickly transfer a material between containers. This exemption includes beakers, buckets, funnels, portable pumps, and similar equipment. If you must stop your transfer before it's complete, you must secure the container per acceptable procedures, temporarily identify its contents, and preferably keep it near the original container. To prevent unintentional contamination of the stock, don't transfer the material back into the original container.

19. Identifying pipeline, ducts, valves, etc.

You must clearly identify:

a. All pipes, ducts, valves, etc., that carry hazardous materials in any form or visibly connect to hazardous materials sources per Chapter 9.1, "Hazardous material safety and health," of this Handbook.

b. Pipes, ducts, etc., which visibly connect to hazardous materials sources and which don't carry the materials from that source in a manner that is clearly visible to any observer.

c. The contents of pipes, ducts, etc., if you can't see their contents because of obstructions such as a wall or they are underground.

If the number or location of pipes, ducts, etc., in any area, makes it difficult to identify each one, you may hang the placards around the area or along its length. Placards may take the form of color coding, labels, or signs. You must place placards according to their size, visibility, and the points of approach to the area. All identifications and labeling must follow JSC 08695, "Procedure for Color Code of Piping and Mechanical Systems."

Material safety data sheets

20. Availability of MSDSs

You must be able to readily access MSDSs in your work area during your work shifts. Your supervisor must maintain an up-to-date file of MSDSs for hazardous materials you use in your operations in a readily accessible location. All MSDSs in your work area must have a JSC MSDS index number. Replace any unnumbered MSDSs with numbered copies from Occupational Health Services.

21. Responsibility for MSDSs at JSC

Occupational Health Services keeps the central repository of MSDSs for JSC and must collect, maintain, and distribute the MSDSs and help you get MSDSs. An on-line index of these MSDSs is available on the Total Health Home page. You may contact the OHS MSDS Coordinator at (281) 483-7512 for any questions you may have about MSDSs.

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22. Ordering an MSDS

a. First check the NASA/JSC MSDS Search for any MSDSs not in your files. If the MSDS is in the Index and scanned into the system, you can print the MSDS directly off the screen.

b. If the MSDS is in the Index, but is not scanned into the system, submit a completed JSC Form 277, "Material Safety Data Sheet Request Form," (Appendix 9A) to the Occupational Health Services MSDS Coordinator (SD33). The MSDS Coordinator will contact you when the item has been scanned into the system.

c. If the MSDS is not in the Index, request a copy of the MSDS from the manufacturer or supplier of the product.

d. If the MSDS in your work area is more than 5 years old, it may be outdated. Contact the manufacturer or supplier to determine if a more current MSDS is available.

e. Submit all new and updated MSDSs, along with a completed JSC Form 277, to the Occupational Health Services MSDS Coordinator (SD33).

Purchases of hazardous materials

23. Purchase requests for hazardous materials

Both contractors and civil servants must follow the requirements for purchasing hazardous materials in this chapter. You must:

a. State on the purchase request whether the material requires an MSDS and determine if a MSDS is on file in the central repository by checking the NASA/JSC MSDS Search. If an MSDS is on file, the purchase request will have the notation or stamp MSDS ON FILE and give the JSC MSDS number. If an MSDS is not on file or unavailable from the JSC central MSDS repository, the purchase request must have the notation or stamp MSDS REQUIRED. RECEIVING OFFICE: UPON RECEIPT OF MSDSs, FORWARD ONE COPY EACH TO CENTRAL MSDS REPOSITORY AND TO USER.

b. Notify the Occupational Health Branch and the Environmental Office before you:

- Use any hazardous materials initially.
- Change the usage of any hazardous material.

24. The role of Procurement in purchasing hazardous materials

The following requirements apply:

a. The Procurement Support Group must support Procurement in identifying contract requirements for safety concerns under SLP 4.6, "Purchasing." They must also coordinate all procurements involving hazardous materials with the Occupational Health

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Branch to identify requirements the supplier must follow and document. The Occupational Health Branch requires the following shipping documents:

- MSDS (OSHA Form 174 or equivalent), to precede the material or accompany the first shipment if more than one shipment is planned per contract
- A current MSDS, to accompany the next shipment of the material if there is any change in the health or safety information
- A current MSDS, to accompany the next shipment if there is a change in the chemical nature of the material in any way during the life of the contract

b. Procurements of any potentially hazardous material must follow Subpart 23.3 of the Federal Acquisition Regulations (FAR) and NASA FAR Supplement 18-23.3, "Hazardous Material Identification and Material Safety Data." All procurement offices must make sure that specific safety or health requirements are in purchase orders and contracts. Specifically, safety or health requirements will indicate whether an MSDS is necessary.

25. Responsibilities of the receiving office

All receiving offices must:

a. Make sure that an MSDS accompanies all hazardous materials when specified on the purchase order.

b. Confirm that each shipping container has a label that identifies the contents given on the MSDS, the manufacturer or distributor of the material, and the specific physical or health hazards cited in the MSDS.

c. Send all MSDSs sent with any shipments of materials to the Central MSDS Repository (SD33). You must keep copies of the original MSDS in the receiving office repository to be distributed later with the material.

d. Make sure a copy of the MSDS accompanies all hazardous materials in storage and distribution either on or off site. MSDSs must be made available to receiving office employees on request.

e. Make sure receiving office employees are trained in the measures to take in the event of a spill or leak of hazardous materials.

f. Immediately impound the material and contact the responsible forwarding office for correction if the MSDS is missing from the shipping documents. If an MSDS is already on file, the receiving office may add this MSDS to the shipping papers if the name and supplier of the material on the shipping container and the MSDS are identical. The exception to this is generic materials such as hydrochloric acid or caustic soda.

g. Reject and return any shipment or transfer of hazardous materials if the supplier or forwarding office fails to provide an MSDS.

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26. Redistributing hazardous materials

If you redistribute or reissue hazardous materials you must follow Paragraphs 9 through 13 of this chapter. Obtain a MSDS following procedures in Paragraphs 20, 21, and 22 of this chapter and meet the labeling requirements in Paragraphs 17, 18, and 19 of this chapter. You must also meet the requirements of OSHA found in 29 CFR 1910.1200, Hazard Communication.

Employee training and information

27. Training for handling hazardous materials

If you handle or use hazardous materials, or work in an area with hazardous materials, you must receive information and training on hazardous materials in your work area when you are first assigned, annually, and when new hazards or chemicals are introduced in your work area. Training must include:

a. The requirements of 29 CFR 1910.1200.

b. Operations in your work area where hazardous materials are present.

c. Location and availability of the written hazard communication program, lists of hazardous materials, and MSDSs.

d. Methods and observations to detect the presence or release of a hazardous material in the work area such as visual appearance or odor.

e. Physical and health hazards of the materials in the work area.

f. Measures you can take to protect yourself from these hazards. This includes specific procedures that protect you from exposure to hazardous materials such as work practices, emergency procedures, and personal protective equipment.

g. Details of JSC's hazard communication program, including an explanation of the labeling system, the MSDSs, and how you can obtain and use the appropriate hazard information.

After first taking an instructor-led class, you may take your annual training through the on-line HazCom training accessible on the Total Health Homepage. Individual contractors may arrange to provide their own Hazard Communication training as long as the training meets the requirements of 29 CFR 1910.1200 and this manual.

If you work in an office environment, you may take your annual training through the computer-based class on the Total Health Homepage even if you have not previously taken an instructor-lead class.

Training and certification are the responsibility of line management. The Occupational Health Branch must provide any help at the request of line management. This must include actual training and certification in any aspect of hazard communication, the hazards and use of hazardous materials, and personal protection. Hazard Communication Training records

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are available through the Occupational Health Services (SD23), Hazard Communication function.

28. Information on hazard communication

The following information must be made available to you on request:

a. 29 CFR 1910.1200, Hazard Communication

b. A written copy of this chapter, "Hazard communication"

c. MSDSs for hazardous materials in your work area

d. The hazardous materials inventory for your work area as described in Paragraphs 9 through 13 of this chapter

Responsibilities

29. How employees, on-site contractors, and employee representatives can support this program

You are expected to report all safety and health issues to your supervisor for resolution.

As an employee representative, you may participate in the hazard communication program through the JSC Executive Safety Committee or the JSC Safety Action Team (see Chapter 1.1, "Management commitment," of this Handbook). Participation allows you to comment on policy, accompanying surveys, and inspections, developing necessary corrective actions, and verifying the completion of all corrective actions.

At your request, employee representatives will be given copies of the written program, MSDSs, hazardous materials lists, training records, and any other employee services this Chapter provides.

30. Lists of facility managers or organizational safety representatives

Lists of safety representatives and facility managers are in the current JSC telephone directory. The Safety and Test Operations Division ((281) 483-2084) updates this list.

31. Responsibilities for hazard communication

The following individuals and organizations have responsibilities for hazard communication:

a. As a ***line manager*** at any level, you must identify and acquire all necessary resources to implement the hazard communication program and oversee the program in your organization.

b. As a ***supervisor***, you must address any employee concerns or complaints and make sure your employees:

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- Have on-the-job training using 29 CFR 1910.1200 and JSC's hazard communication program.
- Know the necessary safety information, including hazardous materials inventories and MSDSs.
- Have access to job hazard analyses, job safety analyses, and other safety and health hazard assessments and evaluations
- Select, use, and care for protective clothing, equipment, and emergency facilities.
- Select and use monitoring equipment properly.
- Have access to a copy of this chapter and MSDSs.
- Tell Center Operations of any hazards that need to be corrected (existing or potential) to make sure handling or use of hazardous materials in JSC facilities is safe.

c. The ***Center Operations Directorate*** must make sure facilities are designed and built to anticipate hazardous conditions from activities that use hazardous materials as requested by line management, the Safety and Test Operations Division, or the Occupational Health Branch.

d. The ***Occupational Health Branch*** must:

- Review guidelines, evaluations, and recommendations for health protection measures to make sure they meet health standards for control of, or exposure to, hazardous materials.
- Help line organizations implement all the health aspects of the Hazard Communication Standard and JSC's hazard communication program.
- Maintain a central repository of MSDSs and the hazardous materials inventory.
- Make Hazard Communication Training available to JSC employees, both contractor and civil service.

Special requirements

32. Laboratory requirements

All JSC laboratories, meeting the definition in 29 CFR 1910.1450, must follow the requirements in this chapter and Chapter 6.8, “Laboratory safety and health,” of this Handbook. If you work in a laboratory you must demonstrate understanding and practice of good laboratory techniques, including procedures to decontaminate yourself and the facility in the event of a spill or escape.

Facilities engaged in manufacturing-type operations or in large-scale, multipersonnel activities that require close coordination of efforts must follow the general requirements of the program found elsewhere in this Handbook.

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33. Security-sensitive materials

If you control any security-sensitive hazardous materials, you must:

a. Generate a memorandum of understanding outlining how you follow the intent of JSC's hazard communication program. The Occupational Health Branch and the Safety and Test Operations Division must review and concur on the memorandum of understanding.

b. Follow JHB 1600.3, JSC "Security Manual," (as revised) for the memorandum of understanding on security-sensitive materials and classified products of JSC's hazard communication program such as hazardous materials lists and inventories. The Occupational Health Branch and the Safety and Test Operations Division will help you determine whether specific materials are security sensitive.

c. Never include drugs or narcotics, controlled substances, nuclear or radioactive substances, or explosives on unclassified lists of hazardous material.

d. Compile classified lists separately and lock them in files.

e. Restrict the distribution of copies of such lists to the following:

- Occupational Health Branch
- Safety and Test Operations Division
- Security Office
- The responsible Division Office

f. Allow access to such lists by any other person only if authorized by the Occupational Health Officer, with the concurrence of the requester's division chief.

g. Follow the accountability procedures in JHB 1600.3.

Contractors

34. Contractors who use hazardous materials on site

If you, as a contractor, work with hazardous materials on site at JSC, you must:

a. Obtain the following information before you begin any work on site:

- A copy of this chapter
- Instructions on accessing JSC's site-wide hazardous materials inventory
- Instructions on accessing the NASA/JSC MSDS index for hazardous materials at JSC and Ellington Field

This information is updated yearly or when new information becomes available. The contractor is responsible for the circulation of this information to employees according to 29 CFR 1910.1200.

b. Make sure your employees see the information in Subparagraph a. above.

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c. Follow the requirements of JSC's hazard communication program by working with your NASA technical manager.

d. Have access to any information and technical help you need from the JSC safety and health personnel. If you do specific, short-term jobs on site, you will be given information for pre-start reviews of your safety programs and scheduled activities. JSC will support you on a case-by-case basis.

e. Perform the same duties that distributors perform for manufacturers and customers if they distribute hazardous materials at JSC.

f. State your contract safety and health plan and how you will review purchase requests, if you will purchase hazardous materials to be brought on site.

g. Describe how you will implement hazard communication in your safety and health plan. The Safety and Test Operations Division will formally request updates through procurement channels.

h. Supply a list of all hazardous materials used at JSC to the Occupational Health Branch for review when your contract starts and update and submit the lists at least yearly. You must provide information in a way to support the Occupational Health Branch's computer database.

i. Inform the Occupational Health Officer of any hazardous material you need to purchase and use in an on-site facility for the first time. You must supply a copy of the current MSDSs for all hazardous materials you bring on site at JSC.

j. Supply a copy of each MSDS for each hazardous material you control for use on site to the Safety and Test Operations Division and the Occupational Health Branch.

35. Using hazardous materials off site

If you, as a contractor, use hazardous materials off site, you must follow JSC's hazard communication program as set forth in your contract. Contract requirements never supersede any statute, code, or regulation as required by law.

Emergency planning and response

36. Preparing for an emergency

Spills or leaks of hazardous materials often will require countermeasures under the Environmental Protection Agency and OSHA regulations. Usually, when a hazardous material spills or leaks into the environment or becomes an immediate threat to the safety of personnel or facilities, an emergency exists and requires immediate response under established contingency plans.

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Handle all leaks and spills as described in JMI 8800.3, “Preventing and Reporting Pollution,” mishap reporting requirements in this Handbook (see Chapter 2.7), and JSC's emergency response plan.

The Occupational Health Branch must, in case of emergency, acquire specific information on trade name products for purposes of emergency or first aid treatment.

37. Reporting emergencies

You must report all emergencies at JSC and Ellington Field by calling your emergency number; x33333 for JSC and the Sonny Carter Training Facility, x44444 for Ellington Field, 911 off site, and x5911 at WSTF.

References

38. For more information on hazard communications

a. DOT Emergency Response Guidebook (latest edition).

b. *Hazardous Materials, Managing the Incident*, Noll, G. G., Hildebrand, M. S., Yvorra, J. G., Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma, 1995.

c. NPR 8715.3, “NASA Safety Manual.”

d. 29 CFR 1910.1200, Hazard Communication.

e. 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories.

f. *The Occupational Environment - Its Evaluation and Control*, ed S.R. Nardi, American Industrial Hygiene Association, 1997.

g. Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents & Biological Exposure Indices (BEIs)(latest edition), AGCIH--American Conference of Governmental Industrial Hygienists.

Chapter 9.3
Pesticide control

This could be you . . .

An employee who worked in an area that had been treated with pesticides contacted the pesticides. This caused his skin to itch, blister, crack, and change color.

After spraying pesticides, a worker did not wash thoroughly before eating and suffered mouth, throat, and stomach burns as a result.

A worker dropped a pesticide container that ruptured and splashed pesticide into the worker's eyes.

1. Who must follow this chapter

You must follow this chapter if you:

a. Store, handle, mix, apply, or dispose of pesticides as part of your job.

b. Work in an area that has been treated with pesticides.

White Sands Test Facility (WSTF) must follow federal, state, and local laws as well as the intent of this chapter.

2. What this chapter covers

This chapter covers the minimum requirements for storing, handling, mixing, applying, and disposing of pesticides. You'll find emergency information in Paragraphs 12 and 13.

3. Definition of a pesticide

A pesticide is any substance that prevents, destroys, repels, or mitigates any pests such as insects or weeds. They are called insecticides, herbicides, or additives.

4. Required information for any pesticide you are working with

You must have either information from the original container label or material safety data sheet (MSDS) with you while working with any pesticide. They will tell you:

a. Contents by generic and trade names.

b. Directions for use:

- Plant material, animal, or site to which the product is to be applied
- Specific pest to be controlled by the product
- The situation, location, and conditions under which you may use the product

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- Rate and equipment requirements
- How to apply the product
- When to apply the product

c. Statement of classification.

d. Hazards to humans, animals, or the environment.

e. Statement of practical treatment.

f. Signal word and precautionary statements:

- Danger - highly toxic product
- Warning - moderately toxic product
- Caution - low order toxicity product

5. Precautions you must observe when storing and handling pesticides

If you store or handle any pesticides, you must observe these precautions:

a. Store pesticides in original containers with legible labels. The label will tell you how to store the product, when practical.

b. Make sure the storage area is secured at all times.

c. Make sure the storage area is well ventilated with an exhaust fan in operation at all times.

d. When removing pesticides from a chemical storage facility or storage area, note the exact amount used on a chemical checkout sheet.

e. If you are a spray operator, you are responsible for safely transporting pesticides.

f. Make sure all pesticides containers are secured so they don't break and spill.

g. Don't leave pesticides unattended or unlocked.

h. Keep all paper and cardboard containers dry.

i. Fill out and approve the chemical use sheet before using pesticides.

6. Precautions you must observe when mixing pesticides

If you mix any pesticides, you must observe these precautions:

a. Don't mix pesticides inside chemical storage areas. Always mix pesticides outside in open air.

b. Always have another person present when mixing pesticides.

c. Read directions before opening a container or mixing pesticides.

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d. Don't put a water nozzle directly into a pesticide solution. Keep a minimum of 18 inches between water nozzle and solution to prevent back siphoning.

e. Minimize splashing.

f. Make a slurry of pesticide powders and water before adding it to a spray tank.

g. Be aware of fire hazards.

h. Wear required safety equipment.

7. Precautions you must observe when applying pesticides

If you apply any pesticides, you must observe these precautions:

a. Apply pesticides in strict accordance with the label or manufacturer's directions.

b. Special applications such as pesticide "fogging" around potentially occupied areas require you to post a warning at least 24 hours in advance.

c. Keep pesticides away from people. Don't spray if others are close.

d. Shower at the end of the day with soap.

e. Have a physical every 6 months to determine physical health and chemical toxin levels in the body.

f. Don't smoke, eat, or drink during pesticide application. Clean your hands before you do smoke, eat, or drink.

g. Have MSDSs for the pesticides you are using readily accessible.

8. Disposing of pesticides

When you dispose of any pesticides, you must:

a. Rinse empty containers at least three times and pour the rinse water into a spray tank.

b. Punch several holes in empty containers and place them in a dumpster.

c. Put liquid chemical waste in metal containers and notify the Operations Control Center ((281) 483-2038) for pickup.

9. Precautions you must observe when using pesticide equipment

When working with pesticide equipment, you must observe these precautions:

a. Make sure equipment is in good working condition before adding pesticides.

b. If you have a mechanical problem, thoroughly clean equipment before taking it to the mechanic.

c. Clean equipment as soon as you finish using it (inside and out).

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d. Properly dispose of cleaning waste.

10. Protective clothing and equipment you must use when working with pesticides

If you work with any pesticides, you must wear the following personal protective equipment:

a. Disposable sprayer suit: Never wear a sprayer's suit longer than 4 hours.

b. Goggles: Wear snugly but comfortably.

c. Rubber boots: Wear them under your pant leg so pesticides won't run into the boot.

d. Rubber gloves: Wear them outside your sleeve if spraying upwards and inside if spraying toward ground.

e. Respirator: You must be assigned your own respirator and never share it. Replace the filter after 8 hours of actual use. Replace the filter each day or more often if breathing becomes difficult or if you smell pesticide odors.

See Chapter 5.6, "Personal protective equipment," for information on getting, using, and cleaning your personal protective equipment.

11. Training you must have to work with pesticides

If you work with any pesticides, your training must include the following:

a. Certification under federal and state laws and regulations. See Chapter 5.8, "Hazardous operations: safe practices and certification," of this Handbook for more information on certification.

b. First aid training for at least one person on each shift. The training must include the symptoms of overexposure to pesticides.

c. Proper use and maintenance of respirators. This includes a complete medical exam and respirator fit test as described in Chapter 7.2, "Respiratory protection," of this Handbook.

12. Emergency actions for pesticide spills

If a spill occurs in the field, you must follow these guidelines in this order:

a. Give first aid if necessary. First aid kits and eye wash bottles must be within easy reach on all vehicles.

b. Stop the flow from the sprayer. You must understand the flow of pesticides through the spray equipment and how to stop the flow with the least damage.

c. Contain the spill if pesticide could flow into storm sewers. This may not be a problem if you are using a dry material or if a leak occurs over grass. Dike the spill with sod or soil. Absorb the pesticide with soil, sawdust, or a special product for absorbing pesticides.

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d. Notify the Project Manager or Technical Foreman to get help if necessary and have someone follow up on the spill. If immediate response is necessary, call your emergency number.

e. Rope off the area to warn people of the spill and prevent further contamination.

f. Don't leave the spill unless there is someone there to warn people of the hazard.

g. Clean up the site. This is the most critical step. To clean up you must:

- Dispose of absorbents properly and remove and dispose of contaminated soil.
- Shovel all contaminated material into a leak-proof container and dispose of them as excess pesticides.
- Observe plants that have been accidentally doused to assess the damage.

h. Find the reason for the spill and take any necessary steps to prevent another spill.

13. Actions for an overexposure to pesticides

Remember, your emergency numbers are: x33333 at JSC and SCTF, x44444 at Ellington Field, 911 at any off-site location, and x5911 at WSTF.

If you think you or a coworker has been overexposed to pesticides, you must:

a. Notify your supervisor immediately or call your emergency number.

b. Get prompt medical attention.

c. Take the actions shown in this table for specific overexposures:

If . . .	***Then you must . . .***
Pesticides are spilled on you	• Wash the exposed skin with soap and water for at least 15 minutes • Change any contaminated clothing promptly • Shower well before putting on clean clothes
You feel dizzy or sick on the job	• Report it immediately to your supervisor • See a doctor if there is any chance illness is due to pesticides
You ever have an itching or burning sensation on the skin while working with pesticides	• Immediately wash the affected area thoroughly with soap and water
You detect unpleasant odors or unusual odors	• Leave the area immediately and report it to your supervisor
Pesticides get into your eyes	• Rinse them thoroughly with clean water for at least 15 minutes and then have them checked by a doctor

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d. Give the medical staff full details on the pesticide.

14. For more information on pesticide safety, laws, and regulations

You can find more information on pesticide control in these documents:

a. MSDSs for specific pesticides

b. The Federal Insecticide, Fungicide, and Rodenticide Act

c. Structural Pest Control Board Law and Regulations; The State of Texas, January 1993

d. Texas Pesticide Regulations; Texas Department of Agriculture, March 1990

e. Texas Pesticide Laws; Texas Department of Agriculture, 1989

f. Texas Pesticide Applicator Trainer – General Manual - Commercial and Noncommercial; Texas Agricultural Extension Service

g. "Applying Pesticides Correctly – A Guide for Private and Commercial Applicators"; U.S. Environmental Protection Agency, 1991

h. "Working Safely with Pesticides"; U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, March 1976

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Chapter 9.4
Materials that contain lead: how to work with them safely

1. Who must follow this chapter

You must follow this chapter if you do any task that involves materials that contain lead, such as:

a. Removing lead-based paints by any method such as grinding, buffing, scraping, burning or chemical peeling.

b. Welding or torching cut metal coated with lead-based paint.

c. Performing abrasive blast on surfaces coated with lead-based paints.

d. Preparing surfaces where lead is present.

e. Applying paint that contains lead.

Before working on any kind of maintenance or renovation project you must determine if any hazardous materials are involved. This includes lead, chromium, asbestos and other physical, chemical, or biological hazards.

2. Definition of lead

Lead is a toxic material. Chronic or long-term overexposure may produce lead poisoning. Symptoms include headaches, stomach cramps, dizziness, drowsiness, tremors, loss of feeling, muscular aches, and pains. Prolonged exposure can affect the kidneys, bone marrow, and nervous and reproductive systems.

Allowable levels and monitoring

3. Lead exposure limits

The permissible exposure limit (PEL) is an exposure to lead, without respirators, at airborne concentrations greater than 50 micrograms per cubic meter of air (50 $\mu g/m^3$) averaged over an 8-hour period.

The action level is an exposure, without respirators, to an airborne concentration of 30 $\mu g/m^3$ of air calculated as an 8-hour time-weighted average.

4. When you need to determine exposure levels

As an employer who has a workplace or operation that is covered by this standard, you must initially determine if any of your employees may be exposed to lead at or above the action

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level. If you do not have personnel trained and equipped to do the evaluation, contact Occupational Health Services office ((281) 483-6726) and they will do the evaluation.

5. Responsibilities of a supervisor or company

As an employer, you are responsible for determining if any employee has been exposed to lead above the action level. When you or Occupational Health Services monitor for lead, you must notify the employee of the results within 5 working days after receiving the results.

6. Monitoring for lead

If employees do any operations where lead-containing materials may become airborne, posing an inhalation hazard, your employer must first determine if any employee is exposed at or above the action level. Periodic monitoring of worker exposure levels may be required if initial monitoring exceeds the action level. You will find procedures for starting a lead exposure assessment in the Occupational Safety and Health Administration (OSHA) General Industry Standard 29 CFR 1910.1025, Lead, and in the OSHA Construction Industry Standard 29 CFR 1926.62, Lead.

7. Who must observe the monitoring

Employers must provide employees or their representative an opportunity to observe any monitoring of employee exposures to lead.

Protecting yourself against exposure to lead

8. Protection from exposure

Until your employer conducts exposure monitoring, your employer must assume that your exposure to lead will exceed the PEL and must provide you with the following:

a. Appropriate respiratory protection

b. Appropriate personal protective equipment

c. Clean change areas

d. Hand-washing facilities

e. Blood monitoring for lead and zinc protoporphyrin (ZPP)

f. Training in the hazards of lead and the use of respirators

9. Respiratory protection

You must use respiratory protection:

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a. When engineering and work practice controls cannot reduce exposures below the PEL.

b. Any time an employee requests them.

c. Before a completing a lead exposure assessment in areas where there is a high risk of airborne lead exposure.

See Chapter 7.2, "Respiratory protection," of this Handbook for more requirements.

10. Protective work clothing and equipment

When your exposure to lead exceeds the PEL, your employer must provide you with clean and dry protective clothing. Don't take lead-contaminated clothing home or remove dust by blowing or shaking. Your employer must provide clothing such as the following:

a. Coveralls

b. Gloves

c. Shoes

d. Face shields

e. Vented goggles

f. Other appropriate protective equipment

11. Housekeeping

Yes, you must keep all surfaces as free as possible of lead dust and follow specific work practices. Vacuuming with HEPA filtration is the preferred method of cleaning surfaces and clothing. Never use compressed air hoses for cleaning unless used in conjunction with a ventilation system.

12. Hygiene facilities and practices

You must use wash facilities whenever you are exposed to lead. Once your exposure to lead exceeds the PEL, your employer must provide the following:

a. Change areas

b. Showers (where feasible)

c. Eating areas

13. Posting signs

You must post signs in areas exceeding the PEL to keep untrained and unprotected personnel from entering the area. Signs must state: WARNING: LEAD WORK AREA, POISON, NO SMOKING OR EATING.

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Other requirements

14. Medical surveillance

Initial medical surveillance of tests for blood lead (PbB) and ZPP levels is required if you are exposed to lead above the action level on any one day. Periodic blood tests for PbB and ZPP are required if you are exposed to lead above the action level for more than 30 days in any 12-month period.

A medical surveillance program of periodic medical exams must be made available when you:

a. Have a blood lead test at or above 40 μg/dl.

b. Notify your employer that you have signs of lead intoxication.

c. Desire medical advice on the ability to produce a child.

d. Become pregnant.

e. Have difficulty breathing during a respirator fit test or during use.

See Chapter 3.6, "Occupational Healthcare Program," of this Handbook for more information.

15. Medical removal protection

Medical removal protection ensures that you will be removed from any type of work where lead exposures exceed the action level. The following apply:

a. Medical removal protection takes effect if two blood lead tests taken within 2 weeks of each other both exceed 50 μg/dl.

b. Your wages and benefits are protected as long as the job lasts or for up to 18 months, whichever is shorter.

16. Information and training

If your exposure to lead equals or exceeds the action level on any one day, you must have yearly lead training that includes:

a. Content of the Occupational Safety and Health Administration (OSHA) standard.

b. Specific exposure producing operations.

c. Respiratory protection program.

d. Medical surveillance programs.

e. Methods of compliance.

f. Written compliance program.

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g. Use of chelating agents.

h. Access to records.

See 4.1, “Program description” (for safety and health training), of this Handbook for more information.

17. Records you must keep

As an employer, you must maintain records on:

a. Employee medical surveillance data.

b. Training.

c. Exposure monitoring results.

You must make all records available on request to employees, former employees, their designated representatives, and OSHA.

18. For more information on lead

You can find more information on lead in these documents:

a. 29 CFR 1910.1025, “Lead”

b. 29 CFR 1926.62, “Lead”

Chapter 9.5
Explosives and solid propellant safety

This could be you . . .

An employee received minor injuries when a NASA standard initiator ignited from being exposed to radio frequency radiation without a Faraday cap installed.

A small amount of propellant ignited when someone scraped it with a "non-sparking tool." No one was hurt, but the employee was very surprised.

A propellant production facility was heavily damaged when spilled propellant ignited. The cost of this accident was over 10 million dollars.

1. Who must follow this chapter

You must follow this chapter if you use, test, handle, store, receive, transport, or dispose of explosives, solid propellants, or systems containing explosives or solid propellants.

2. What is an explosive, solid propellant, system that contains an explosive or solid propellant, or electroexplosive device (EED)?

a. An explosive is a material that undergoes rapid chemical change and generates large amounts of hot, high-pressure gases when exposed to heat, impact, friction, detonation, or other means of ignition.

b. A solid propellant is an explosive mixture that propels rockets or missiles, or generates gases for powering auxiliary devices or systems. Solid propellant and propellant as used in this chapter mean the same thing.

c. A system that contains explosives, propellants in any system, subsystem, component, device that functions by igniting an explosive or propellant inside the system, subsystem, or component. "System" is used instead of "system that contains explosive, or propellant" in this chapter.

d. An EED is a system containing explosives or propellants, and is fired by passing an electrical current through the explosive or propellant.

3. Precautions you must observe when working with explosives, propellant, or systems

You must follow the requirements below when working with explosives, propellants, or systems at JSC.

a. Don't handle explosives, propellants, or systems in a manner that could cause damage.

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b. Don't carry explosives, propellants, or systems in pockets, toolboxes, lunch boxes or other unprotected places.

c. Don't expose explosives, propellants, or systems to open flame, direct sunlight for long periods of time, or heating and electrical equipment.

d. Don't use bale hooks to handle explosives, propellants, or systems.

e. Don't use nails through packing materials or containers of explosives, propellants, or systems.

f. Keep the safe distances required by Paragraph 6.d.

g. Have a Hazardous Operations Permit as described in Chapter 5.8, "Hazardous operations: safety practices and certification," of this Handbook.

4. Special precautions when working with explosives, propellants, or systems

You must do the following:

a. Prepare detailed operating procedures listing tasks in a logical order that doesn't introduce new hazards.

b. Prepare a hazard analysis before you work with explosives, propellants, or systems.

c. Have an Safety and Test Operations Division representative review and sign off on the detailed test procedures and hazard analysis.

d. Prohibit smoking, open-flames, or heat-producing operations around explosive or propellant systems.

e. Make sure that test chambers are designed and built to JPR 1710.13, "Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems."

f. Allow only authorized personnel, trained in accordance with Paragraph 9, to handle explosives, propellants, or systems.

5. Working safely with EEDs

You must:

a. Follow all other requirements for working with explosives, propellants, or systems in this chapter.

b. Twist wire leads together or shield them and attach the leads to a good ground.

c. Make sure that wire leads are not twisted into loops, dipole antennas, or other types of antennas.

d. Provide electromagnetic protection with Faraday plugs or caps on EEDs with connectors instead of wire leads. If they are not available, then use other means of protection, such as shorting springs or aluminum foil between the connectors.

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e. Eliminate electrostatic charge buildup by using wriststats or legstats.

f. Never use or allow radios, cellular telephones, or other transmitting equipment around EEDs.

g. Never rub or polish EEDs.

h. Use only continuity testers and firing units specifically designed for use with EEDs.

6. Safely store explosives, propellants, or systems

There are several things that you must do when storing explosives, propellants, or systems:

a. You must follow these requirements in and around storage locations:

- Remove all loose packing materials, skids, dunnage, empty boxes, and other combustible materials from magazines.
- Mow and clean a 50-foot or larger fire break around your magazine.
- Don't use or store flammable materials in magazines.
- Don't allow flame-, spark-, or other-producing devices in magazines without written permission from the Safety and Test Operations Division.
- Don't smoke within 50 feet of a magazine.
- Don't use magnesium flashlights, X-ray equipment, photographic flashbulbs, or strobe lights with 10 feet of a magazine without written permission from the Safety and Test Operations Division.
- Use only "non-sparking" or reduced-sparking tools around explosives, propellants, or systems.

b. You must follow these requirements for all facilities storing explosives:

- Have the Safety and Test Operations Division review and approve all facilities used to store explosives, propellants, or systems.
- Keep magazine doors in good working condition.
- Keep magazine doors locked at all times, except when working in the magazine.
- Have at least one 3A or larger rated fire extinguisher in good working condition, outside the magazine.
- Separate storage according to the class, division, and storage compatibility group (SCG). See Paragraphs 6 and 7 of this chapter.
- Post signs stating, "Explosives," "No Smoking," along with the appropriate fire symbol. See Paragraph 10 of this chapter.
- Keep up-to-date inventories of all explosives, propellants, and systems stored in the magazine.

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c. You must follow these requirements to avoid problems with electrical energy:

- Meet the National Fire Protection Association Code 70, "National Electric Code" for hazardous locations.
- Provide static grounding systems per NSS 1740.12, "NASA Safety Standard for Explosives, Propellants, and Pyrotechnics," Chapter 5.
- Provide lightning protection per NSS 1740.12, Chapter 5.
- Check all grounding systems at least every 6 months.

d. You must observe the following safe distances:

If the class and division is . . .	***And if the exposure is to . . .***	***Then use the safe distance tables listed in . . .***
1.1	Inhabited buildings or public transportation routes	NSS 1740.12, Table 8-1
1.1	Operations on the same line	NSS 1740.12, Table 8-2
1.1	Other magazines	DOD 6055.9-STD, "Ammunition and Explosives Safety Standard," Tables 9-4 and 9-5
1.2	Anything	DOD 6055.9-STD, Tables 9-6 to 9.9
1.3	Anything	NSS 1740.12, Table 8-3
1.4	Any exposure	DOD 6055.9-STD, Table 9-11
1.5	Same as 1.1	
1.6	Same as 1.1	

7. What the class and division numbers and SCGs mean

The class and division numbers and the SCGs were set up by the United Nations Organization for storage and shipment of hazardous materials worldwide. Explosives, propellants, and systems fall under class 1. The divisions and SCGs indicate the relative hazard within class 1:

b. Use the following table to find the class and division:

If the hazard from the explosive, propellant, or system is . . .	***The class and division is . . .***
Mass detonation of almost all the material	1.1
Fragments or firebrands	1.2
Mass burning of almost all the material, but not detonation	1.3
Minor fire or blast damage limited to the package	1.4

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If the hazard from the explosive, propellant, or system is . . .	*The class and division is . . .*
Mass detonation of the material, but there is very little chance of detonation or mass burning causing detonation	1.5
Mass detonation of the system, but very little chance of accidentally initiating the system	1.6

b. Use this table to find the SCGs:

If the explosive, propellant, or system is . . .	*The SCG is . . .*
An initiating explosive that is sensitive to heat, friction, or percussion	A
A detonator or other device that contains explosives designed to initiate an explosives train	B
A bulk propellant, propelling charge, or system with or without its own way of initiating	C
A bulk explosive or system that contains explosive with its own means of ignition and two or more independent safety features	D
A system that contains explosives and propelling charges, without its own means of ignition; doesn't include systems that contain flammable or hypergolic liquids	E
A system that contains explosives and propelling charges with its own means of ignition; doesn't include systems that contain flammable or hypergolic liquids	F
Fireworks, an illuminating, incendiary, smoke or tear producing, or noise producing system; doesn't include water activated or white phosphorus	G
A system that contains explosives and white phosphorus or pyrophoric materials	H
A system that contains explosive and flammable liquids or gels	J
A system that contains explosives and toxic chemical agents	K
A system or bulk explosive or propellant not in other SCGs; not having characteristics allowing storage with other types of systems; waste, damaged, or contaminated explosives, propellants, or systems; or a new explosive, propellant or system	L
A system that is extremely insensitive	N
A system that presents minor blast or fire hazard which is designed to confine the effects within the system or the packaging and doesn't hamper firefighting activities around the system	S

8. Protective clothing and equipment you must use when working with explosives, propellants, or systems

When you work with explosives, propellants, or systems, you must first perform a hazard analysis to determine what personal protective equipment is required. It may include the following types of personnel protective equipment.

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a. Eye protection

b. Face shields

c. Wriststats or legstats

d. Conductive safety shoes

e. Non-static-producing clothing such as cotton or specially treated anti-static garments

9. Training you must have to work with explosives, propellants, or systems

You must be certified to handle explosives, propellants, or systems under Chapter 5.8, "Hazardous operations: safe practices and certification," of this Handbook. Your training must cover the following subjects for each explosive, propellant, or system you work with:

a. Nature and properties of the explosive, propellant, or system

b. Correct personal protective equipment to use in specific environments and where you can find it

c. Approved materials that are compatible with the explosive, propellant, or system

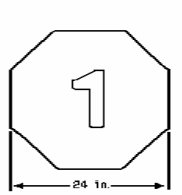
d. Proper handling methods for the explosive, propellant, or system

e. Proper storage for the explosive, propellant, or system

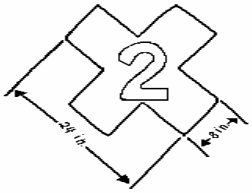
f. Proper transportation requirements for the explosive, propellant, or system

10. Fire symbols for working with explosives, propellants, or systems

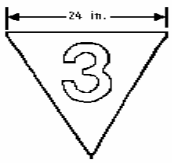
Post the following fire symbols as described in the tables below.



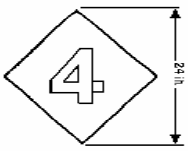
Class 1, Division 1
24 in. NSN-7690-01-082-0290
12 in. NSN-7690-01-081-9581



Class 1, Division 2
24 in. NSN-7690-01-082--289
12 in. NSN-7690-01-087-7340



Class 1, Division 3
24 in. NSN-7690-01-081-9583
12 in. NSN-7690-01-081-9582



Class 1, Division 4
24 in. NSN-7690-01-082-6709
12 in. NSN-7690-01-081-9584

Background: Orange #12246 [see Federal Standard (Fed. Std.) 595B or General Services Administration (GSA) catalog]

Numbers: 10 in. high and 2 in. thick: Black = 17038 (see Fed. Std. 595E or GSA catalog

Post fire symbols in the following ways:

If the explosive, propellant, or system hazard is . . .	***The fire symbol is . . .***
Mass detonating	1
Fragment or blast damage	2
Mass fire	3
Moderate fire, minor explosive	4

Post fire symbols in the following ways:

On . . .	***Then display . . .***
Small buildings	A symbol on each side of a building
Buildings with long sides	As many symbols as required, but more than one
Buildings that are not visible from approaches	At least one symbol on each approach
Storage buildings	At least one symbol on a building
Vehicles transporting explosives on site at JSC	At least two symbols on the vehicle

11. Emergency actions for explosives, propellants, or systems

You must take the following actions for these emergencies:

a. If an ***explosion*** happens, you must:

- Evacuate the building according to your building's emergency action plan.
- Call your emergency number and report the explosion.

b. If a ***fire*** happens, you must call you emergency number and take action as described in this table for the fire symbol posted.

If the fire symbol is . . .	***Then . . .***
1	• Don't fight the fire unless you have planned a rescue attempt • Don't try to put out the fire unless other fire symbol 1 materials are far enough away and the fire chief approves • Take cover if your safety is in doubt
2	• Sound an alarm • Fight the fire only if it is in the beginning stages and you are trained to do so • Prevent the fire from spreading, if possible • Protect yourself from fragments
3	• Fight the fire only if explosives are not involved and you are trained to do so • Use lots of water if white phosphorus or tear-producing agents are involved • Use dry sand or dry powder in the early stages of a fire involving tear-producing

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If the fire symbol is . . .	*Then . . .*
	agents • Don't use carbon dioxide, water, or halon on fires involving magnesium, titanium, aluminum, or other light metals; use a 2-inch layer of dry sand or powder on the floor for light metal fires; rake the burning metals into the layer of sand or powder and put another layer of sand or powder on top of the burning metals
4	• Fight these fires • Protect yourself from minor explosions and hot fragments

Remember, your emergency numbers are: x33333 at JSC or Sonny Carter Training Facility, x44444 at Ellington Field, 911 at any off-site location, and x5911 at WSTF. You must call your emergency number if you see an emergency.

12. For more information on working with explosives, propellants, and systems

You can find more information on working with explosives, propellants, and systems in these documents:

a. Department of Defense, DOD 6055.9-STD

b. Air Force Manual, AFM 91-201, "Explosives Safety Standard"

c. Army Materials Command Regulation, AMC-R 385-100, "Safety Manual"

d. Army Technical Manual, TM5-1300, "Structures to Resist Accidental Explosions"

e. NSS 1740.12

f. JPR 1710.13, "Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems"

g. 49 CFR 172-183, Department of Transportation Regulations for Transportation of Hazardous Materials

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Appendix 9A

Forms

The following forms listed in this appendix are available electronically at the following web addresses:

JSC Form 277 Material Safety Data Sheet Request Form
http://forms.jsc.nasa.gov/ (via form search)

OSHA Form 174 Example of Material Safety Data Sheet
http://www.osha-slc.gov/Publications/MSDS/msdsform.html

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Appendix 9B

Miscellaneous guidelines and instructions

This appendix contains the following attachments:

9.1A Restricted and Prohibited Materials

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Attachment 9.1A
Restricted and Prohibited Materials

1. Prohibited Materials

The following materials are prohibited for purchase, use, or storage at JSC:

a. Chlorinated debenzo-p-dioxins and dibenzofurans

a. 2,4-Dinitrotoluene

b. Trichlorophenols

c. Tetrachlorophenol

d. Pentachlorophenol

e. Tetrachlorobenzene

f. Pentatchlorobenzene

g. Hexachlorobenzene

h. Endrin

i. Heptachlor

j. Lindane

k. Methoxychlor

l. Toxaphene

m. 2,4,5 TP Silvex

n. Chlordane

b. Heptachlor

c. Any new use of materials containing greater than 1% asbestos (in any form).

d. Use or storage of any material containing greater than 50 parts per million (ppm) of polychlorinated biphenyl (PCB)..

e. Any new use of any new use of materials containing greater than 10 ppm of PCBs.

f. Chlorofluorocarbons [CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, Halon 1211, Halon 1301, Halon 2402, carbon tetrachloride, and methyl chloroform (all isomers except 1,1,2-trichloroethane)] used as aerosol propellants.

g. New purchases or installations of Halons for fire extinguishing systems.

h. Existing fixed systems and portable fire extinguishers must be replaced with non-Halon systems, as funding and technology permits.

i. Zinc dichromate for any other use than analytical laboratories

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2. Restricted Materials

The following chemicals may not be used for the listed prohibited process or in the designated concentrations:

a. The following solvents and solvent mixtures may not be used as cleaning or degreasing agents or related purposes. Remember that the product name may not have the chemical constituent in the name; you must review the MSDS and product label to find the ingredients. Although, not currently restricted for use other than cleaning and degreasing, these chemicals should only be used when there is no less toxic substitute.

- Acetone
- N-butyl alcohol
- Benzene
- Carbon disulfide
- Carbon tetrachloride
- Chlorobenzene
- Chloroform
- Cresols (including o-, m-, and p-) and cresylic acid
- Cyclohexanone
- 1,2-dichlorobenzene
- 1,4-dichlorobenzene
- 1,2-dichloroethane
- 1,1-dichloroethylene
- 2,4-dinitrotoluene
- Ethyl acetate
- Ethyl benzene
- Ethyl ether
- Hexachloroethane
- Isobutanol
- Methanol
- Methylene chloride
- Methyl ethyl ketone
- Methyl isobutyl ketone
- Nitrobenzene

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- Pyridine
- Tetrachloroethylene
- Toluene
- 1,1,1-trichloroethane
- 1,1,2-trichloro-1,2,2-trifluoroethane
- Trichloroethylene
- Trichlorofluoromethane
- Vinyl chloride
- Xylene

b. Asbestos-containing materials (ACMs) Materials that contain greater than 1% asbestos currently in service, such as fireproofing, lagging, floor tiles, mastic, some ceiling times, and gaskets, may be used until the end of their useful lives or until they become damaged. Damaged ACMs must be managed or abated under Chapter 5.7, "Asbestos in the Workplace," of this Handbook and JHB 8800.6, "Asbestos Control Manual." Installing new ACMs or products containing ACMs is prohibited.

c. Surface coating or other painting activities with coatings containing lead or chromates.

d. Purchase and installation of new equipment, such as thermostats and thermometers, containing liquid mercury is prohibited. Equipment currently in service may be used until the end of their useful lives or until they become damaged at which time they must be replaced with non-mercury containing alternatives.

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Part 10
Safety and health requirements for facilities and facility systems

1. Who must follow Part 10

You must follow Part 10 if you design, construct, alter, repair, operate, or maintain facilities at JSC or a JSC field site. The following table tells you which chapters from Part 10 apply to which tasks.

If you . . .	*Then you must follow . . .*
Design, construct, alter, or repair any facilities at JSC or JSC field sites, to include prime construction contractors and sub contractors Oversee facility operations as a facility manager or line manager	Chapter 10.1, "Safety and health requirements for designing, constructing, and operating facilities."
Design or operate any test, vacuum, or oxygen-enriched facility at JSC or JSC field sites	Chapter 10.2, "Safety and health requirements for test, vacuum, or oxygen-enriched facilities."
Oversee the operation of any hazardous, critical, or complex facility at JSC or JSC field sites	Chapter 10.3, "Operational readiness inspections for hazardous or critical facilities." Chapter 10.4, "Facility baseline documentation requirements for critical, complex, or hazardous facilities."

2. How to use Part 10

Part 10 provides basic requirements to make sure facility designs and operations are safe. If you are designing, constructing, altering, repairing, operating, or maintaining a facility, start with Chapter 10.1 to find the basic requirements. Then branch off to any other chapter in Part 10 or in this Handbook that applies to your facility or operation.

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Chapter 10.1
Safety and Health Requirements for Designing, Constructing, and Operating Facilities

1. Who must follow this chapter

You must follow this Chapter if you:

a. Design, construct, alter, repair, or operate facilities at JSC or JSC field sites. This includes design and construction to modify existing facilities.

b. Oversee facility operations as a line manager or facility manager.

Paragraph 14 lists the responsibilities of directors, the Facility Management and Operations Division, the Safety and Test Operations Division, the Occupational Health Branch, and the Environmental Office.

Requirements for designing and operating facilities

2. General requirements you must follow when designing and constructing facilities

To design a safe facility, you must make sure safety, health, and environmental hazards in the facility are controlled. In addition to the standards and requirements in Paragraphs 4 and 5 of this Chapter, the following requirements apply:

a. Make sure a Safety and Test Operations Division and Occupational Health representative attend all pre-design and project reviews. Make sure the facility manager is involved with and approves any facility modifications.

b. You must never modify an existing facility unless you coordinate with the Center Operations Directorate.

c. Reference all codes and standards for the facility design in the drawings and specifications so that the general construction contractor and sub contractors will know which requirements to follow.

d. Control hazards in the facility design by one or more of the following:

- Making sure that all standards, codes, and requirements that apply to the facility are incorporated into the design, specifications, and drawings. This method is best for standard facility systems such as electrical, fire, and plumbing and for standard work areas such as office areas.
- Planning the location, design, and layout of the facility carefully and considering what operations will occur in the facility and what maintenance will be required. This includes a Facility Safety Management Plan as described in Paragraph 8.6 of NPR 8715.3, “NASA Safety Manual.”

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- Doing preliminary hazard analyses and follow-on hazard analyses on the facility or parts of the facility as described in Chapter 2.4, “Hazard Analysis,” of this Handbook. Hazard analyses should begin when you develop the early design concepts and continue as you develop more design details. You must do hazard analyses on all building areas.
- Following the requirements in JPD 8820.3, “Facility Configuration Management Program.”

e. Do an environmental review before or during the design phase as described in JPR 8550.1, “JSC Environmental Compliance Procedural Requirements.”

f. Design and install ventilation systems to meet ASHRAE STD 62-2001, “ASHRAE Standard: Ventilation for Acceptable Indoor Air Quality,” and ASHRAE STD 55-1992, “Thermal Environmental Conditions for Human Occupancy,” and NFPA standards. These standards require you to:

- Make sure the design supplies ventilation air throughout the occupied space.
- Maintain acceptable indoor air quality throughout the occupied space even when the air supply is reduced when the area is occupied such as in variable air-volume systems.
- Use either the ventilation rate procedure or the indoor air quality procedure in designing the system and document your assumptions. You can find the procedures in the ASHRAE standards cited above.
- Control temperature and humidity to limit microbial growth.
- Supply outside air for ventilation in volumes that meet ASHRAE STD 62-2001 requirements.
- Make sure the outside air used for ventilation meets the National Primary Ambient-Air Quality Standards.
- Install duct detection and shutdown relays be where required by NFPA.

g. Avoid designing obstructions or projections into an aisle or passageway if possible. If they are necessary, call for them to be marked or flagged. Pointed, sharp, or jagged obstructions or projections must be covered and maintained with resilient material. Follow NFPA 101, 29 CFR 1910, and 29 CFR 1926.

h. Follow these requirements for emergency showers and eyewashes:

- Meet or exceed ANSI Z358.1 (current version).
- Install emergency showers and eyewashes in laboratories and other areas where hazardous chemicals, acids, or other corrosive substances are handled, used, stored, and transported.
- Locate emergency showers and eyewashes in accessible locations that require no more than 10 seconds to reach. Keep the path of travel free of obstructions that may inhibit the immediate use of the emergency equipment. You may provide personal

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eyewash bottle only to supply immediate flushing until a plumbed or self-contained eyewash can be reached. Personal eyewash bottles support plumbed and self-contained units but must never replace them. You must inspect and maintain personal eyewash bottles per the manufacturer's requirements.

- Provide adequate drainage and non-slip floor surface.

i. Make sure the design of clean rooms and laminar-flow clean work stations which contain cleaning facilities using flammable or toxic fluids are evaluated and approved by the Occupational Health Branch and the Safety and Test Operations Division.

3. Requirements you must follow when operating facilities and equipment

When operating any facility at JSC or JSC field sites, you must:

a. Follow all safety, health, and environmental requirements that apply to the operation. See other Chapters of this Handbook.

b. Follow the configuration management requirements that apply to facility operations from JPD 8820.3.

c. Follow these requirements for emergency showers and eyewashes:

- Meet ANSI Z358.1 (current version).
- Flow test plumbed emergency showers and eyewashes weekly to prevent water contamination and to make sure they work. Document the flow tests.
- If the unit fails to work properly, tag the unit out until repairs can be made and provide an equivalent unit.
- If you use self-contained emergency showers or eyewashes, they must have a water supply for at least 15 minutes of flow without refilling and you must inspect and maintain them per the manufacturer's requirements. Personal eyewash bottles don't meet the requirements for plumbed or self-contained eyewashes, but can be used initially. You must inspect and maintain the personal eyewash bottles per the manufacturer's requirements.

d. Make sure elevators are inspected yearly by someone who is competent and independent of the organization doing the elevator maintenance. Immediately report any defects to the Safety and Test Operations Division and Work Control.

e. Follow these requirements for heating, ventilation, and air conditioning (HVAC) systems:

- Make sure the HVAC runs only when the building is occupied and that the building is flushed by the ventilation system before people arrive unless other requirements forbid it.
- Schedule maintenance activities that interfere with HVAC when the building is unoccupied or if occupied, clear it with the Facility Manager at least 48 hours to a

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week before the shutdown. Inform the facility manager and occupants when you schedule these activities.

- Maintain appropriate pressure relationships between building areas. For example, loading docks are a frequent source of exhaust odors. Keeping the rooms surrounding the loading docks under positive pressure prevents odors from being drawn into the building.
- Make sure intake ducts are not next to sources of vapors, fumes, or mists, or to the exhaust ventilation ducts of that building or other buildings.
- Never use chemicals around air intakes as the odor will enter the facility.
- Avoid recirculating air from areas that are sources of contaminants such as, maintenance areas, chemical storage areas, and laboratories.
- Compare makeup air quantities and ventilation rates to building design, building use, and ASHRAE STD 62-2001. Make adjustments as necessary. Keep in mind that increasing ventilation rates to meet ASHRAE standards may exceed the capability of HVAC equipment to condition the air in Houston's hot, humid climate.
- Inspect all equipment regularly (per maintenance schedule) to make sure it is in good working order. Maintain dated records of maintenance inspections and repairs.
- Maintain all equipment guarding per OSHA and ANSI standards.
- Use checklists when conducting HVAC maintenance inspections to make sure all components are inspected. Document any changes in function, capacity, or operating schedule.
- Take steps to prevent microbiological growth such as bacteria, mold, or mildew in HVAC components that are exposed to water like drain pans, coils, cooling towers and humidifiers. If you have any questions about these issues call the Occupational Health Branch and the site work control (281-483-2038).

f. Follow these requirements for cooling towers:

- Clean the cooling towers regularly. As a general rule, you must clean cooling towers at least once every 3 months. You may clean them less frequently if performance data shows it is acceptable. However, you must clean them at least every 6 months. Performance data may require more frequent cleaning.
- When a cooling tower has been shut down for a long time, do routine cleaning and disinfecting just before starting the equipment. Wear appropriate personal protective equipment (PPE) when doing the work and maintain safety requirements if the area is a confined space or if fall protection is required.
- Use chemicals sparingly. Add chemicals to the water at a rate sufficient only to maintain predetermined chemical concentrations. Keep the total bacteria count below the acceptable level.

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- Use an appropriate bleed-off. Bleed off water at a rate based on total dissolved solids, chlorides, or other appropriate parameter of the circulating water. Check the bleed-off rate during regular maintenance inspections.

4. Standards for facility design and operations

The following standards apply to facility design and operation. Use the latest edition unless otherwise noted below. If there are conflicts among any of the standards, follow the most stringent of the requirements.

For . . .	***Follow these standards . . .***
General facility design or operations	29 CFR 1910, "Occupational Safety and Health Standards, General Industry," specifically: 29 CFR 1926, "Occupational Safety and Health Standards for the Construction Industry" Uniform Building Codes NPR 8715.3, "NASA Safety Manual," Chapter 8 NPR 8820.2, "Facilities Project Implementation Handbook" NASA STD 8719.7, "Facility System Safety Guidebook" JPD 8820.3, "Facility Configuration Management Program" JPR 8553.1, "Environmental Management System Procedural Requirements" JPR 8500.1, "JSC Environmental Compliance Procedural Requirements" Other Chapters in this Handbook or standards in 29 CFR 1910 that apply to the facility
Fire Safety	Public Law 91-596 (OSHA Act), 29 CFR 1910 and 29 CFR 1926 Public Law 100-678 (Section 6), "Compliance with Nationally Recognized Standards" NASA STD 8719.11, "NASA Safety Standard for Fire Protection"; this document doesn't detract from National Fire Protection Association (NFPA) codes and standards NFPA standards, latest edition; you are encouraged, but not required, to use NFPA "recommended practices" in the National Fire Codes Factory Mutual (FM) data sheets Uniform Fire Codes with Houston amendments Underwriters Laboratories Standards
Fault tolerance requirements for safety-critical systems	Other Chapters in this Handbook or standards in 29 CFR 1910 that apply to the facility NPR 8715.3, Paragraph 1.8
Designing or operating certain facility	ANSI/ASME A17.1, "American National Standard Safety Code for

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systems	Elevators, Dumbwaiters, Escalators and Moving Walks," as amended
	American Society of Heating and Refrigeration Engineers standards
	American Society of Mechanical Engineers Boiler and Pressure Vessel Safety Code
	JPR 1710.13B, "Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems"
	ANSI/Illuminating Engineering Society standard RP-7, "Standard Practice for Industrial Lighting" (Advisory)
	ANSI/Illuminating Engineering Society standard RP-1, "Standard Practice for Office Lighting" (Advisory)
	Other Chapters in this Handbook or standards in 29 CFR 1910 that apply to the facility system

5. Fire safety requirements for facility design

As a facility designer, you must make sure JSC facilities meet all fire safety requirements that apply. The following requirements apply as well as the standards in Paragraph 4 above:

a. Before designing any changes to any existing facilities, make sure a comprehensive fire protection engineering survey and preliminary hazard analysis is done to identify any fire safety problems in the facility. Correct these problems in your new design.

b. You may use less stringent requirements or other fire protection methods if a thorough fire protection engineering study shows that you will have at least an equal level of fire protection as provided by the above standards. The Safety and Test Operations Division must approve the use of less stringent requirements.

c. You may use these documents as guidelines to help you resolve fire protection issues:

- FM Loss Prevention data sheets.
- NFPA "Fire Protection Handbook."
- "Handbook of Fire Protection Engineering" (Society of Fire Protection Engineering).
- NFPA "Industrial Fire Hazards Handbook."
- OSHA 29 CFR 1910 and 29 CFR 1926.

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Requirements for constructing facilities

6. Requirements for installing new local exhaust ventilation systems

Follow these requirements when installing new local exhaust ventilation systems such as exhaust hoods:

a. Consult the Occupational Health Branch and the Safety and Test Operations Division early in the planning and design or selection of a new exhaust hood and do a preliminary hazard analysis.

b. Consider the kinds of chemicals to be used, the quantity of the chemicals, and the conditions for the use of the chemicals.

c. Use a local exhaust ventilation system to protect workers from airborne contaminants such as fumes, vapors, or dusts. Make sure the local exhaust ventilation system you use is effective in removing contaminants from the work area and exhaust them outside the building.

d. Report the installation of any new local exhaust ventilation system or modification of an existing system to the Occupational Health Branch for evaluation before starting up the system and to the Safety and Test Operations Division before installations for approvals.

e. Special Note for Perchloric Acid Hoods: Heated perchloric acid produces vapors that condense and form explosive perchlorates. Construct designated perchloric acid fume hoods with materials that won't readily react with perchloric acid and make sure the hood has wash-down capabilities. Designate perchloric acid hoods with a sign reading: PERCHLORIC ACID ONLY. Coordinate the design with the Safety and Test Operations Division.

7. Requirements for constructing facilities

If you do or oversee any construction at JSC, you must follow 29 CFR 1926, "Occupational Safety and Health Standards, Construction Industry" and 29 CFR 1910, "Occupational Safety and Health Standards for General Industry." Use EM 385-1-1, "U.S. Army Corps of Engineers Safety and Health Requirements" as a guide. EM 385-1-1 is mandatory for U.S. Army Corps of Engineers projects. You must also follow JSC's construction safety, occupational health, and environmental requirements in the paragraphs below. The following general requirements also apply:

a. Pre-award meetings must review JSC fire, occupational safety, occupational health, security, and operations requirements of the contract. The Safety and Test Operations Division, Occupational Health Branch, and Environmental Office will attend these meetings as required. The prime contractor and subcontractors must attend.

b. Construction supervisors must control the construction site, workers, and visitor access, especially with regard to safety and health. See Paragraph 11 of this Chapter for more

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information. Visitors must have permission of the construction supervisor in charge to enter the site.

c. You must inform all organizations that may be involved with or affected by the construction or hazards that may result. This must include the facility manager, safety and test operations division and Occupational Health Branch, and the environmental office.

d. Safety and test operations division, Occupational Health Branch, and environmental office personnel must be on the construction access list.

e. The organization doing the construction must:

- Post all required Occupational Safety and Health Administration (OSHA) notices, emergency telephone numbers, and a list of telephone numbers to call in case of an accident.
- Post all environmental notices and follow all environmental requirements, such as storm water controls and permits.
- Report all accidents and incidents immediately, including spills or discharge of toxic or hazardous material, by dialing the appropriate emergency numbers (JSC x33333, Ellington Field/Sonny Carter Training Facility x44444) and, to the person designated by the contracting officer, safety and test operations division, Occupational Health Branch, and the environmental office.
- Maintain the site exactly as it was before the accident or incident and keep on site all personnel involved or who have knowledge of the accident or incident at the scene.
- Complete and post all necessary permits and forms.

8. Safety oversight at construction sites

If you do any construction at JSC, you as a prime contractor must observe the following requirements and enforce them with any sub-contractors:

a. Appoint a contractor safety monitor who has the safety and health knowledge to be responsible for overall safety of construction operations. This person is empowered to stop unsafe operations and enforce corrective action.

b. Have OSHA competent safety supervisors and alternate supervisors to make sure workers know and follow all safety, health, and environmental requirements for the project. Supervisors must always:

- Be dedicated to supervising and overseeing safety.
- Have a copy of the safety and health plan and any special written safety and health procedures on site and readily available.

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- Be present or appoint a dedicated safety monitor to be present during hazardous operations or conditions, as required by the plan. Conduct a hazard analysis before conducting a hazardous operation and have it approved by the safety and test operations division and the Occupational Health Branch.
- Ensure that simultaneous tasks don't result in workers entering hazardous areas where entry is prohibited by hazard analysis, the Safety and Health Plan, or OSHA or NASA requirements. For example, entering an area with overhead work and the potential for falling objects.

c. Appoint someone to be responsible for safety and health during activation of the completed project.

9. Construction safety meetings

If you do any construction at JSC, you must hold a pre-work safety meeting with your employees and regular safety meetings will be at least every two weeks and documented as to subject and attendees. This includes briefing missing employees on the content of the meeting. You must coordinate these meetings with the Center Operations Directorate Facility Management and Operations Division. Safety meetings must cover as a minimum:

a. Individual responsibility for occupational safety, occupational health, and environmental safety to include wearing PPE, mishap reporting, emergency information and who to contact, chemical waste storage, and dumping waste products.

b. Specific hazards of the jobs being done and applicable OSHA and other safety standards associated with the phase of work in progress.

c. Guards, barricades, and other devices designed to protect workers, the on-site contractor, government employees, and the public.

d. Other areas deemed important by you, JSC construction managers, or the Safety and Test Operations Division, Occupational Health Branch, and the Environmental Office.

10. Hazardous operations during construction

If your construction work involves any hazardous activities, you must:

a. Follow the requirements in Chapter 5.8, "Hazardous Operations: Safe Practices And Certification," of this Handbook. This includes getting the necessary permits and making sure workers are certified, as required for work here at JSC, Sonny Carter Training Facility, or Ellington Field. Signatures and approvals for permits must follow Chapter 5.8 with these exceptions:

- The JSC COD Construction Office, construction manager, or contractor safety and health representative may sign the "Responsible Safety Representative" signature block.

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- The JSC COD Construction Office or construction manager may sign the "Fire Warden" signature block for new construction when there are no fire wardens or facility manager.
- The COD Construction Office, the construction manager, and the occupational safety and occupational health groups must approve any entry into a confined space. Permits must have all required signatures. Follow Chapter 6.10, "Entering Confined Spaces," of this Handbook.

b. Make sure only competent, trained workers do hazardous tasks under competent supervision.

c. Assign an OSHA required competent person to all excavations and trenching operations.

d. Assign an OSHA qualified person to all electrical work.

e. Follow other parts of Chapters of this Handbook as required:

- Chapter 8.2, "Lockout/Tagout Practices."
- Chapter 5.6, "Personal Protective Equipment."
- Part 4, "Health protection practices."

11. Protecting the work area

To protect the Construction Employees; NASA-JSC Project Management Team Members; other JSC Civil Servants; Contractor, Sub-Contractor; Consulting Employees and Visitors in and around the work site:

a. You must post signs at all construction or maintenance entrances notifying anyone who enters this project site as to who is allowed on this site; where to report when entering the site, if a sign-in is required; what PPE is required and when it is to be used; and any other job-site requirements. (i.e., Authorized Construction and JSC Inspection Personnel only. The Project Site must follow all OSHA, EPA, NFPA and NASA-JSC Safety & Health Handbook Requirements.) Emergency contact numbers for key project personnel must also be conspicuously posted on the sign.

b. Fixed barriers must meet the requirements in the OSHA standards for guardrails, 29 CFR 1910 and 29 CFR 1926, or be at a minimum substantial supported orange (nylon or plastic) barricade fencing with metal post 8 feet on center and meet the guardrail standard strength (minimum 200-pound direct pressure on top tail, as illustrated in the OSHA standard). You may also use sections of chain-link metal fencing an alternative, provided it is supported by substantially anchored posts. You must establish adequate entrances to meet the current NFPA and OSHA required access, egress and life safety codes.

c. All barriers must be substantially supported and provide for adequate means of access or egress. Barriers must not create tripping hazards for personnel having to access or egress these hazardous or secured areas.

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d. At excavations or trenches, the barriers must be an adequate distance back on the outside perimeter of the spoil pile or an adequate set distance from the excavation opening, so that support posts and barrier do not fail, if a person falls against the barrier. The minimum distance from the excavation opening is 2-feet, unless the ground is unstable or the side wall is undercutting or is fissured.

e. Use barrier tape only for temporarily blocking interior facility room entrances or hallways where hazardous work is being performed. Barrier tape must be a minimum of 4-feet back from the work area to provide workers with an adequate access area. Entrances must have at least two (2) rows of tape set at the height requirements for handrails (42-inch top tape and 24-inch mid tape line).

f. Barrier tape and enclosures required by OSHA for specialized work (i.e., asbestos, dust barriers, hazardous waste locations, electrical and others) must meet applicable OSHA requirements.

g. The safety, occupational health, environmental, and security personnel may use temporary barriers to temporarily cordon off hazardous areas or areas required for investigation.

h. Railings and decking must be free of all splinters, projecting nails, or other hazards that could produce injuries.

i. Rebar caps must be the reinforced metal plate type and placed on all protruding rebar that presents a hazard to workers, regardless of height. You must maintain the caps throughout the length of the hazard exposure.

j. All hazard warning devices aforementioned and others utilized on the project work site must be colored or painted using brilliant contrasting colors and reflective panels (when required) meeting the most recent ANSI requirements.

k. Safety vests for flagging personnel must meet current United States Department of Transportation's (USDOT) Manual on Uniform Traffic Control Devices (MUTCD) required ANSI/ISEA 107-1999 Standard for High Visibility Apparel – Class II requirements for daytime use and if performing nighttime work shall meet the ANSI/ISEA Class III requirements.

l. Flags, warning signage, hand signaling devices, cones, barricades, and other devices must meet the USDOT/MUTCD requirements for daytime or nighttime operations. You must tag faded or discolored fluorescent cones and signage, not meeting these requirements as "Hazardous-Do Not Use" and repair them or remove them from service.

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12. Safety inspections and approvals at construction sites

If you oversee a construction site at JSC:

a. You must inspect the site at least weekly for hazards and failures in following safety, health, or environmental requirements. Document any identified hazards. See Chapter 2.5, "Routine Inspections," of this Handbook for more information.

b. Users must inspect lifting equipment and scaffolds daily. See Chapter 8.5, "Lifting operations and equipment safety," and Chapter 8.7, "Ladders, Scaffolds, And Elevated Platforms: How To Work With Them Safely," for more information.

c. The Safety and Test Operations Division and Center Operations Directorate must inspect and approve all cranes at least 48 hours before a lift.

d. You must submit lift plans and have them pre-approved by the Safety and Test Operations Division and Center Operations Directorate. You must submit non-critical lift plans at least 48 hours before the lift and before any lifting operations. You must submit critical lift plans at least 72 hours before a lift and before any lifting operations. See Chapter 8.5, "Lifting Operations And Equipment Safety," for more information.

e. You must use fall protection, if required. You must inspect the equipment before and after each use. You must also maintain it in proper working order and make sure any equipment used to stop a fall was not damaged in any way. See Chapter 5.6, "Personal Protective Equipment," for more information.

f. You may also be inspected by:

- The director or directorate safety committee that is or will be responsible for the facility at least monthly.
- The safety and test operations division, Occupational Health Branch, and environmental office (if applicable) periodically. These inspections may be announced or unannounced.
- OSHA, EPA, and TNRCC, unannounced visits. These agencies will issue citations and take necessary action for any violations. Compliance officers are present on site at varying times and may inspect your site. Immediately notify the center operations project managers office and the safety and test operations division if OSHA compliance personnel arrive at your site. Notify the Environmental Office if EPA or TNRCC personnel arrive at your site.

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Other requirements and responsibilities

13. Approval for facility operations

Before you may operate a new or modified facility, it must be approved by one of the following:

a. An operational readiness inspection if required by Chapter 10.3, "Operational Readiness Inspections For Hazardous Or Critical Facilities," of this Handbook.

b. A readiness review, such as a use readiness review if deemed necessary by the director responsible for the facility. You would use this review for facilities or modifications that don't meet the criteria for an operational readiness inspection, but still involve risk to personnel or JSC operations. Use Chapter 10.3 as a guide.

c. Acceptance inspections and tests of the facility and fire protection systems by the Facility Management and Operations Division and the Safety and Test Operations Division.

14. Responsibilities for designing or building facilities

The following people and organizations have responsibilities for designing or building facilities:

a. An ***organizational Director*** at JSC must:

- Make sure facility designs meet the requirements in JPD 8820.3.
- Make sure any facility modifications done or contracted by your organization are coordinated with the Center Operations Directorate.
- Make sure an environmental review is done before or during the design phase as described in JPR 8550.1, "JSC Environmental Compliance Procedural Requirements."
- Submit the drawings and specifications for facility modifications not overseen by the Facility Management and Operations Division to the Safety and Test Operations Division, and Occupational Health Branch for review and approval. This will avoid delays.

b. The ***Facility Management and Operations Division*** must:

- Make sure facility designs meet the requirements in JPD 8820.3.
- Make sure an environmental review is done before or during the design phase as described in JPR 8550.1, "JSC Environmental Compliance Procedural Requirements."
- Send drawings, specifications, and other design documents on any new construction or facility modification to the safety and test operations division and Occupational Health Branch for review and approval.

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- Make sure that the responsible facility manager reviews and approves any facility modification project before advertising it for award of a contract.
- Make sure that the safety and test operations division and Occupational Health Branch approve the drawings, specifications, and other design documents before advertising a construction project for award of a contract.
- Make sure necessary inspection and testing occur during critical phases of any construction project, whether it is new construction or a facility modification and that the safety and test operations division and Occupational Health Branch concur.
- Make sure all required fire protection systems and features are installed, tested, and functioning properly as defined in contract specifications before final payment and that the safety and test operations division and Occupational Health Branch concur.

c. The ***Safety and Test Operations Division*** and ***Occupational Health Branch*** must review and approve by signature the drawings and specifications of all construction projects. The environmental office must review and approve by signature the drawings and specifications of all construction that involves an environmental issue.

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Chapter 10.2
Safety and health requirements for test, vacuum, or oxygen-enriched facilities

1. Who must follow this chapter

You must follow this chapter if you design, operate, oversee, or modify facilities that are used for testing or that involve vacuum, or oxygen-enriched environments.

Requirements for test facilities

2. Test facility

A test facility is a building, area in a building, or outside area where hazardous tests and training activities are conducted as described in Chapter 6.9, "Space systems and test safety," of this Handbook.

Test facility requirements don't apply to laboratories that conduct analysis, research, or experimentation unless human subjects are used.

3. Requirements for all test facilities

Test and training facilities meet the requirements in Chapter 10.1, "Safety and health requirements for designing, constructing, and operating JSC facilities," of this Handbook. Facility support systems must meet the requirements found in other chapters of this Handbook that apply.

Test facilities and facility support equipment must:

a. Provide an environment where a credible single-point failure, loss of or change in utilities, or loss of software command won't injure test personnel or damage property.

b. Include warning systems that you can see and hear in test and support areas. Warning systems must:

- Provide adequate warning to the affected area.
- Include an effective maintenance program to keep the systems ready to safely and effectively support hazardous tests.

c. Include safety or medical monitoring stations if a real-time test safety officer or medical representative will be present for tests in the facility. Make sure monitoring capabilities are acceptable to the Safety and Test Operations Division or the Occupational Health Branch and include the following:

- Visual coverage of the test
- Access to necessary data

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- Direct communication with the test director
- Access to test team communications

d. Include redundant life support systems if the facility provides life support functions to test team members such as breathing air, oxygen, or cooling. Redundancy isn't necessary if there is time to detect a life threatening condition and rescue the affected team member.

e. Provide in-chamber emergency alarms and egress capability for test chambers and chamber locks large enough to trap personnel.

f. Include oxygen flow limiters, venting, or monitoring devices to prevent an oxygen-enriched environment in test areas where test personnel use oxygen and that don't meet the requirements of Paragraphs 7, 8, 9, and 10 of this chapter.

g. Provide emergency power and other necessary utilities for systems which, if lost, would endanger test personnel or property.

h. Meet the requirements of Paragraphs 7 through 11 of this chapter if they are vacuum or oxygen-enriched test facilities.

4. Requirements for test facilities using human test subjects

If the facility uses human test subjects, you must:

a. Make sure rescue personnel can rescue incapacitated test subjects quickly under all test and anticipated emergency conditions.

b. Have a material control program to prevent flammability and toxic off-gassing hazards where people work in enclosed environments. The following are the minimum requirements for material control:

- Make sure such hardware meets the flammability and toxic offgassing requirements of NASA-STD-6001 (formerly NHB 8060.1C), "Flammability, Odor, Offgassing, and Compatibility Requirements and Test Procedures for Materials in Environments That Support Combustion."
- Get written approval from the JSC Materials and Process Branch (ES4) for any material applications.

c. Include provisions to safely end a test and remove the test subjects if a power failure, fire, or other emergency happens.

d. Include a non-electric lifting device as the primary means to place and remove test subjects from the water in underwater test facilities.

5. Safety and quality assurance provisions for test facilities

For safe operations that meet quality requirements, you must:

a. Have a safety plan that addresses how you make sure your test and facility operations are safe. Have your plan approved by the Safety and Test Operations Division.

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b. Prepare and maintain facility failure and hazard analyses as described in Chapter 2.4, "Hazard analysis," of this Handbook. The hazard analysis must address all hazards of the facility hardware, support equipment, facility software, and operations and how the hazards are controlled.

c. Document quality assurance tasks for the facility in either the facility operating procedures or a quality assurance plan. Develop and maintain a quality assurance plan if your facility handles flight hardware or if required by the Flight Equipment Division. Quality assurance tasks may include:

- Calibrating instruments.
- Making sure consumables in life support systems such as breathing air or water meet any standards that apply.
- Inspecting hardware and making sure operations meet requirements.
- Certifying pressure systems.

6. Operating procedures

Your test facility must have documented facility operating procedures at the operating level as described in Chapter 10.4, "Facility baseline documentation requirements for critical, complex, or hazardous facilities," of this Handbook. The Safety and Test Operations Division must concur on your operating procedures by signature. Your operating procedures may contain more stringent requirements than those of this Handbook if necessary.

Your operating procedures must:

a. Carry out the safety requirements of this chapter and of Chapter 6.9 of this Handbook.

b. Outline the processes, ground rules, and personnel for facility and test operation.

c. Outline the process to work with the Safety and Test Operations Division.

Requirements for vacuum or oxygen-enriched facilities

7. Vacuum or oxygen-enriched facilities

A vacuum or oxygen-enriched facility is a building, area in a building with either a vacuum or oxygen-enriched environment as defined in the Glossary.

The requirements for vacuum or oxygen-enriched facilities don't apply to the underwater neutral buoyancy facilities where the breathing air is less than 23% oxygen by volume.

8. Requirements for vacuum or oxygen-enriched facilities

All vacuum and oxygen-enriched facilities must meet these requirements:

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a. Follow safety codes and standards that apply such as National Fire Protection Association, National Electric Codes, and American Society of Testing Materials Standards.

b. Provide relief devices that are certified under JPR 1710.13, "Design, Inspection, and Certification of Pressure Vessels and Pressurized Systems," for chambers that contain oxygen-enriched environments.

c. Have a material control program to control hazards with increased flammability or vacuum instability. The following are the minimum requirements for material control:

- Make sure hardware used in oxygen-enriched environments meets the requirements of NASA-STD-6001 (formerly NHB 8060.1C), "Flammability, Odor, Offgassing, and Compatibility Requirements and Test Procedures for Materials in Environments That Support Combustion."
- Make sure materials used in vacuum environments meet the requirements of and JSC-SP-R-0022A, "Vacuum Stability Requirements of Polymeric Materials for Spacecraft Application."
- Get written approval from the JSC Materials and Process Branch (ES4) for any material applications.

d. Provide a means to automatically de-energize electrical equipment and systems when the fire suppression system is activated.

e. Ensure electrical circuits are properly controlled. Normal values for current limiter settings may not be enough in a vacuum or oxygen-enriched environment. You must:

- Use adequate fuses or current limiters to electric circuits.
- De-energize all circuits before making or breaking connections. Use an environmental electrical connector such as the "zero-G connector," Marshall Space Flight Center specification 40M39580B, and interrupt the load before making or breaking connections, if necessary.

9. Requirements for facilities with people in oxygen-enriched environments

For facilities with people in oxygen-enriched environments, you must:

a. Use materials that meet the flammability requirements of NASA-STD-6001 (formerly NHB 8060.1) in the use atmosphere for all wire insulation and accessories.

b. Design, make, and install wire runs and bundles to:

- Avoid damage to insulation or connectors from crimping, scraping, pressure, or other sources of damage.
- Make them easy to inspect.

c. Keep all systems free of hydrocarbon contamination.

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d. Never use pyrotechnic or ordnance devices where the device or heat from the device could contact an oxygen-enriched environment.

e. Provide a means to immediately detect an incipient fire or other hazardous condition in each manned compartment of any test area. Automatically monitor any compartments that you can't watch.

f. Include firefighting provisions and suppression systems to allow you to safely rescue test subjects under pretest and test conditions. You must be able to activate and control the system from outside and inside a test compartment.

10. Requirements for facilities with people in vacuum environments

For facilities with people in vacuum environments, you must:

a. Provide a means to repressurize locks and chambers in an emergency. You must develop procedures for emergency repressurization and conduct periodic training and drills.

b. Make sure that any failure in a facility environmental control system that affects one test subject doesn't affect any other test subjects.

Other requirements for test, vacuum, or oxygen-enriched facilities

11. Training for working in test, vacuum, or oxygen-enriched facilities

Your facility must have written training and certification requirements for each position. You must:

a. Be trained in:

- Your duties for normal operations and emergencies.
- Hazards you face and safety precautions you must take.

b. Be certified under Chapter 5.8, "Hazardous operations: safe practices and certification," of this Handbook if you are a chamber operator or rescue technician.

12. Emergency planning for test, vacuum, or oxygen-enriched facilities

You must:

a. Have an emergency action plan as described in Chapter 3.8, "Emergency preparedness," of this Handbook.

b. Conduct emergency drills at least twice a year under your or JSC's emergency procedures to make sure the test team can react to emergencies effectively. A representative of the Safety and Test Operations Division must monitor and evaluate your emergency drills. Regular emergency drills aren't required for inactive facilities. If the

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facility has been inactive, all test team members must have participated in an emergency drill within three months before the test.

13. Other requirements test, vacuum, or oxygen-enriched facilities must meet

In addition to the requirements in this chapter, test, vacuum, or oxygen-enriched facilities must meet the requirements in this table as they apply.

For . . .	***Follow this standard . . .***
Test facilities that use human subjects	• NPD 7100.8, “Protection of Human Research Subjects”
Vacuum or oxygen-enriched facilities	• JPR 5322.1, “JSC Contamination Control Requirements Manual” • JPD 8080.4, “Exposure to Reduced Atmospheric Pressures” • NFPA STD 99B, “Standard for Hypobaric Facilities” • ASTM, “Fire Hazards on Oxygen Systems” • Compressed Gas Association, “Accident Prevention in Oxygen-Rich and Oxygen-Deficient Atmospheres”
Determining what materials are acceptable in vacuum or oxygen-enriched environments	• NASA – STD - 6001 • JSC-SP-R-0022A

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Chapter 10.3
Facility Readiness Reviews for Hazardous or Critical Facilities

1. Who must follow this chapter

You must follow this Chapter if you:

a. Oversee a facility described in Paragraph 3 of this Chapter.

b. Are a member of an Operational Readiness Inspection (ORI) or Use Readiness Review (URR) committee.

c. Are a director with a facility that requires a facility readiness or URR.

2. Definition of a facility readiness review

A facility readiness review is a review to determine if a facility is ready to operate and operate safely after initial construction or modification. At JSC there are two levels of facility readiness reviews, depending on the hazards, criticality, or complexity of the facility, which are listed and defined below:

a. An ORI is a rigorous formal inspection by a committee, to approve a facility as ready to operate safely and effectively before it begins operations.

b. A URR is a less rigorous and less formal review to approve less hazardous, complex, or critical facilities as ready to operate safely and effectively before they begin operations.

Note: Other requirements in this Handbook, such as Chapter 6.9, require readiness reviews for specific activities, such as hazardous testing. Chapter 10.3 only covers reviews necessary to approve initial facility operation or resuming facility operation after a modification.

3. What facilities must have a facility readiness review

“Facility” as used in this Chapter may be a building, a work area in a building such as a test chamber, or an outside work area. Facilities with a small risk of injury, damage, or mission failure, such as office buildings, don’t require a facility readiness review, but other standards may require acceptance testing of certain systems (see Chapter 10.1 of this Handbook). The table provides the criteria for which facilities must have an ORI or URR.

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Facility . . .	***ORI criteria . . .***	***URR criteria . . .***
New JSC Facilities	Major facilities that pose a significant risk of death, serious injury, serious property damage, failure of JSC's mission, or failure of space flight missions.	Facilities that pose a very low risk of death, serious injury, or mission failure. Facilities that pose a significant risk of minor injury, moderate property damage, or mission failure. The Director, S&MA must concur that a URR, rather than an ORI, is allowable.
Modifications to JSC Facilities	Generally modifications done with C of F funding or several minor modifications to facilities that would require an original ORI. Major modifications to critical or hazardous systems, regardless of dollar value, or changes in management philosophy or operation within hazardous or critical facilities. The facility management may conduct a URR if the Director, S&MA concurs.	Generally modifications done with less that C of F funding that pose a low risk to personnel, property, or mission The JSC Director, S&MA must concur that a URR, rather than an ORI, is allowable.
Non-JSC Facilities where JSC personnel participate in hazardous operations.	Non-JSC facilities with personnel in a vacuum or oxygen-enriched environment with a contract or agreement with any non-JSC organization to support a JSC program that includes this Chapter. This Chapter applies to non-JSC facilities that: • Have altitude, space simulation, or hyperbaric chambers • Test or check out spacecraft • Use other equipment in operations with personnel in a vacuum or oxygen-enriched environment	Non-JSC facilities where other hazardous environments are involved at the discretion of S&A management or the managers overseeing the personnel working at the facility.

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4. When a facility readiness review is done

When required by Paragraph 3 above a facility must have a facility readiness review before starting or resuming operations. You should hold the facility readiness review before acceptance testing, but may conduct non-hazardous tests and check outs the facility's systems and equipment before the facility readiness review unless your facility uses human subjects in a vacuum or oxygen-enriched environment.

You must never put personnel in a hazardous environment or jeopardize NASA property or missions as a part of any test or checkout before:

a. Completing at least an initial facility readiness review and resolving the committee's recommendations.

b. Following human research policies and procedures such as NPD 7100.8, "Protection of Human Research Subjects."

5. Appointing a review committee

The following outlines the process for appointing an ORI or URR:

a. For an ORI:

- The organizational director responsible for the facility coordinates with the OCE and nominates potential members for the ORI committee.
- The Center Director appoints the chairperson of the committee via a letter.

b. For a URR:CC

- The division chief responsible for the facility nominates members for the URR committee and prepares an appointing letter for the signature of the responsible organizational Director.
- The organizational Director is the appointing authority and will appoint a committee chairperson.

6. Committee membership

A review committee normally has a chairperson, an executive secretary, and around six more voting members. The membership listed below is mandatory for ORIs. For URRs, Safety, Health, and Medical may waive their participation.

A review committee must have the following members and supporting personnel:

a. The following rules apply to ORIs and may be considered by the appointing authority for URRs. The center director may make exceptions to these rules to include highly qualified specialists as committee members:

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- All committee members who are division chiefs or below must come from an organization other than the one responsible for the facility. Personnel in the facility organization support the ORI committee.
- At least two members must be division chief level or above. Other members must be branch chief level or above.

b. The committee chairperson who runs the committee and must be a division chief or above.

c. The executive secretary who does administrative tasks for the committee and:

- Advises the organization responsible for the facility as it prepares for the facility readiness review.
- Develops a review schedule and agenda after consulting with the organization responsible for the facility.
- Presents the schedule and agenda for approval at the first committee meeting.
- Attends meetings held to prepare for the facility readiness review to provide direction, answer questions about the committee's requirements for the inspection, and assist in preparing variance requests, if required.

d. If required, a doctor knowledgeable of occupational and environmental medicine requirements.

e. An industrial hygienist if occupational health concerns are involved.

f. One representative from the safety and test operations division or resident quality assurance, reliability, and safety office.

g. One representative from the quality branch. At JSC field sites, one person from the resident quality assurance, reliability, and safety office may represent safety and quality.

h. One representative from the organization that supplies the test subjects.

i. Other members from disciplines such as facility engineering, facility management techniques, and test engineering. Members from non-JSC organizations are also desirable.

j. Alternate members picked by the appointing authority to fill in for regular members who must be absent because of emergencies.

k. Personnel who support the facility readiness review to include:

- The management, responsible for the facility will serve as the single point of contact with the review committee and make sure the facility is ready for the review.
- Personnel who operate the facility or those asked to support the review. These personnel must cooperate with the review committee by providing information requested during the review.

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7. Facility readiness review process

A facility readiness review usually follows this process. The chairperson may change the procedure to fit the circumstances as long as the intent of the procedure is fulfilled. The steps are:

a. The committee meets when called together by the chairperson. The committee must keep records of its proceedings. The review begins with:

- A committee briefing from those who designed or will operate the facility. This briefing must summarize the information needed in Paragraph 8 of this Chapter.
- The committee tours the facility.

b. The committee decides what other information and details are needed.

c. The chairperson assigns teams of one to three members who investigate and gather the information and details needed and then report back to the full committee. Any committee member may investigate any item personally if he or she wants to.

d. Committee members note discrepancies and recommendations and turn them in to the secretary, who assigns a control number.

e. The full committee evaluates and classifies all recommendations. For ORIs, see Paragraph 9 of this Chapter. URR committees assign action items to the facility through committee consensus. Members with minority opinions may appeal to the appointing authority or S&MA Director.

f. The committee reviews its recommendations or action items with facility personnel to make sure that the recommendations are understood and that the committee has not acted on the basis of inaccurate or incomplete information. The management responsible for the facility makes sure corrective actions are done.

g. The committee issues its findings and recommendations in writing to the appointing official or others as necessary.

h. The committee follows up to make sure the facility takes action on mandatory recommendations by the deadlines.

i. The committee issues a final report and sends copies to the appointing authority and the manager responsible for the facility.

j. The committee continues to act until the facility is approved for operations. This may involve overseeing or reviewing the results of acceptance testing.

k. The appointing authority, after accepting the final report, disbands the committee unless he or she decides that the committee will do post-facility readiness review as described in Paragraph 12 of this Chapter.

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8. Committee activities

The review committee must make sure the following are adequate for safety and operations:

a. Facility design, construction, or changes.

b. Facility staff to include:

- Its size and organization.
- The responsibilities of each staff member.
- Training for each staff member.

c. Interfaces among and responsibilities for all organizations that operate or use the facility.

d. Pre-operations inspection, quality control, and shakedown testing in the facility.

e. Plans and procedures for normal and emergency operations.

f. Facility baseline documentation described in Chapter 10.4, “Facility Baseline Documentation Requirements For Critical, Complex, Or Hazardous Facilities,” of this Handbook

g. Facility safety program to include the following:

- Supporting safety services and facilities.
- Hazard analyses.
- Compliance with all safety requirements that apply to the facility, such as this Handbook and other JSC, NASA, National Fire Protection Association (NFPA) and federal requirements.
- Human factors and occupational health.

h. Reliability, failure mode and effects analyses, and single-point failure summaries.

i. Other factors that directly or indirectly affect the safe operation of the facility.

j. Environmental protection in JSC facilities.

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9. Classifying ORI committee recommendations

An ORI committee must classify each recommendation in one of four categories and set deadlines to have actions on recommendations completed. The classifications are:

Classification . . .	*Vote required . . .*	*Other requirements . . .*
Mandatory—involves a credible risk of a mishap or operational problem that could cause injury, death, major property damage, or a priority impact to the environment.	One-third vote of the full committee	Note all votes for "mandatory" in minutes and reports if a recommendation doesn't get the necessary one-third majority vote
Nonmandatory—involves risk of minor property damage, operational problems, or other impact to the environment where immediate action isn't required	Any vote that doesn't classify the recommendation as mandatory, further study needed, or rejected	None
Further study needed	A majority vote of the full committee	Assign action items for further study, track them to completion, and document the results in the final report
Rejected	A majority vote of the full committee	Document all "rejected" recommendations in the final report

10. Final report

The final report must include:

a. Recommendations or action items and their corrective actions.

b. Any variances from recommendations or requirements.

c. Recommendation for certification that the facility is approved for operation.

In addition, a presentation before the JSC Management Council is required before the Center Director grants certification. The facility manager conducts this presentation in conjunction with the committee chairperson.

11. Addressing review committee recommendations and action items

As the manager responsible for the facility, you must:

a. Take corrective action on all mandatory ORI recommendations and URR action items by the committee deadlines.

b. Never conduct any operations that involve personnel in a hazardous environment before corrective action on mandatory recommendations is complete.

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c. Consider nonmandatory ORI recommendations or any other URR recommendations for early implementation.

d. Present actions taken to the committee for approval and provide written documentation as necessary.

e. Discuss any mandatory ORI recommendation or URR action item that you can't take action on because of cost, operational, or schedule impacts with the committee. If the committee doesn't change the recommendation or action item, you must request a variance. Follow these rules for variances:

- Request a variance from the center director through the committee for recommendations that don't involve JSC, NASA, NFPA, State, or Federal requirements.
- Follow the variance process in Chapter 1.4, "Written Safety And Health Program," of this Handbook for variances from JSC, NASA, NFPA, State, and Federal requirements. Make sure the ORI committee also reviews the variance requests.
- Have the senior manager from the organization that supplies test subjects concur on any variance request that involves the safety of human subjects.

f. Keep a copy of the final report as described in Chapter 10.4 of this Handbook.

12. Post-facility readiness reviews

As the manager responsible for the facility, you are encouraged to bring the review committee or another committee in to review your facility and operation, especially if your facility uses human subjects in a vacuum or oxygen-rich environment. It is recommended that you hold such a review at least once each six months or more often if you think it is necessary due to conditions or special problems in the facility. Make sure written records of any post-facility readiness reviews are sent to the appointing authority.

13. Non-JSC facilities

Facility readiness reviews are done on non-JSC facilities described in Paragraph 3 of this Chapter. If JSC has a contract or agreement with your non-JSC organization as described in Paragraph 3 of this Chapter, you must:

a. Send JSC a list of facilities you believe require a facility readiness review. You must send this list within 14 days of signing the contract or agreement or at any later time when you find that a facility readiness review is needed. The list must include information to help JSC evaluate your facilities such as:

- General description the facility and its operations
- What JSC project the facility supports

b. Follow this Chapter with these exceptions:

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- The person in charge of your site or a higher-level official will be the appointing official. He or she will fulfill the responsibilities of the appointing authority found in this Chapter.
- Committee members must be equal in rank to JSC division and branch chiefs as described in Paragraph 6 of this Chapter. JSC will arrange for committee members from government organizations if necessary.
- The same committee members may participate in more than one review. However, you must keep the review for each facility and its records separate from reviews and records for other facilities.

c. Allow JSC to send qualified observers if necessary. These observers must have access to all committee meetings and records.

d. Send the final report to the Director, S&MA. He or she must send the report and his or her personal assessment of the facility's overall safety to JSC's Center Director. The report must include all information on variances to mandatory ORI recommendations or URR action items and the schedule and due dates for corrective action on all mandatory and nonmandatory ORI recommendations or URR action items.

e. Send a plan for post-facility readiness reviews recommended in Paragraph 12 of this Chapter to JSC's Center Director and Director, S&MA.

14. Maintaining ORI committee reports

The facility manager or lab manager must keep a copy of the report as a part of the Facility Baseline Documentation (see Chapter 10.4 of this Handbook). The S&MA Director sends ORI reports to NASA Headquarters Safety and Risk Management Division as requested. Resident quality assurance, reliability, and safety offices will keep copies of ORI reports for JSC remote sites.

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Chapter 10.4
Facility baseline documentation requirements for critical, complex, or hazardous facilities

1. Who must follow this chapter

You must follow this chapter if you:

a. Oversee a facility described or listed in Paragraph 2 of this chapter.

b. Are a director at JSC and have facilities described or listed in Paragraph 2 below. Paragraph 12 of this chapter lists your responsibilities.

2. What facilities must have facility baseline documentation

"Facility" as used in this chapter may be a building, a work area in a building such as a laboratory, or an outside work area. A facility must have facility baseline documentation if it:

a. Is critical to JSC's overall mission.

b. Is hazardous.

c. Has very complex operating systems.

The following table lists existing JSC facilities that must follow this chapter.

Facility . . .	***In building . . .***
Mission Simulation and Training Facility	5
Crew Systems Laboratory	7
Photographic Technology Laboratory	8
Development Fabrication Facilities	9 and 10
Systems Integration and Mockup Laboratory	9N
Preflight Adaptation Trainer Laboratory	9N
Structures and Mechanics Laboratory	13
Standards and Calibration Laboratory	15
Avionics Systems Laboratory	16
Central Heating and Cooling Plant	24
Auxiliary Chiller Facility	28
Mission Control Center - Houston	30
Lunar Curatorial Facility	31

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Facility . . .	***In building . . .***
Hypo/Hyperbaric Chambers	32
Space Environment Simulation Laboratory	32
Space Environment Effects Laboratory	33
Mission Simulation Development Facility	35
Central Computer Facility	46
Emergency Power Building	48
Vibration and Acoustic Test Facility	49
138-kV Electrical Substation	221
Atmospheric Reentry Materials and Structures Evaluation Facility	222
Radiant Heat Verification Facility	260
Hypervelocity Impact Research Laboratory	267
Water Treatment Facility	319
Energy Systems Test Area	350-356
Neutral Buoyancy Laboratory (Sonny Carter Training Facility)	920
White Sands Test Facility	as determined by WSTF Manager

Facility baseline documentation

3. Facility baseline documentation

If your facility meets the above criteria or is listed above, you must develop, validate, and maintain a set of baseline documentation for your facility before beginning operations. Paragraphs 4 through 10 below describe what facility baseline documentation must contain.

4. Configuration control documentation

You must have a documented system to identify and control your facility's configuration that meets JPD 8820.3, "Facility Configuration Management Program." You must document your configuration control system in your general operating procedures described in Paragraph 5 below. See JPD 8820.3 for a list of document types. You must keep the following documentation:

a. Current facility drawings used to construct or modify the facility. Usually these drawings are for the construction of facilities projects and don't include the facility equipment.

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b. Equipment drawings used to install or modify facility equipment such as test instrumentation, test article fixtures, and test equipment. These drawings may include functional schematics, block diagrams, or one-line drawings.

c. Nonmetallic materials surveys that identify and approve (via a Materials Usage Control Board) all nonmetallic materials used in a test article, facility, or system in a reactive environment.

5. General operating procedures

You must have a general operating procedures document that is nonspecific. A general operating procedure contains your basic policies, describes your facility organization and its functions and responsibilities, and describes how you collect and control your facility baseline documentation. A general operating procedure must include:

a. General operating requirements that describe how you implement your policies and fulfill your functions and responsibilities. This includes:

- Requirements for test plans, test procedures, and data management
- The organization of test teams and review boards

b. Facility operating requirements that describe how you maintain configuration control, cleanliness, environmental impact control, and materials control.

c. Organization interface agreements that define the responsibilities of organizations that use or operate your facility and how those organizations work together.

d. Data management requirements that define how you handle, reduce, print, distribute, control, and store data from tests or operations of the facility. You must include requirements to keep backup copies of critical documentation in a separate location.

e. Safety requirements and procedures to make sure your facility operations are safe. You must address these items:

- Safety reviews
- Emergency planning and fire protection planning
- Certification and recertification of pressure systems and lifting equipment
- Equipment calibration
- Tests involving human subjects
- Operations in vacuum or oxygen-enriched environments
- Operations with hazardous materials

f. A variance process that defines how you evaluate and approve variances from any requirements you must follow or from your own policies and procedures. You must follow Chapter 1.4, “Written safety and health program,” of this Handbook to request a variance from any JSC or higher requirement.

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6. Detailed procedures

You must have detailed procedures that described how you operate machinery or systems, conduct tests, and control resources and schedules. You may develop these procedures yourself or use manufacturers' procedures when available.

7. Safety documentation

You must keep the following documents:

a. Hazard analyses that identify hazards and hazard controls in hardware or software systems and their human interfaces. You must have hazard analyses on the facility, facility systems, and facility equipment. The Safety and Test Operations Division must approve hazard analyses. The hazard analysis may also include an environmental impact assessment as described in JPR8553.1, "JSC Environmental Management System Procedural Requirements."

b. Failure mode and effects analyses that analyze the effects of a system, subsystem, or component failure on the safety of people and equipment. You only need to do failure mode and effects analyses on critical systems or as deemed necessary from your hazard analysis.

c. Safety review records that document inspections by contractor or civil service organizations. These records must, as a minimum, identify safety discrepancies found and the corrective actions taken.

d. Breathing air records that validate the quality of the air used by personnel.

8. Training documentation

You must have the following training documents:

a. Training requirements that define the minimum training needed to qualify personnel to operate equipment or systems, or to be a member of a test team. Training may include formal academic training, classroom courses, on-the-job training, and certification. You must also address recertification if necessary. This includes environmental training per JPR 8550.1, "JSC Environmental Compliance Procedural Requirements."

b. Training records that show completion of training requirements.

9. Maintenance documentation

You must have developed and implemented a preventative maintenance plan for all critical systems and equipment. Maintenance documents describe how you maintain the facility, facility systems, and facility equipment in a safe, working order and show maintenance history. You may use manufacturers' maintenance manuals. These documents must include:

a. Manuals that describe necessary maintenance and upkeep.

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b. Procedures and programs for routine and unscheduled maintenance, including recertification of hoists, cranes, elevators, and pressure systems.

c. Records that document maintenance done on the facility, systems, and equipment.

10. Other documentation

You must keep the following documents:

a. Records from a readiness review, such as an operational readiness inspection or user readiness review, that approve your facility if such a review was done.

b. Test readiness review records that document the actions, recommendations, and approval of a test readiness review board. This applies only to test facilities.

c. Documentation that shows management approval of any variances granted.

d. Other records that document such things as pressure system certification, lift hardware certification, and instrument calibration.

Other requirements

11. Maintaining facility baseline documentation

You must:

a. Keep facility baseline documentation as centrally located as practical.

b. Keep it updated.

c. Follow JPD 1440.6, "NASA Records Management," and NPR 1441.1, "NASA Records Retention Schedules," (current version) for keeping, archiving, or destroying records.

12. Directors' responsibilities for facility baseline documentation

As an organizational director, you must:

a. Decide which of your facilities must follow the requirements in this chapter.

b. Make sure each facility or laboratory manager has the required facility baseline documentation.

c. Review the status of your facility baseline documentation during the first quarter of each calendar year to make sure it meets this chapter. After your review:

- Bring any discrepancies found during your review to the attention of the responsible facility or laboratory manager for corrective action.
- Certify that your baseline documentation meets the requirements of this chapter to the Director, Safety and Mission Assurance in writing. Note any outstanding discrepancies and the expected completion dates for corrective actions. Certify White

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Sands Test Facility baseline documentation to the resident Chief, Quality Assurance, Reliability, and Safety Office.

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Part 11
Safety and health requirements for JSC contracts and purchases

1. Who must follow Part 11

You must follow Part 11 if you identify, develop, manage, or monitor JSC contracts or purchases. The following table tells you which chapters apply to what activities.

If you . . .	*Then you must follow . . .*
Identify, develop, manage, or monitor any JSC contracts or purchases	Chapter 11.1, "General safety and health requirements for JSC contracts and purchases"
Identify, develop, manage, or monitor any support services or construction contracts	Chapter 11.2, "Safety and health requirements for services or construction contracts"

2. What Part 11 covers

Part 11 provides you with information on how to include safety in contracts or purchases.

3. How to use Part 11

Chapter 11.1 gives you the overall safety-related requirements for JSC contracts and purchases. Use this chapter as a "shopping list" to pick from to help you define the safety-related requirements for your contract. Chapter 11.2, "Safety and health requirements for services and construction contracts," gives you further guidance in selecting requirements for services contracts and construction contracts. Chapters covering other classes of contracts are planned at this time.

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Chapter 11.1
General safety and health requirements for JSC contracts and purchases

1. Who must follow this chapter

You must follow this chapter if you identify, develop, manage, or monitor JSC contracts or purchases. Paragraph 15 of this chapter lists the responsibilities of organizations and individuals who contract for goods and services, including customer organizations, contracting officers, the Legal Office, and the Safety and Test Operations Division.

2. What this chapter covers

This chapter:

a. Provides the following information:

- What kinds of contracts and purchases there are at JSC.
- An overview of the various regulations and NASA requirements to consider for JSC contracts.
- Brief descriptions of safety products that may be required in certain contracts.
- General instructions for implementing these requirements throughout the life of the contract.

b. Fulfills the following regulations:

- "McNamara-O'Hara Services Contract Act, as amended, FAR [Federal Acquisition Regulations] Subpart 22.10."
- "Labor Standards for Contracts Involving Construction, FAR Subpart 22.4."
- "Walsh-Healey Public Contracts Act, FAR Subpart 22.6."
- Federal and NASA procurement regulations.
- NASA and JSC policies and requirements for safety and health.

Safety in contracts and purchases

3. Making sure contractors are safe

To have safe contractor operations, you must begin by defining all safety requirements, tasks, and products in the solicitation and then monitor contractor safety performance until the contract ends. To do this, you must:

a. Identify and document safety requirements. Start identifying safety requirements when you start developing the scope of the contract. Pay particular attention to the need for

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system safety engineering requirements to address hazards associated with the goods to be made or work to be done. System safety tasks must reflect the preliminary work breakdown structure whenever possible.

b. Identify and request the funds needed to fulfill safety requirements and do safety tasks. Safety requirements can add as much as 3% to 4% to the cost of the contract. Usually 0.5% to 2% of the total acquisition cost is required to meet basic federal and NASA safety requirements. Costs for system safety engineering will add to this and depend on such things as the risks of new or modified designs, new hazard control technologies, hazardous operations, or program complexity.

c. Include safety requirements in solicitations and contracts. Make safety a line item in the schedules of solicitations and contracts. Include provisions to stop contractor work if an imminent danger to life or health exists.

d. Cross-reference the tasks to the work breakdown structure and to the statement of work (SOW) if you think your contract may require system safety engineering tasks. You may also cross-reference them to hazards with specific facilities, operations, or the work environment of the contract.

e. Consider safety in selecting contractors. Items to review include:

- The Contractor's Safety and Health Plan.
- The Contractor's Occupational Safety and Health Administration (OSHA) Form 200 or 300 for the past 5 years.
- Other safety documentation that applies to the contract with particular attention to the locations where the contractor will work.

f. Provide selected contractor with a pre-work briefing and keep minutes and attendance records of each briefing. Briefings must include:

- JSC, NASA, and OSHA safety requirements and NFPA fire safety requirements.
- Emergency procedures.
- Procedures for handling mishaps (including reporting and investigating).
- Nearby JSC and contractor operations that could be hazardous to the new contractor's people or operations.

g. Monitor the progress and quality of safety products beginning with phase-in activities and through the life of the contract. The Safety and Test Operations Division will help contract administration personnel monitor contractor performance of safety tasks. Guidance for this may be in the contract schedule, in JPD 5310.7, "JSC Safety, Reliability, and Quality Assurance Audits of JSC Contractors," in surveillance plans, or by special request of the contract administrators. When a contract meets the following conditions, it will have a higher priority for monitoring:

- The goods and services being acquired pose a significant safety risk to JSC employees or programs, or any work is to be done at a JSC facility.

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- The contract value exceeds $1,000,000, or the contract officer or the contracting officer's technical representative (COTR) requests it.

h. Inspect and accept safety deliverables at contract milestones or when the contractor delivers them, such as at milestone reviews. Contract administrators must request support from the Safety and Test Operations Division as required to review and comment on safety deliverables before acceptance.

i. Develop and follow a tailored surveillance plan to grade contractor safety performance on the following factors:

- Number and type of mishaps.
- The lost time and OHSA recordable incident rates as compared to JSC goals and the industry average.
- Open safety discrepancies.
- The number of OSHA citations.
- Other factors such as proactive safety activities (including participation in the JSC safety program), mishap prevention activities, and participation in the NASA Lessons Learned program.

You may consolidate the safety surveillance plan with an overall contract surveillance plan.

k. Have the contractor identify all hazards and safety-related risks transferred to the government that have not been identified in the contract, previous deliverables, or supporting documentation. This includes training records of contractor personnel to support follow-on procurements of support services.

4. Off-the-shelf products

If you are involved in purchases of off-the-shelf products, you must follow 29 CFR 1960.34(b) and put special emphasis to items designed and made locally. Supplies, equipment, services, and material purchased directly from vendors must meet any federal safety and health laws and regulations that apply. Follow these requirements:

a. You must require suppliers to:

- Provide material safety data sheets (MSDSs) for hazardous materials.
- Identify any potentially hazardous items not identified by the government as hazardous in the contract schedule. All hazardous items delivered to the government must also include enough information to ensure the safe use, operation, or servicing of these items.
- Meet the requirements for system safety in Chapter 2.4, "Hazard analysis," for major hardware and software acquisitions.

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- Review procurements to make sure products meet safety and health provisions in this chapter.

b. If you discover defective or unsafe products, you must communicate findings about defective or unsafe products or materials that may require recall. JSC will make use of information available from the following:

- Internal sources such as mishap report findings, inspection reports, or complaints of defective materials and equipment.
- External sources such as notices from vendors, product safety bulletins, or information systems such as the Government-Industry Data Exchange Program.

5. Contractor injury and illness rates

JSC contractors must maintain rates that are below JSC goals. JSC goals may be lower than the most recent specific industry national averages for their Standard Industry Classification Code (SIC) at the three- or four-digit level. This applies to both the OSHA recordable injury and illness incidence rates and the lost and restricted workday case rates. When the Bureau of Labor Statistics changes from the SIC classification system to the North American Industry Classification System (NAICS) and begins publishing data under the new system, JSC will compare contractor rates with the rates generated under NAICS.

6. Classes of contracts and purchases

This paragraph establishes the following classes for JSC contracts and purchases for the purpose of this Handbook:

a. The ***services or support services*** class includes services to support a JSC organization in doing certain tasks. The work required is usually defined in generic terms such as engineering support, facilities engineering, maintenance, or fire protection. Contract administrators call for specific tasks by the contract SOW, task orders, or other means, consistent with generic tasks in the SOW.

b. The ***facility acquisitions*** class includes the design, construction, modification, repair, and demolition of facilities. These are commonly known as construction of facilities and minor construction, rehabilitation, and repair projects. All phases of a facility's life, from requirements definition through construction and demolition, are within the scope of this class. Purchasing goods and services for facility operation will generally fall in some other class, such as services.

c. The ***spaceflight programs*** class includes contracts for the space flight programs as described in documentation for space flight programs. Safety requirements for these programs are tailored to federal regulations and NASA requirements that apply and are usually documented as program requirements.

d. The ***payloads*** class includes purchasing goods and services associated with launching payloads into space for a specific mission in the space environment. Payload-specific

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purchases of goods and services for ground support are included in this class. If a flight program element is considered a "payload," program requirements will state the extent to which payload requirements apply.

e. The ***grants*** class includes buying "knowledge" from basic research and development by a contractor. JSC usually provides funds, and occasionally facilities or equipment, to a contractor to obtain the knowledge or other results of the work.

f. The ***lease of equipment and facilities*** class includes the use, but not ownership, of facilities and equipment by NASA for many purposes. Examples include off-site office or training space, test equipment, test beds, and data processing equipment.

g. ***Interagency loans and agreements*** aren't usually considered an "acquisition" for procurement purposes. However, goods and services are often acquired or exchanged thorough interagency loans and agreements. For the purpose of this Handbook, this class includes loans and agreements between NASA and other government agents, both domestic and foreign.

h. The ***non-programmatic research and development*** class includes purchasing research and development goods and services not within the scope of other contract or purchase classes in this chapter.

i. The ***major hardware systems*** class includes the purchase of major hardware systems and components not covered under another contract class. This class includes prototype hardware that may result from research and development.

j. The ***hazardous materials*** class includes purchasing materials such as gases, liquids, or powders, or "items" that could release harmful materials when used or worked with, such as welding rods, abrasive disks, aerosols, or metal stock. You may procure such materials by small purchase buys, as part of a blanket contract, bulk purchases, or as a part of an overall contract.

k. The ***concurrent engineering*** class represents an innovative approach to NASA engineering contracts that uses a parallel rather than a phased flight program engineering approach. Concurrent engineering poses special challenges to traditional NASA system safety engineering requirements.

Safety products and instructions

7. Safety products and deliverables

The ***safety and health plan*** is the basic contract deliverable. It sets forth the basic features and scope of the contractor's safety and health program. The plan states how the contractor will follow JSC requirements and how it will work with JSC on safety and health matters. The plan doesn't supersede contractor safety or health policies or other regulations the contractor must follow. If there is no mutual concern for hazards or risk, JSC generally expects the contractor to follow federal, state, and local regulations with minimum JSC

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oversight. You will find the data requirements description (DRD) on the JSC Safety Homepage at http://www4.jsc.nasa.gov/safety/home/contract.htm.

The safety and health plan must be approved before the contract start date. The Contracting Officer may approve an alternate schedule with the concurrence of the Safety and Mission Assurance Directorate.

An approved safety and health plan must include provisions for submitting the following data to JSC:

a. ***Mishap reports*** are required from certain contractors by Chapter 2.7, "Mishap and incident investigation," of this Handbook. You will use mishap data to assess the contractor's safety performance. The contractor may submit this data using the standard NASA Form 1627, "NASA Mishap Report," (Appendix 1A of Part 1), or any form that provides the same data. Note: Occasionally, a contract may not require a safety and health plan but may require mishap reporting. You may use the language of the mishap reporting paragraph of the DRD for a separate DRD for this purpose. Data on contract labor hours are also required, but use any feasible solution to get the data and document it in the contracted file after concurrence from the Safety and Test Operations Division.

b. ***Safety statistics*** help JSC evaluate the overall performance of a contractor's safety program. The information required is found on JSC Form 288, "Statistical Information - Contractor Safety and Health Program," in Appendix 1A of Part 1.

c. ***Material Safety Data Sheets***. See Appendix 6A of Part 6 for an example of a MSDS template. See Chapter 9.2, "Hazard communication," of this Handbook for more information. Usually, Material Safety Data Sheets are required when a contractor:

- Will use hazardous materials while working at JSC, Ellington Field, or Sonny Carter Training Facility.
- Will deliver goods to JSC and those goods contain hazardous materials.
- Has a possibility of working with delivered goods in any way that will expose personnel to hazardous materials. Examples include grinding, sandblasting, or welding.

d. The ***roster of terminated employees*** informs the JSC Clinic when it should retire employee medical records.

e. ***Safety and health program evaluation*** uses OSHA's model of a successful, continuously improving safety and health program—the "Program Evaluation Profile." JSC has modified this model slightly to support JSC's application to OSHA's Voluntary Protection Program. See Chapter 1.10, "Safety and health program evaluation," of this Handbook for more details.

f. ***Annual summary of occupational injuries and illnesses*** is a copy of the contractor's OSHA log (OSHA Form 200 or 300) or equivalent data. It must be submitted every February when the contractor posts it. JSC will analyze discrepancies between the OSHA log and the contractor's mishap data to make sure that contractor has followed its reporting requirements.

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g. ***Workplace safety analyses*** that usually result from an incident, close call, or a hazardous condition that must be corrected. Examples of such safety analyses include job safety analyses, hazard operability studies, accident investigations other than those in Subparagraph a above, and failure analysis. Results are usually communicated to JSC in hazard analyses reports, safety assessment reports, or operational readiness review documentation.

8. Other safety products and deliverables to include as appropriate

The following data may also be required:

a. The ***system safety program plan*** (SSPP) is required if the contract includes system safety tasks. It is similar to the safety and health plan above except that it outlines the contractor's system safety engineering program. System safety engineering is generally required whenever you think complex hardware, software, environmental, or personnel interactions could create hazards that must be eliminated or controlled. See Attachment 802B, Appendix 8B for a list of references that describe system safety engineering techniques. The SSPP may be included in the Safety and Health Plan or specified as a separate plan in the SOW or the data requirements of the contract. The results of a system safety program are hazard analysis reports and safety assessment reports. Examples of items an SSPP may cover include the following:

- Flight hardware.
- Critical ground support equipment.
- High-hazard, high-value, or mission-critical facilities.
- Hazardous operations.

b. Older contracts may require ***risk evaluations*** and ***safety and health program self-evaluation reports*** as described in the DRDs. Consult with the Safety and Test Operations Division for guidance on whether to replace these deliverables with a requirement for the ***program evaluation*** as described in Subparagraph 7.e above.

9. How to decide which safety tasks and products are necessary

The table below is a guide organized by contract class (see Paragraph 6 above) to help you select the safety tasks and products for your contract. Your selection is based on the risks the contractor will face in fulfilling the contract. You must use the following factors to tailor safety tasks and products to your contract as a minimum:

a. The hazards of producing and delivering goods or services.

b. The hazards of the goods and services that become government property.

c. The value of the contract or purchase and whether it is cost-plus or fixed-price.

d. How critical the contract or purchase is to NASA's mission.

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e. Whether the goods are made or services are done at a JSC facility, at a contractor facility, or at a third-party facility.

f. The nature of other goods being made and services being done where the contractor is working.

g. Whether NASA equipment or property is made available to the contractor to do the work required.

h. Whether representatives or property of anyone other than the contractor is present at the location where work is done.

i. The degree of risk associated with subcontracts that are part of a prime contract.

j. The level of risk shared between NASA and the contractor, whether explicitly stated in the contract or implied by legal, regulatory, or other activity or standards.

Contract class . . .	***Safety & health plan required?***	***System safety products required?***	***Mishap reports required?***	***Safety statistics required?***	***Other safety reports . . .***
Services and support services	Always if done on NASA property	Job hazard analyses, hazard operability studies or equivalent (as needed)	Always for mishaps at JSC, EF, or SCTF At non-JSC sites, only if govt. personnel or eqpt are involved	Always, on-site contracts (other than construction) For offsite contracts with mishap reporting requirement - labor hours and status of corrective actions	The following as specified in the safety and health plan. • Roster of terminated employees • Self evaluations • Risk evaluations • MSDSs • OSHA logs Older contracts only
Facilities, architect and engineer	None	In design review packages	None	None	None
Facilities, construction	Always for on-site construction	None	OSHA recordables only	Labor hours and status of corrective actions	MSDSs
Spaceflight programs	Always for primes; specifics determined by program management	Initial and modified designs	Same as Services Contracts	Same as Services Contracts	Same as Services Contracts
Payloads	Always (Payload Safety Plan)	Initial and modified designs	Always if on govt. premises or involves govt. property or personnel.	Labor hours and status of corrective actions	MSDSs for hazardous materials

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Contract class . . .	*Safety & health plan required?*	*System safety products required?*	*Mishap reports required?*	*Safety statistics required?*	*Other safety reports . . .*
Grants	If done on government property	Hazardous operations on govt. property	Same as Services Contracts	Same as Services Contracts	MSDSs for hazardous materials
Equipment and facility leases	No; safety conditions will be addressed in lease.	No	When in JSC custody	When in JSC custody, report through responsible JSC organization	Risk evaluation
Interagency loans and agreements	If hazardous operations or hardware involved	Same as Services Contracts	Same as Services Contracts	Same as Services Contracts	Same as Services Contracts
Non-programmatic research & development	Same as Services Contracts	Same as Services Contracts	Same as Services Contracts	Same as Services Contracts	Same as Services Contracts
Major hardware systems	Deferred to Flight Program office	Deferred to Flight Program office	Always if on govt. premises or involves govt. property or personnel	No	None
Hazardous materials	None	None	None	None	MSDSs

Regulations and requirements for contracts

10. Procurement regulations

There are three basic groups of regulations and requirements you could put in JSC contracts: procurement regulations, federal and other regulations, and NASA requirements. You must decide which of the regulations and requirements in Paragraphs 11, 12, and 13 of this chapter apply to your contracts. For example, hazardous materials regulations apply only if the work under the contract involves hazardous materials in any way. You must include clauses and reference regulations and requirements in both the solicitation and the final contract.

Procurement regulations reflect statutory requirements found in Title 48 CFR. You will find the basic federal procurement regulations in the FAR. NASA supplements the FAR through the NASA FAR supplement (NFS). JSC implements the NFS through JSC prescriptions. You must follow these regulations and include clauses from them that apply to your contract:

a. Federal Acquisition Regulations:

- Subpart 9.1, “Responsible Prospective Contractors,” paragraph 9.104-1(e).
- Subpart 23.1, “Pollution Control and Clean Air and Water.”

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- Subpart 23.3, “Hazardous Material Identification and Material Safety Data.”

b. NASA FAR Supplements:

- Subpart 18-23.1, “Environmental Protection.”
- Subpart 18-23.3, “Hazardous Material Identification and Material Safety Data,” including 18-23.370, “Acquisition of potentially hazardous items from or through another government agency.”
- Subpart 18-23.7, “Safety and Health.”

c. JSC Prescription: JSC 52.223-91, “Safety and Health.”

11. Federal and other regulations you must include in your contracts

Contractors and vendors must follow a wide variety of federal regulations at a cost and risk burden to JSC. Include the following and other federal regulations that apply:

a. 10 CFR, Chapter I, Department of Energy and Nuclear Regulatory Commission, especially the following:

- Part 20, “Standards for Protection Against Radiation.”
- Part 34, “Licenses for Radiography and Radiation Safety Requirements for Radiographic Operations.”
- Part 71, “Packaging and Disposal of Radiographic Materials.”

b. 29 CFR, OSHA, Parts 1900 to 1999, especially the following:

- Part 1910, “Occupational Safety and Health Standards, General Industry.”
- Part 1925, “Safety and Health Standards for Federal Services Contracts.”
- Part 1926, “Occupational Safety and Health Standards, Construction Industry.”
- Part 1990, “Identification, Classification, and Regulation of Potential Occupational Carcinogens.”

c. 40 CFR, Chapter I, EPA, especially the following:

- Subchapter C, “Air Programs.”
- Subchapter D, “Water Programs.”
- Subchapter E, “Pesticide Programs.”
- Subchapter F, “Radiation Protection Programs.”
- Subchapter G, “Noise Abatement Programs.”
- Subchapter I, “Solid Wastes.”
- Subchapter J, “Superfund, Emergency Planning, and Community Right-to-Know Programs.”

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- Subchapter N, "Effluent Guidelines and Standards."
- Subchapter R, "Toxic Substances Control Act."

d. 49 CFR, Chapter I, Department of Transportation, especially the following:

- Subchapter B, "Hazardous Materials Transportation and Pipeline Safety."
- Subchapter C, "Hazardous Materials Regulations."

e. Other Federal Documents and Requirements

- Federal Standard No. 313, as revised, "Preparation and Submission of Material Safety Data Sheets."
- Specifications Kept Intact (SPECS-IN-TACT), Master 01411, "General Safety Requirements," (see Attachment 11.1A, Appendix 11B for a list of the contents) and JSC submasters. SPECS-IN-TACT is a set of NASA-originated specifications for designing and building facilities. Basic specifications or masters are established at the agency level for a wide range of facility design requirements. Each Center complements selected masters by developing submasters.

f. State and local regulations that apply to contractors. You must include any state and local regulations that apply. These regulations may also be a cost and risk burden to NASA. You may have to work out arrangements with your contractors to meet state and local regulations in a cost-effective manner.

12. JSC and NASA requirements you must include in your contracts

Include the following JSC and NASA requirements that apply:

a. JPR 1700.1, "JSC Safety and Health Handbook," current version.

b. NPR 8715.3, "NASA Safety Manual."

c. Flight program specific requirements such as NSTS 5300.4, "Safety, Reliability, Maintainability and Quality Provisions for the Space Shuttle Program."

d. Other NASA or JSC requirements and standards that apply.

13. Consensus standards, practices, and guidelines to include in contracts

You are encouraged to include consensus standards and practices in its acquisition activities as referenced in NASA safety requirements that apply. Examples of such standards include:

a. Boiler and Pressure Vessel Codes of the American Society of Mechanical Engineers (ASME)

b. National Fire Codes of the National Fire Protection Association (NFPA)

c. Uniform building codes

d. Uniform Fire Codes

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e. Guidelines issued by the National Institute for Occupational Safety and Health

f. Guidelines issued by the EPA

14. Citing standards in contracts

If you must cite a safety or health standard in a SOW, you must:

a. Identify the number and title of the standard.

b. Tell the prospective bidder or contractor where to get a copy of the standard.

c. Describe in enough detail how the standard applies to the contract.

15. Responsibilities for safety in contracts and purchases

a. ***Customer organizations who contract for goods or services*** must:

- Identify to the JSC Safety and Test Operations Division's Procurement Quality Group a point of contact who will be responsible for the safety aspects of the contract. This will normally be the technical manager, COTR, or some member of your staff.
- Identify risks and hazards with the procurement that must be controlled or eliminated.
- Identify safety activities that must be funded during budget activities and request enough funds to do them.
- Make sure safety requirements are included in purchase requests, solicitations, and contracts by means such as SOW clauses or data requirements.
- Direct the contractor to perform necessary safety tasks.
- Monitor the contractor's safety performance under the contract including the safety and health plan, phase-in plan, etc.
- Support safety program audits and surveys as required by the JSC Safety & Mission Assurance Directorate.
- Allow JSC safety personnel to review the proposed procurements for safety requirements on request. JSC safety review is mandatory for any procurement that involves flight hardware, costs more than $1,000,000, or is a high risk to personnel or property. Contact the Procurement Quality Group of the Safety and Test Operations Division.
- Support the Contracting Officer in making sure the contractor follows the safety requirements and delivers required safety products.
- Coordinate all changes to safety requirements and deliverables with Procurement Quality Group of the Safety and Test Operations Division before issuing a contract change.
- Fulfill the responsibilities in Paragraph 2.3.1 of NPR 8715.3.

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b. As a ***contracting officer***, you must:

- Make sure that the Safety and Test Operations Division has concurred with all safety aspects before issuing any solicitation or contract for goods or services, including any changes to the safety aspects of the contract work. See SLP 4.6, "Purchasing," for details.
- Include the appropriate safety-related clauses and requirements required by the FARs, including NASA and JSC supplements into all contracts.
- Follow up on contractor mishap investigations.
- Fulfill the responsibilities in Paragraph 2.3.2 of NPR 8715.3.

c. The ***Legal Office*** must make sure the appropriate safety and health clauses are included in contracts as concurred by the Safety and Test Operations Division.

d. The ***Safety and Test Operations Division*** must help contracting officers and their COTRs evaluate the risks and hazards of the products and services supplied by a procurement by:

- Advising technical representatives and JSC organizations on identifying and tailoring safety requirements from the beginning of any procurement activity.
- Helping to draft, select, and verify specific safety provisions that apply to the procurement under NASA and JSC supplements to the FARs and with NASA and JSC requirements.
- Coordinating the review of purchase requests as described in SLP 4.6, "Purchasing," and identifying safety requirements before issuing purchase orders.
- Coordinating with the contracting officers the form and language of safety requirements to be included in solicitations and contracts, including changes.
- Monitoring contractor performance as required.
- Evaluating the contractor's safety-related products, deliverables, and performance, including safety plans and hazard analyses.
- Coordinating with the Quality Team of the Flight Equipment Division on procurement matters.
- Fulfilling the responsibilities in Paragraphs 2.3.3 & 2.3.4 of NPR 8715.3

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Chapter 11.2
Safety and Health Requirements for Services and Construction Contracts and Grants

1. Who must follow this chapter

You must follow this Chapter if you identify, develop, manage, or monitor services or construction contracts or grants.

2. What this chapter covers

This Chapter provides you:

a. Safety requirements and references to be included in services and construction contracts and grants.

b. Instructions for identifying and implementing safety requirements throughout the life of a contract.

c. Approved wording and clauses to use in service contracts.

d. Data requirements lists (DRLs) and data requirements descriptions (DRDs) for services contracts.

Determining the safety requirements for services contracts

3. Analyzing a proposed services contract for safety requirements

If your organization intends to contract for a service, you must evaluate the proposed contract to see if it needs a safety program. This evaluation tells you what safety requirements you must include in the contract and help you determine what funding the safety program will need.

You evaluate the contract by answering the following questions as a minimum:

a. Will the contractor do any hazardous operations? List hazardous operations, the potential severity of any mishaps such as death, severe injury, and how often the mishap could occur. Include line items in the statement of work (SOW) or work breakdown structure where each operation applies. Hazardous operations of special interest include those that:

- Your organization hasn't done before.
- Will be done in new or modified JSC facilities or programs.
- Involve new and potentially hazardous technologies.

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b. Will the contractor be required to maintain facilities baseline documentation? See Chapter 10.4, “Facility Baseline Documentation Requirements for Critical, Complex, or Hazardous Facilities,” of this Handbook for details. If so, list the facilities involved and the tasks the contractor must do.

c. Will the contractor be using hazardous materials on site at JSC or deliver them to JSC as part of a product or service? If so, identify the line items in the SOW or work breakdown structure that will use hazardous materials. Also note any unusual hazards with or large amounts of hazardous materials the contractor may use.

d. Will the contractor do any hazardous testing? If so, list the hazardous tests. Note any that will involve human subjects and hazardous hardware.

e. Will the contractor service, operate, maintain, or test flight hardware? If so, list the flight hardware by item or by group. Note whether each item is off-the-shelf or unique, and the program it supports. Determine if any new safety analyses will be done or any existing analysis reviewed and updated for flight hardware.

f. Have you identified any other hazards or safety issues with the contract? If so, describe them in detail and state the risk to JSC.

g. Will any of the hazardous hardware or operations, identified in Subparagraphs a through f above require system safety engineering tasks to identify and control their hazards? If so, send a list of those items to the Safety and Test Operations Division for review.

4. What to do with your analysis

After you and the contracting officer agree on the analysis and results, you must:

a. Make the results of your analysis available to the Safety and Test Operations Division. One way to do this is to attach the analysis to JSC Form 352, "Coordination and Approval Document," when beginning coordination. You are encouraged to pre-coordinate your analyses with the Safety and Test Operations Division for new or complex procurements. Include at least a copy of the evaluation results, the proposed SOW, and work breakdown structure or its equivalent (if available). You must send it to the Safety and Test Operations Division for review and concurrence if the contract:

- Value is $1 million or more.
- Will include testing of human subjects.
- Will involve operating or maintaining facilities that fall under Chapter 10.4 of this Handbook.
- Work will present an unusually degree of hazard.
- Will include flight equipment or critical ground support equipment used to support flight operations, including payloads.
- Will involve using hazardous materials, using potentially hazardous items, or generating hazardous waste.

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- Will pose a great challenge to JSC's emergency preparedness and response capability.

b. Contact the Safety and Test Operations Division for any necessary guidance and concurrence on hazards or liabilities with the contract for which you have no instructions or guidance.

c. Communicate any significant results of your analysis together with any recommendations to the Senior Advisory Group (SAG) or mini-SAG during the Acquisition Strategy exercise.

Preparing the solicitation for services contracts

5. What to include in the solicitation

You must include safety requirements you identified and approved during the functional requirements analysis in contract solicitations. Include requirements, clauses, and data descriptions you identified as necessary from your functional requirements analysis. You also:

a. May require bidders to submit certain types of information to show they can safely perform the tasks in the contract.

b. Must list any unique safety tasks, such as system safety engineering, that the contract will require in the solicitation. This will allow bidders to cost those tasks.

6. What to consider during source selection

It is helpful to tie safety requirements to specific items in the work breakdown structure or SOW. The Source Evaluation Board (SEB) or Source Selection Committee may use these safety requirements in preparing a proposal evaluation plan.

If safety may be a factor in source selection, the SEB chairperson must consider including a member from the Safety and Test Operations Division on the board or as an evaluator. This office will support the evaluation of proposals when bidders submit safety and health plan or a system safety program plan with the proposal.

Contractor proposals may include innovative approaches to safety and health. If accepted by the government, include them in the safety and health plan. There may be some start-up training, etc., needed to fully deploy these innovations. Make sure the details are included in the appropriate plan and schedules (such as for phase-in).

7. Including safety in the contract negotiations

You must resolve any safety weaknesses with the winning bidder before you approve the safety and health plan. The negotiating team chairperson may request the Safety and Test Operations Division to support the negotiations in any way if any safety and health

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objectives or tasks will be negotiated prior to contract award. This office will support negotiations in one of the following ways:

a. Through formal membership on the negotiation team

b. By advising the team

c. By providing a point-of-contact

8. What you must do after the contract is awarded

The contract, as awarded, must include at least all functional safety requirements previously approved by the Safety and Test Operations Division. If you want to deviate from those requirements, you must get prior concurrence from the Safety and Test Operations Division. During the life of the contract you must:

a. Use safety as a factor to determine the award fee.

b. Monitor the contractor's safety program. Document your approach to monitoring the contractor (such as in a Contracting Officer's Technical Representative's [COTR's] contract surveillance plan). The plan will address surveillance of any subcontracts. Monitoring may need to begin with contract phase-in.

c. Make sure the contractor will be ready to fully follow its safety and health plan at contract start date. This means:

   - The contractor will fully follow regulatory and JSC safety program requirements from contract start date to contract completion.
   - The contractor has training and phase-in plans and schedules which address (a) certification of operators doing hazardous tasks, (b) new hires, and (c) safety and health program innovations proposed by the contractor during source selection.

d. Review contract changes for safety impact. Changes to specific safety requirements won't require Safety and Test Operations Division concurrence as long as they meet all regulations and NASA requirements.

e. Do a new functional requirements analysis if you change the contract to require new services or hardware. Get concurrence from the Safety and Test Operations Division as you did with the initial analysis.

f. Request support from the Safety and Test Operations Division as needed. This office will support you in any of the above tasks as described in JPR 1700.1, "JSC Safety and Health Handbook," or as requested.

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Clauses and data requirements for services contracts

9. Safety and health in the SOW

You must include the following or similar text in the SOW for solicitations and contracts:

> X. SAFETY AND HEALTH. The contractor will perform tasks to ensure the protection of personnel, property, equipment, and the environment in contractor products and activities generated in support of institutional and space flight program objectives. To ensure compliance with pertinent NASA policies and requirements and Federal, State, and local regulations for safety, health, environmental protection, and fire protection, the contractor will develop and implement a safety and health program in accordance with a NASA-approved safety and health plan. The contractor will implement system safety engineering tasks for flight and institutional program activities and products in accordance with the schedule and applicable flight and institutional requirements as documented in the contractor's system safety program plans (SSPPs) which have been approved by NASA. The contractor shall develop and implement risk management techniques (including risk assessment) to be applied to hazards derived from analyses of activities and products for the purpose of eliminating or controlling hazards as specified in NASA policies and requirements for hazard reduction. The JSC Safety and Health Handbook provides detailed requirements and instructions regarding safety and health procedures and policies at JSC and is incorporated by reference into all JSC contracts when performance is on site at a JSC facility. It can be viewed at http://www.jsc.nasa.gov/da/da5.

10. Clauses and data requirements you must include

You must include any clauses or data requirements in your solicitation or contract from Paragraphs 12 through 15 of this Chapter that apply. Follow these rules:

a. Use the DRDs listed below that are tailored for support services contracts. Never change or replace these DRDs without approval from the Safety and Test Operations Division.

b. Include any necessary data requirements in the DRL. You will find instructions for including safety data requirements in the DRL in "Data Requirements Descriptions for Service Acquisitions and Instructions for the Data Requirements List," and the accompanying instruction page.

c. Send at least one copy of each data requirement to the Safety and Test Operations Division.

11. Data requirements and clauses for the safety and health plan

You must include DRD SA-1-1, "Safety and Health Plan," and JSC Form 288, "Accident/Incident Summary Report," unless the contract meets the exception in Paragraph 13 below. The COTR or other contract official must approve the plan before the contractor

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may do any hazardous operation or by a date stated on the schedule, usually within 45 days, whichever comes first. The Safety and Test Operations Division and the Occupational Health Branch must concur on the plan. The contractor must maintain the plan as required or by specific direction from the Contracting Officer or the COTR.

You must also include a safety and health clause in the solicitation or contract if a safety and health plan is required. The Safety and Test Operations Division must approve any changes to a safety and health clause. The clause must be one of the following:

a. NFS 1852.223-70, "Safety and Health," as described in NFS 18-23.7001, "NASA Contract Clauses," Subparagraph a, if the plan will be submitted for NASA approval 45 days after contract start date.

b. NFS 1852.223-73 as described in NFS 1823.7001(c), if the plan will be part of the proposal and used for source selection.

c. Alternate I to NFS 1852.223-73 as prescribed in NFS 1823.7001(d) if you will negotiate the plan before contract award.

Note: Contracts let before early 1997 may include several safety DRDs for deliverables now covered in the DRD for the safety and health plan. These safety DRDs are valid until the contract is rebid. If separate DRDs are required, contact the Safety and Test Operations Division for help.

12. Exceptions to the safety and health plan requirement

A safety and health plan may not be required if a contractor meets the criteria of NFS 1823.7001(b). The Safety and Test Operations Division must approve any exceptions to the requirement for a safety and health plan. Usually, this will be the case if:

a. The contract value is less than $5 million.

b. No hazardous operations or flight hardware are involved.

c. The contract will include the Service Contract Act of 1965, which includes adequate safety and health provisions.

d. The contract will require that work totaling less than 1000 hours in a quarter be performed on site at JSC, Ellington Field, or the Sonny Carter Training Facility.

13. Clauses you must include for hazardous materials

You must include the following clauses in any solicitation or contract that involves hazardous materials or potentially hazardous items in any way. The contractor and any subcontractors must deliver material safety data as described in the safety and health plan. If the contractor acquires hazardous materials or potentially hazardous items from or through another government agency (see FAR Part 8, "Required Sources of Supplies and Services," and FAR Subpart 17.5, "Interagency Acquisitions Under the Economy Act"), the contractor must make sure that the responsible agency provides the data required by FAR Subpart 23.3

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and the clause at FAR 52.223-3, "Hazardous Material Identification and Material Safety Data." The clauses include:

a. The clause at FAR 52.223-3 if the work under the contract will involve hazardous materials. See Federal Standard No. 313, as revised, "Preparation and Submission of Material Safety Data Sheets," for more information. The contractor must submit hazardous material data on the following:

- All items in, or ordinarily catalogued under, the Federal Supply Classes listed in Table I of Appendix 8A of Federal Standard No. 313, as revised.
- Items having hazardous characteristics in the Federal Supply Classes listed in Table II of Appendix 8A of Federal Standard No. 313, as revised.
- Any other material designated by a government technical representative as potentially hazardous and requiring safety controls.

b. The clause at NFS 18-52.223-72, "Potentially Hazardous Items," if the contract will involve potentially hazardous items. Also see NFS 1823.3, "Hazardous Material Identification and Material Safety Data," for more requirements. You must also identify these items and list them in the solicitation or contract. The contractor must maintain the list of potentially hazardous items as described in its safety and health plan.

14. Data requirements for system safety

If the contract requires system safety engineering tasks, you and someone from the Safety and Test Operations Division must screen the tasks for appropriate system safety requirements. Include the results in the solicitation or contract. System safety engineering tasks are usually direct costs to the contract and thus must be carefully scrutinized. You must also include the following data requirements:

a. DRD SA-1-8, "***System Safety Program Plan***." NASA must approve this plan before the contractor may do any system safety engineering tasks. The contractor may submit one or more SSPPs for different projects before starting a project or by a date specified in the schedule (usually within 45 days), whichever comes first. The contractor must:

- Maintain the plan as required or by direction from the Contracting Officer or the COTR.
- Reference SSPPs in the safety and health plan as described in DRD SA-1-1.

b. DRD SA-1-9, "***Hazard Report***." The contractor will send these reports data to NASA as described in its safety and health plan and the schedule. The Safety and Test Operations Division must concur on these reports.

c. DRD SA-1-10, "***Safety Assessment Report***." The contractor usually delivers these reports at contract milestone or safety program management reviews to show the status of system safety engineering tasks. These reports provide an overview of system safety risks to JSC risk managers and are particularly valuable when the system safety program is fairly complex. Less complex system safety programs may not require these safety

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assessment reports. These reports don't require NASA approval but may result in further contractual direction after NASA reviews them.

Requirements for construction contracts

15. Safety in construction solicitations and contracts

As a Contracting Officer, you must make sure that solicitations for bid and construction contracts require the contractor to:

a. Follow 29 CFR 1926, "Occupational Safety and Health Standards, Construction Industry."

b. Follow Chapter 10.1, "Safety And Health Requirements For Facility Design, Construction, And Operations," of this Handbook.

c. Follow any other provisions required by law or the basic contract clauses.

d. Submit a safety and health plan enough in advance of the scheduled start of construction to allow the Safety and Test Operations Division and the Occupational Health Branch to review the plan and submit comments. The plan must thoroughly address the specific hazards and OSHA standards associated with the project, to include protection from falling objects where appropriate. You must approve the plan before any construction may begin.

e. Submit a hazard analysis for the project that explicitly addresses specific hazards associated with the project. The contractor may submit the analysis in phases, but the Safety and Test Operations Division must approve the hazard analysis for each phase before work on that phase may start.

f. Submit a site-specific steel erection plan if the project will involve steel erection. The plan must meet the guidelines in 29 CFR 1926, Subpart R, Appendix A.

g. Ensure that contractor project safety officers and site supervisors take the 10 hour or 30 hour OSHA Construction Outreach Training before starting work. The contractor must provide training records for project safety officers, site supervisors, and foremen before beginning work on the project.

16. What to do after a construction contract is awarded

You must make sure the contractor follows its safety and health plan and any other safety and health requirements in the contract. The Safety and Test Operations Division will periodically inspect the job site.

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Grants

17. Requirements for JSC grants

If the grant involves working in a JSC facility or with JSC equipment, the grantee must submit a hazard assessment of the work to the grants officer. If the risk's significant, the grantee must:

a. Submit a safety and health plan to the grants office or designee for approval.

b. Report and investigate any mishaps as required by Chapter 2.7, "Mishap And Incident Investigation," of this Handbook.

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Appendix 11A

Forms

The following forms listed in this appendix are available electronically at the following web addresses:

JSC Form 288 Statistical Information - Contractor Safety and Health Program
http://forms.jsc.nasa.gov/ (via form search)

NASA Form 1627 NASA Mishap Report
http://forms.jsc.nasa.gov/ (via form search)

OSHA Form 174 Example of Material Safety Data Sheet
http://www.osha-slc.gov/Publications/MSDS/msdsform.html

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Appendix 11B

Miscellaneous guidelines and instructions

This appendix contains the following attachments:

11.1A Master 01411

11.1B List of System Safety Engineering Techniques and References

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Attachment 11.1A

Master 01411

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01411

GENERAL SAFETY REQUIREMENTS

03/97

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-- End of Section Table of Contents --

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NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION

NASA-01411 (MARCH 1997)
NASA
SUPERSEDING NASA-01411
(SEPTEMBER 1996)

****

SECTION 01411

GENERAL SAFETY REQUIREMENTS
03/97

****
NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This narrowscope section covers mandatory safety requirements.
****

1 GENERAL

1.1 SUMMARY

The requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 REFERENCES

****
NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.
****

The publications listed below form a part of this section to the extent referenced:

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	(1996) Occupational Safety and Health Standards
29 CFR 1926	(1996) Safety and Health Regulations for Construction

CORPS OF ENGINEERS (COE)

COE EM-385-1-1	(1981; Rev 1984) Safety and Health Requirements Manual

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA NHB 1700.1	(1993) (V1-B) NASA Safety Policy and Requirements Documents (Note: this document is now NPR 8715.3, “NASA Safety Manual.”)

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01330, "Submittals," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

****

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-08 Statements

Statements shall be submitted for the following items in accordance with paragraphs entitled, "Safety Plan" and "Protection Plan," of this section.

Safety Plan
Protection Plan

SD-13 Certificates

License Certificates for Radiation Materials and Equipment shall be submitted by the Contractor for all specialized material and equipment that could cause fatal harm to construction personnel or to the construction project.

SD-18 Records

Records shall be submitted in accordance with paragraph entitled, "Gas Protection," of this section.

1.3.1 Safety Plan

Contractor shall submit a safety plan to the Contracting Officer for approval within 15 calendar days after notice to proceed. Compliance to the [_____] will be met. This document will be made available upon request from the [_____].
Safety plan shall include, as a minimum, the following:

a. Safety program objectives.

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b. Methods to attain safety objectives.
c. Responsibility of key personnel for the Contractor.
d. Safety meetings, surveys, inspections, and reports.
e. Disaster and emergency programs.
f. Lists of key personnel to be contacted in times of emergency.
g. Program to show compliance with Federal OSHA Safety and Health Standards 29 CFR 1910 and 29 CFR 1926 and various safety requirements of [_____] [NASA NHB 1700.1] [COE EM-385-1-1].
h. Methods to comply with the requirement for immediate reporting of accidents to the Contracting Officer.
i. Statement that the Contractor will not invalidate the integrity of safety systems without proper authorization.
j. Procedures for emergency actions to be taken to secure dangerous conditions, to protect personnel, and secure work areas in the event of accident or an act of nature.
l. Procedures for securing the accident site so that the area remains secure until arrival of a safety investigator. Accident site will remain secured until released by the Contracting Officer.

1.3.2 Protection Plan

Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations shall be protected against damage.

1.4 GENERAL SAFETY PROVISIONS

Contractor shall take safety and health measures in performing work under this Contract. Contractor shall meet with the Contracting Officer to develop a mutual understanding relative to administration of the safety plan. Contractor is subject to applicable federal, state, and local laws, regulations, ordinances, codes, and orders relating to safety and health in effect on the date of this Contract.

During the performance of work under this Contract, the Contractor shall comply with procedures prescribed for control and safety of persons visiting the project site. Contractor is responsible for his personnel and for familiarizing each of his subcontractors with safety requirements. Contractor shall advise the Contracting Officer of any special safety restriction he has established so that Government personnel can be notified of these restrictions.

1.5 SAFETY CLEARANCE PROCEDURES RED HOLDOFF TAG SYSTEM

Contractor shall ensure that each employee is familiar with and complies with these procedures.

Contracting Officer will, at the Contractor's request, apply holdoff tags and take other actions that, because of experience and knowledge, are known to be necessary to make the particular equipment safe to work on.

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No person, regardless of position or authority, shall operate any switch, valve, or equipment that has an official red holdoff tag attached to it, nor shall such tag be removed except as provided in this section.

No person shall work on any equipment that requires a holdoff tag unless he, his immediate supervisor, project leader, or a subordinate has in his possession the stubs of the required holdoff tags.

When work is to be performed on electrical circuits, the work shall be performed only by personnel qualified observing the required safety clearance.

A supervisor who is required to enter an area protected by a holdoff tag will be considered a member of the protected group provided he notifies the holder of the tag stub each time he enters and departs from the protected area.

Identification markings on building light and power distribution circuits shall not be relied on for established safe work conditions.

Before clearance will be given on any equipment other than electrical (generally referred to as mechanical apparatus), the apparatus, valves, or systems shall be secured in a passive condition with the appropriate vents, pins, and locks.

Pressurized or vacuum systems shall be vented to relieve differential pressure completely.

Vent valves shall be red tagged open during the course of the work.

Where dangerous gas or fluid systems are involved, or in areas where the environment may be oxygen deficient, system or areas shall be purged, ventilated, or otherwise made safe prior to entry.

1.5.1 Tag Placement

Red holdoff tags shall be completed in accordance with the regulations printed on the back thereof and attached to any device which, if operated, could cause an unsafe condition to exist.

If more than one group is to work on any circuit or equipment, the employee in charge of each group shall have a separate set of holdoff tags completed and properly attached.

When it is required that certain equipment be tagged, the Government will review the characteristics of the various systems involved that affect the safety of the operations and the work to be done; take the necessary actions, including voltage and pressure checks, grounding, and venting, to make the system and equipment safe to work on; and apply such holdoff tags to those switches, valves, vents, or other mechanical devices needed to

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preserve the safety provided. This operation is referred to as "Providing Safety Clearance."

1.5.2 Tag Removal

When any individual or group has completed its part of the work and is clear of the circuits or equipment, the supervisor, project leader, or individual for whom the equipment was tagged shall turn in his signed holdoff tag stub to the Contracting Officer. That group's or individual's holdoff tags on equipment may then be removed on authorization by the Contracting Officer.

1.6 ACCIDENT TREATMENT AND RECORDS

Contractor shall post emergency first aid and ambulance information at project site.

Contractor employees may utilize Government dispensary facilities located in building [_____] for injury and emergency medical treatment. Such treatment shall be recorded by the Contractor on form [_____], Injury Report. Contact Occupational Medicine Services. [(Telephone (___) ___-____)]

1.7 FIRE PREVENTION AND PROTECTION

Open-flame heating devices will not be permitted except by approval in writing from the Contracting Officer. Approval for the use of open fires and open-flame heating devices will not relieve the Contractor from the responsibility for any damage incurred because of fires.

Burning trash, brush, or wood on the project site shall [not] be permitted.

1.8 USE OF EXPLOSIVES

Explosives shall not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval shall not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, shall be only where directed and in approved storage facilities. These facilities shall be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

1.9 ELECTRICAL

Contractor shall appoint an individual responsible for the electrical safety of each work team to restrict entry to dangerous locations to those authorized by him jointly with the Government.

1.10UNDERGROUND UTILITIES

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Safety clearance from the Contracting Officer is required before any Contractor personnel enters a manhole. Contractor shall contact the Contracting Officer for support services by calling [(___) ___-_____] at least 24 hours in advance.

Contractor shall be responsible for removing water and debris before commencement and during execution of work in manholes.

1.11RADIATION SAFETY REQUIREMENTS

Loss of radioactive material shall be reported immediately to the Contracting Officer.

Actual exposure of the radiographic film or unshielding the source shall not be initiated until after 5 p.m. on weekdays.

In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, no assumptions shall be made as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, a fully instructed employee shall be positioned inside such building or area to prevent exiting while external radiographic operations are in process.

1.12 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

1.13 PROTECTION OF WORK

Prior to performing any excavation work or any surface penetrations 6 inches or deeper (such as driving stakes more than 6 inches in the ground) on any ground surface, the Contractor shall obtain from the inspection office the current subsurface utility drawing of the particular area to be worked on. Contractor shall stake out subsurface high voltage cables, communication cables, and pipe lines indicated within the scope of the work contemplated. After exposure, the Contractor shall obtain agreement from the Contracting Officer on how much closer to cable or pipe the excavations can be permitted.

Contractor shall notify the Contracting Officer, 48 hours prior to the start of excavation work or surface penetration, to enable the Contracting Officer to review measures being taken to prevent hazard to employees and possible damage to subsurface utilities. Where emergency conditions preclude the 48 hours advance notification, the Contractor shall immediately inform the Contracting Officer of his intention to initiate work prior to actual start of activity.

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After obtaining clearance from the Contracting Officer, the Contractor shall proceed with excavating work, or other surface penetration work. Contractor, however, shall temporarily halt any machine excavation work or other surface penetration when approaching within 10 feet of the staked-out cable or pipe line until the Contractor has exposed the cable or pipe by hand excavation to fix its location.

1.14 GAS PROTECTION

Contractor shall have one or more employees properly trained in operation of gas testing equipment and formally qualified as gas inspectors who shall be on duty during times workmen are in confined spaces. Their primary functions shall be to test for gas and operate testing equipment. Unless equipment of constant supervisory type with automatic alarm is employed, gas tests shall be made at least every 2 hours or more often when character of ground or experience indicates gas may be encountered. A gas test shall be made before workmen are permitted to enter the excavation after an idle period exceeding one-half hour.

Readings shall be permanently recorded daily, indicating the concentration of gas, number and location of drilled piers, point of test, date, and time of test.

Special requirements, coordination, and precautions will apply to areas that contain a hazardous atmosphere or, by virtue of their use or physical character, may be oxygen deficient. A check by Government is required prior to entering confined space. Surveillance and monitoring shall be required in these types of work spaces by both Contractor and Government personnel.

1.15 ROOFING AND COATING

At the beginning of each work day the Contractor shall check with the Contracting Officer before proceeding to work on the roof to ensure safe work conditions.

1.16 WELDING, FLAME CUTTING, AND MELTING

Contractor shall clear welding and cutting operations with the Contracting Officer before operations begin.

Contractor shall discontinue burning, welding, or cutting operations 1 hour prior to the end of the normal work day. A workman shall remain at the site for 1 hour after discontinuing these operations to make thorough inspection of the area for possible sources of latent combustion. He shall be equipped with two full 15-pound carbon dioxide fire extinguishers. Any unsafe conditions shall be reported to the Center Fire Station. [(Telephone: (___) ___-_____)]

During operations involving possible fire hazard, the Contractor shall notify the Contracting Officer and not proceed until clearance is obtained in writing. Contracting Officer may request a standby from the Fire

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Station. This requirement does not relieve the Contractor of his responsibility for welding and cutting safety.

1.17 HIGH NOISE LEVEL PROTECTION

Operations performed by the Contractor that involve the use of equipment with output of high noise levels (jackhammers, air compressors, and explosive device activated tools) shall be scheduled for [weekends] [after duty working hours] during the hours [_____] at [_____]. Use of any such equipment shall be approved in writing by the Contracting Officer prior to commencement of work.

1.18 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor shall:

a. Secure outside equipment and materials and place materials possible to damage in protected locations.

b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

c. Ensure that temporary erosion controls are adequate.

1.19 HAZARDOUS WASTE

Contractor shall identify all wastes produced and dispose of them in the following approved manners:

Identify all wastes and waste producing processes including chemicals, paints, POL products and solvents, and their containers. Unknown wastes will be chemically identified by the Government.

Obtain a determination of whether the waste is hazardous from the Contracting Officer.

Notify the Contracting Officer prior to taking disposal action for any hazardous waste.

For disposal, provide either laboratory analysis data documenting the chemical content of the waste or certification by appropriate organization authority as to the chemical constituents of the waste. Technical assistance on disposal analysis requirements will be provided on request by contacting the Contracting Officer.

Document the waste type, quantity, location, and personnel/contractor/ agency responsible so the material can be tracked from generation through ultimate disposal as required by Environmental Protection Agency under Resource Conservation and Recovery Act.

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2 PRODUCTS (Not Applicable)

3 EXECUTION (Not Applicable)

Attachment 11.1B

References

The list below is representative of references that describe system safety techniques often used by NASA and Johnson Space Center. This list is intended to be neither exhaustive nor authoritative nor is it intended to arbitrarily limit engineers and managers in their selection of analytical techniques.

"Digraph Analysis Assessment Report," EIC 00581, by Grumman Space Station Division (NASW-4300)

Sacks, I. J., "Digraph Matrix Analysis," *IEEE Transactions on Reliability*, Volume R-34, No. 5, December 1985

"Failure Environment Analysis Tool," by Lockheed Engineering and Sciences Company for the Engineering Directorate, Johnson Space Center

"Guidelines for Hazard Evaluation Procedures," by Center for Chemical Process Safety, American Institute of Chemical Engineers

JSC 13830, "Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle, International Space Station"

JSC 17481, "Safety Requirements Document for JSC Space Shuttle Flight Equipment"

JSC 17773, "Instruction for Preparing Hazard Analyses for JSC Ground Operations"

JPR 1700.1, "JSC Safety and Health Handbook," Chapter 2.4, "Hazard analysis"

NPR 8715.3, "NASA Safety Manual"

NSTS 22254, "Instruction for Preparation of Hazard Analyses for the Space Shuttle Program"

NUREG-0492, "Fault Tree Handbook," by the Systems and Reliability Research Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission

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Part 12
Asbestos Control Requirements

1. Who must follow Part 12

You must follow Part 12 if you do any asbestos-related work at JSC, SCTF, or Ellington Field either as a civil service employee or contractor. JSC field sites must follow equivalent requirements that also meet State and Local regulations. All chapters and appendices of Part 12, listed in the table below, apply to any asbestos-related work.

Chapter	***Tile***
12.1	Introduction to Asbestos Control
12.2	Policy and Purpose
12.3	Asbestos Control Program
12.4	Regulations
12.5	General Asbestos Work Requirements
12.6	Notification Requirements
12.7	Competent Person
12.8	Asbestos Worker and Regulated Area Air Sampling
12.9	Regulated Areas and Site Preparation
12.10	Signs, Warnings, and Communications of Hazards
12.11	Wet Removal of Materials
12.12	Cleanup, Clearance Inspection/Air Sampling, and Release
12.13	Waste Disposal
12.14	Emergency and Mishap Procedures
12.15	Job-Specific Performance Requirements - General Information
Appendix 12A	Forms
Appendix 12B	Asbestos Job Performance Requirements and Asbestos Glossary Attachments: 12A Class I - Asbestos Work 12B Class II - Asbestos Work 12C Class III - Asbestos Work - Glovebag 12D Class III - Asbestos Work: Regulated Area Defined by a Barricade With Floor Covering 12E Class III - Asbestos Work: Regulated Area Defined by an Enclosure 12F Class III - Asbestos Work: Other 12G Class IV - Asbestos Work

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	12H Asbestos Glossary

2. What Part 12 covers

Part 12 specifies minimum acceptable standards and procedures for all JSC asbestos-related work.

3. How to use Part 12

a. Part 12 is designed to be self-implementing. It contains procedures for a variety of maintenance-, operational-, and construction-related activities. These procedures are defined under the appropriate Occupational Safety and Health Administration (OSHA) Class of asbestos work as defined in Chapter 12.4 or in 29 CFR 1926.1101, as amended.

b. Each Class of asbestos-related work has specific requirements for notification, protective equipment, regulated area systems and enclosures, and clearance inspections and monitoring. These requirements are discussed in Chapters 12.5 through 12.15 as well as the attachments to Appendix 12B. Controls have been defined for protection of workers, work practices, and methods of minimizing asbestos release. Following these controls will also prevent the unnecessary exposure of building occupants to unacceptable concentrations of asbestos.

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Chapter 12.1
Introduction to Asbestos Control

1. Who must follow Asbestos Control Requirements

a. The standards and procedures in Part 12 apply to all asbestos-related activities conducted at JSC, SCTF, or Ellington Field whether undertaken by JSC organizations, support contractors, or fixed-price contractors. JSC field sites must follow equivalent requirements that also meet State and Local regulations.

b. Part 12 specifies minimum acceptable standards and procedures for all JSC asbestos-related activities. It includes specific performance requirements for the most common asbestos-related tasks at JSC. The standards and procedures set forth are consistent with health and safety standards and procedures in industry, and those established by OSHA, the Environmental Protection Agency (EPA), and NASA. It also applies to other operations that may involve asbestos, even though they are not specifically cited in Part 12.

2. About Part 12

a. Part 12 provides policy, procedures, and guidance for conducting asbestos-related activities at JSC with minimum risk to the employees involved and to building occupants. Part 12 identifies controls for protecting workers, work practices, and methods of minimizing asbestos release. Workers and employees who follow these controls will also prevent the unnecessary exposure of building occupants to unacceptable concentrations of asbestos.

b. Generally, it is only necessary for a job supervisor or foreman to determine whether the work area is known to have asbestos-containing materials (ACM) and to select the appropriate procedures and controls necessary to perform the work. A current inventory of areas currently known to contain asbestos may be found on the JSC Safety and Total Health Home Page, to assist in this determination.

c. Refer any area suspected to have asbestos for which no data exists to the Asbestos Program Manager (APM) (JA131), to the Occupational Health Officer (SD3), or to the Occupational Health Services (OHS) contractor (SD33) before the work activity for confirmatory sampling and analysis.

d. JSC recognizes that some of the requirements within Part 12 procedures may add expense and time delays to procedures previously in place. This is the cost of providing the additional degree of control afforded within the ACP to ensure the occupational safety and health of workers at JSC.

e. Part 12 has been organized to assist the job supervisor or foreman, hereinafter referred to as the originator, in accomplishing effective planning. Oversight and enforcement of the plan and the procedures established by Part 12 will be the responsibility of the APM (JA131). The APM will rely heavily upon the OHS Contractor in monitoring conformance with the asbestos control procedures established by the individual procedures. In rare cases, the APM, Occupational Health Officer, or OHS Contractor

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will issue a stop-work order under the authority of Chapter 1.0, Subparagraph 3.d of this Handbook, if work practices do not provide sufficient protection to workers and building occupants.

3. How to use Part 12 for planning and conducting asbestos-related activities

Planning and conducting asbestos-related activities follows the basic steps listed below:

a. The user establishes the job description and initiates the appropriate work order (e.g., WAD, MCRR, Construction of Facilities Project). The user must identify the asbestos hazard, if known, or request sampling assistance from the OHS Contractor to determine the hazard if the presence of asbestos is suspected but not known. Any Construction of Facilities Project, WAD, or MCRR which will, or has the potential to, disturb facility or building materials must have a written assessment from the OHS or Center Operating Support Services (COSS) contractors on the presence or absence of ACM. The user must involve the APM and the OHS Contractor in planning, design, and construction of projects involving Class I and Class II asbestos work. All Class I and Class II projects must have a formal design/work plan approved by an EPA Accredited Project Designer.

b. The originator (i.e.; foreman/supervisor) determines if the work area is identified in the JSC asbestos database as an area containing asbestos. Refer to the JSC Safety and Total Health Home Page at the following URL http://www4.jsc.nasa.gov/org/totalhealth/asbestoslink.htm for this listing.

c. If the work area is not identified in the database, the originator/supervisor must check with the APM or the OHS Contractor (SD33, ext 3-6726) to determine if there is any other evidence of asbestos in the area. If no evidence can be found, the originator must request the OHS Contractor to perform bulk material sampling to determine the presence of asbestos. The OHS Contractor must receive sufficient lead time, usually three weeks, to coordinate sampling, obtain analyses, and write a report. The COSS Contractor must collect bulk asbestos samples in support of their routine operations and maintenance activities.

d. If there is no ACM, PACM, or evidence of asbestos, the originator may proceed with the job as a normal non-asbestos job.

e. If any work area is identified in the database or other evidence indicates the presence of ACM, the originator will plan an asbestos-related activity using Part 12. The originator shall also identify the scope of the work to be performed.

f. If asbestos is identified in the work area, but no procedure exists for the job to be performed, the alternative procedures of Paragraphs 12.2.5 and 12.2.6 will be followed. The originator will develop specific procedures for the job and have them approved by the APM and the OHS Contractor.

g. If a procedure exists for the job, the originator/supervisor reviews the requirements of the procedure and develops the asbestos work permit (shown in Appendix 12A). Refer to Chapter 12.4 for the Classes of asbestos work and to Chapter 12.15 and to Appendix 12B for job performance requirements (JPRs) of work to be performed. Work permits are not

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required for Class IV asbestos work. The permit may be used as a coordination or notification document by sending a facsimile copy to the identified JSC office.

h. The originator/supervisor shall complete and sign the permit (see Appendix 12A), identifying the necessary controls. The competent person for the job must also sign the permit. Give this permit to the individuals assigned to perform the task and keep it at the asbestos work site, as well as a copy of the appropriate JPR from the attachments in Appendix 12B. Work permits are not required for Class IV asbestos work.

i. Once the task is completed, return the work permit to the originator for record keeping. Maintain executed work permits for at least 1 year, make them available to the APM upon request.

j. All asbestos-related work requires supervision by a competent person. The appropriate employer will designate the competent person for each asbestos-related job. Qualifications of the competent person are subject to review by the JSC APM, the JSC Occupational Health Officer, or their designated representatives. The competent person must sign the work permit.

k. During the actual job, perform on-site inspections and monitoring as required by the procedure. If the assigned competent person is not at the job site, he/she must visit the job site periodically during the course of the work.

l. Upon completion of the job, the originator conducts clearance inspection and air monitoring, as required by the procedure.

m. Upon satisfactory clearance inspection and air monitoring results, if required, the originator will reestablish the work area, and prepare and submit any documentation required by the procedure.

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Chapter 12.2
Policy and Purpose

1. Policy

The following are JSC's asbestos control policies:

a. Chapter 1.0 of this Handbook contains JSC's basic safety and health policy. Chapter 5.7 of this Handbook discusses asbestos for the General JSC population.

b. JSC's basic asbestos policy is to manage-in-place all ACM at the Center. JSC will follow all applicable federal, state, and local regulations and guidelines to manage and control asbestos hazards on JSC property.

c. It is JSC policy to create, maintain, and make available for employee review all medical and exposure monitoring records as prescribed in OSHA regulations 29 CFR 1910.20, 1910.1001, and 1926.1101.

d. It is JSC policy to not expose unprotected and untrained personnel to more than 0.01 fibers per cubic centimeter (f/cc) of asbestos as an 8-hour time weighted average (TWA) concentration. This level is based on the EPA "safe occupancy" level for reentry after an asbestos abatement project.

e. It is the JSC policy that occupational exposures of workers performing asbestos-related activities shall not exceed the OSHA permissible exposure limit (PEL) of 0.1 f/cc (29 CFR 1910.1001, 29 CFR 1926.1101).

2. Purpose

Part 12 provides the information, guidance, standards, and procedures necessary to implement NASA and JSC policy relating to asbestos-related activities. The definitive procedures in Part 12 and the basic policies of federal regulations provide a basis for asbestos-related activities at JSC.

3. Program objectives

a. The goal of the JSC ACP is to manage-in-place the ACM in JSC buildings and facilities in a manner that minimizes asbestos exposure to building occupants, service workers, and the environment. To accomplish this goal, the ACP is designed to:

- Remove asbestos debris that may have been released from the ACM
- Avoid or control disturbances of the ACM during building activities to eliminate or greatly reduce the release of fibers
- Remove and/or repair damaged ACM
- Implement a program of removal of asbestos materials as part of the JSC Facility Maintenance and Construction of Facilities Programs, as feasible
- Isolate and respond to episodic, potential fiber release incidents

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- Properly manage and dispose of asbestos waste

b. The focus is on service workers and workers involved in operations removing ACM since their activities are most likely to release asbestos fibers. These activities include building renovation, maintenance, repair work on building systems, and routine cleaning and custodial work.

c. All tasks involving potential asbestos exposure require some degree of control. Hence, Part 12 covers the removal of even one ceiling tile in a building known to contain spray-applied asbestos insulation (SAI). The degree of control is tailored to the potential of exposure to workers and to building occupants.

4. Program elements

To achieve the program objectives, the ACP will:

a. Alert building occupants to the existence and location of ACM and to the need for not disturbing it through awareness training (e.g.: Hazard Communication, etc.)

b. Establish appropriate work practices for cleaning and maintaining the buildings

c. Establish procedures for minimizing ACM disturbances during demolition and renovation projects

d. Establish procedures for removing ACM

e. Establish procedures for collecting and removing fibers after a release episode

f. Establish procedures for those workers exposed at, or above, the action level for medical surveillance, training, and compliance with the existing respiratory protection program

5. Alternate procedures

Use procedures specified in Part 12 for all asbestos-related activities at JSC. If specified procedures cannot be used because conditions significantly vary from those for which the Part 12 procedures were developed, make a written request to the APM (JA131) providing details of the problem encountered and recommended alternatives. Provide in the alternative procedures equivalent or greater protection than the procedures that they replace. The APM must approve any alternate procedure in writing.

6. Other asbestos-related activities

Asbestos-related activities not specified in Part 12 or asbestos-related activities outside the limiting scope of an existing procedure require the development of a work plan, including health and safety procedures. The JSC APM or his designated representative must approve the work plan.

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Chapter 12.3
Asbestos Control Program

1. Purpose

The purpose of the ACP is to provide a safe work environment by maintaining potential asbestos exposure hazards as low as reasonably achievable for all building occupants and service personnel. This can be achieved through a well-defined ACP that includes asbestos inspection, hazard assessment, and response actions and by ensuring that all JSC asbestos-related work is performed in accordance with the requirements set forth in the remaining chapters of Part 12. Other important aspects of a comprehensive ACP include employee training (Chapter 12.5), medical surveillance (Chapter 12.5), personal protection (Chapter 12.5), work practices and procedures (Chapters 12.3 through 12.13), air and exposure monitoring (Chapter 12.8), waste disposal (Chapter 12.14), and standard operating procedures (Chapter 12.15 and the attachments in Appendix 12B).

This chapter defines the specific procedures for identifying and assessing ACM, developing appropriate response actions for mitigating its hazard potential, and conducting annual ambient air monitoring.

2. Responsibilities

The APM (JA131) has primary responsibility for coordinating the ACP. The APM will use the services and support of both the OHS and facilities maintenance COSS contractors to implement the ACP.

3. Objectives

The primary objectives of the ACP are as follows:

a. Identify the locations(s), type(s), and quantity of ACM

b. Inspect and periodically reinspect to determine the physical condition of existing or suspect ACM

c. Assess the hazard potential posed by existing or suspect ACM based on a set of standard criteria

d. Perform routine annual ambient air sampling

e. Develop and implement response actions to abate existing and potential ACM contamination

f. Respond to emergencies and fiber release episodes

g. Prevent future contamination through minimization of ACM disturbance and damage

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4. ACM inspections and hazard assessments

The APM will ensure that periodic inspection and hazard assessment of suspect or confirmed ACM in JSC facilities is accomplished. The hazard assessment process uses the information contained in the inspection report and involves evaluating the degree of hazard potential that exists based on a set of criteria. The inspection/assessment process provides guidance in anticipating response actions; preparing scopes of work, cost estimates, and schedules; and in the development and prioritization of an overall asbestos management plan.

5. Bulk sampling

a. Perform bulk sampling to verify the presence or absence of asbestos in a particular building or facility material. At JSC, the ACM of primary concern is the SAI or fireproofing on the structural members and decking, but you may also find ACM in a wide variety of other building materials. You must presume the presence of asbestos in the absence of bulk sample analysis confirmation for all suspect ACM.

b. Collecting bulk samples of ACM can cause significant damage and fiber release. Therefore, only those individuals designated by the APM, who are trained in the proper sampling techniques, will be allowed to collect samples. The APM has designated both the OHS Contractor and the COSS Environmental Support Contractor as having trained personnel to perform this sampling. Other contractors must request this designation from the APM.

c. Analyze bulk samples by EPA-approved methods listed in 40 CFR 763.

d. All individuals must wear respiratory protection while obtaining bulk samples of suspect ACM to prevent inhaling fibers.

6. Routine building ambient air sampling

a. Annual Ambient Air Sampling - The OHS Contractor has been conducting a routine program of annual ambient air sampling at JSC for a number of years. The ambient air sampling has been conducted in buildings known to contain SAI and exposed asbestos acoustic/decorative material.

> ***The data collected from this effort has shown that no, repeat NO, significant quantity of airborne asbestos fibers exists within JSC facilities and levels are far below EPA and OSHA limits.***

All samples obtained during the performance of the annual ambient air sampling are collected and analyzed in accordance with the National Institute for Occupational Safety and Health (NIOSH) Method 7400 or Method 7402. As you obtain additional sample data, add it to the existing database. The ambient air monitoring will be performed at least on an annual basis in each of the 34 buildings (1, 2, 3, 4N, 5, 7A, 8, 9A, 10, 11, 12, 13, 14, 15, 16, 16A, 17, 18, 24, 25, 29, 30A, 30M, 31, 32, 33, 36, 44, 45, 49, 350, 352, 419, 420) at JSC which are known to contain SAI or exposed asbestos-containing acoustical/decoration materials.

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b. Asbestos Abatement Project Air Sampling - The OHS Contractor has primary responsibility for air sampling during asbestos abatement projects and particularly the final clearance air sampling. The abatement contractor and/or an outside consultant conduct personnel and other air sampling during the performance of a particular project, as required. For additional information about air sampling requirements refer to Chapter 12.8.

7. Response actions

a. The APM (JA131) is responsible for all response actions. The EPA has defined "response action" to mean: "a method including removal, encapsulation, permanent enclosure, repair, operations and maintenance that protects human health and the environment from friable ACBM" (40 CFR 763).

b. At JSC trained workers will perform one of the following four types of responses when notified about damaged ACM or when notified of a minor or major fiber release:

- **Cleanup of ACM** - This response is appropriate when loose ACM dust or debris is encountered. This is a non-emergency, scheduled activity, normally completed within 48 hours from notification.
- **Repair of ACM** - This response is appropriate whenever ACM is found in a damaged, delaminated, or deteriorated condition over a relatively small area.
- **Removal of ACM** - This response is appropriate whenever ACM is found in a damaged, delaminated, or deteriorated condition over a relatively large area and poses a potential exposure hazard to building occupants. In addition to removing asbestos due to its condition and/or hazard potential, asbestos must also be removed before any construction, renovation, or demolition in structures containing friable asbestos or asbestos that will be made friable by these activities. In addition, no asbestos removal in excess of 160 square feet of surfacing material or 260 linear feet of pipe insulation or 35 cubic feet of any ACM will be performed without prior written notification to the Texas Department of Health (TDH) (see Chapter 12.6).
- **Emergency Response** – Cleanup and containment of a spill/release of known or suspected ACM that presents a potential hazard to building occupants. The APM (JA131) is notified of any emergency involving significant damage to ACM resulting in the release of asbestos fibers. This type of situation is referred to as a fiber release episode. Upon notification, the APM coordinates response actions with the OHS and facilities maintenance COSS contractors. The situation will be evaluated and appropriate actions will be taken. These actions may include cleanup, repair, or removal of ACM as dictated by the particular circumstances.

c. All personnel are instructed to call the site Emergency Operations Center (EOC) numbers to report suspected asbestos debris. The EOC numbers are: extension 3-3333 for JSC and Sonny Carter Training Facility, and 4-4444 at Ellington Field. The EOC will contact the

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JSC Environmental Spill Team for cleanup/containment and the OHS Contractor for hazard assessment and air monitoring.

8. Prohibited activities

To minimize the potential for exposure to asbestos, all **uncontrolled** activities that may damage ACM or PACM or cause the release of airborne asbestos fibers are prohibited. All personnel must:

a. Not cut or drill holes in any ACM/PACM.

b. Not install hangers or fasteners in any ACM/PACM.

c. Not sand, grind, drill, remove, or damage, any ACM/PACM including floor tile, carpet tiles, or adhesives used on these tiles.

d. Not damage ACM/PACM while moving equipment or furniture.

e. Not install curtains, drapes, or dividers in such a manner that they will damage ACM/PACM.

f. Not use an ordinary vacuum, or compressed air or dry sweeping to clean up ACM/PACM debris.

g. Not remove ceiling tiles below ACM/PACM without following the procedures set forth in Part 12.

h. Not hang any item from the suspended ceiling grid below a ceiling plenum with SAI.

i. Not damage any pipe or mechanical system insulation that contains or could contain ACM/PACM. Insulating materials such as Styrofoam, foam rubber, foam glass, or fiberglass do not contain asbestos; however, ACM may exist at the joints and fittings. Contact the APM before conducting activities that may cause disturbance or damage to these materials or follow the applicable procedure in Appendix 12B, Attachments 12A through 12G.

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Chapter 12.4
Asbestos Control Regulations

1. Introduction

Medical evidence linking asbestos to chronic disease has led to efforts to control or reduce asbestos exposure, particularly in environmental and occupational settings where exposure can be prolonged.

Both the OSHA and the EPA have published regulations concerning asbestos exposure. State regulatory agencies, TDH, and the Texas Commission on Environmental Quality (TCEQ) have become involved in administering certain aspects of the regulations.

Failure to follow regulations and apply adequate standards of care in asbestos-related activities may result in unnecessary risk to employees and building occupants.

2. Occupational Safety & Health Administration

a. OSHA has issued two separate asbestos standards that were issued to cover the vastly different conditions in general industry and construction workplaces. These standards were established in the Code of Federal Regulations, Title 29, Part 1910, Section 1001 for general industry (29 CFR 1910.1001) and in the Code of Federal Regulations, Title 29, Part 1926, Section 1101 for the construction industry (29 CFR 1926.1101). These standards establish PELs and numerous requirements that employers must meet. You must use these standards in conjunction with Part 12 to ensure compliance with federal regulations.

b. Both regulations establish requirements for:

- Methods of compliance
- Personal protective equipment (PPE)
- Employee monitoring
- Medical surveillance
- Alerting employees of hazards
- Regulated areas
- Housekeeping procedures
- Training
- Record keeping

c. The OSHA PEL for asbestos exposure is 0.1 f/cc of air as an 8-hour TWA and OSHA also has a 30-minute TWA excursion limit of 1.0 f/cc. These limits apply to workers performing operations involving asbestos products and to construction workers performing abatement, demolition, or renovation involving ACM.

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d. Additionally, 29 CFR 1926.1101 defines Classes of asbestos-related construction work. These Classes are:

- **Class I Asbestos Work:** means activities involving the removal of thermal system insulation (TSI) or surfacing material that has been identified as ACM or is presumed to be ACM (PACM).

  (Note: From 29 CFR 1926.1101(b): surfacing material means material that is sprayed, troweled-on, or otherwise applied to surfaces of ceilings, structural members, and other surfaces for fireproofing, acoustical, and other purposes.)

- **Class II Asbestos Work:** means activities involving the removal of ACM that is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard systems, floor tile and sheeting, ceiling tile, roofing and siding shingles, and construction mastics.

  (Note: From 29 CFR 1926.1101(a)(8): the OSHA Construction Industry Standard does not apply to asbestos-containing asphalt roof coatings, cements and mastics. Therefore, the OSHA Construction Industry Standard applies to asbestos-containing shingles and roofing paper, but does not apply to the asphalt coating/cement/mastic.)

- **Class III Asbestos Work:** means repair and maintenance operations where ACM, including TSI and surfacing ACM and PACM, is likely to be disturbed.

  (Note: From 29 CFR 1926.1101(b): disturbance means activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM and PACM, no greater than the amount that can be contained in one standard-sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or waste bag which shall not exceed 60 inches in length and width.)

- **Class IV Asbestos Work:** means maintenance and custodial activities during which employees contact but do not disturb ACM and activities to clean up dust, waste, and debris from Class I, II, and III activities.

e. In addition to the asbestos standards, OSHA has also issued other standards related to specific safe work practices. Most notable of these is 29 CFR 1910.134, Respiratory Protection. Both 29 CFR 1910.1001 and 29 CFR 1926.1101 reference this standard. Any employer requiring their workers to wear respiratory protection must meet the requirements of 29 CFR 1910.134. This will include a written Respiratory Protection Program plan reviewed by the NASA/JSC Occupational Health Officer or his designated representative.

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3. Environmental Protection Agency

a. Two sets of EPA regulations affect activities at JSC involving ACM.

b. In the first, the EPA regulates asbestos as a hazardous pollutant under the Clean Air Act. The standard, National Emission Standards for Hazardous Air Pollutants (NESHAP), was established in the Code of Federal Regulations, Title 40, Chapter 1, Subchapter C, Part 61, Subpart M, paragraphs 140 through 157 (40 CFR 61.140-157). Both building owners and asbestos-removal operators are responsible for complying with the standard. The standard:

- Requires a thorough inspection for ACM be performed in building and facilities to be demolished or renovated.
- Requires notification to the EPA when a building, or a facility, or a portion thereof is to be demolished regardless of the presence or lack of identified ACM.
- Requires notification to the EPA when a building that contains friable or potentially friable ACM is to be renovated if the amount of the material disturbed meets notification limits.
- Sets standards for wet removal and treatment of asbestos materials during building demolition and renovation.
- Prohibits the spray application of materials that contain greater than 1% asbestos.
- Prohibits the use of molded and friable or wet-applied asbestos materials.
- Sets procedures for air cleaning and for inactive and active waste disposal sites.
- Prohibits visible emissions to the outside.
- Specifies certain disposal procedures.

This EPA regulation focuses on removal of ACM during demolition and renovation activities in buildings, emission of asbestos fibers, and disposal of asbestos waste. The standards are related to environmental controls, not worker protection. This EPA standard governs emission of asbestos fibers into the atmosphere stipulates that there will be no visible emissions from any asbestos-using operation, any waste disposal site, or sanitary landfill. It also requires a variety of dust-suppressing procedures. Special procedures relating to roof removal may be found in 40 CFR 61, Appendix A—Interpretive Rule Governing Roof Removal Operations.

c. The second set of EPA regulations is the “Friable Asbestos-containing Materials in Schools; Identification and Notification Rule” (40 CFR Part 763) promulgated under the Toxic Substances Control Act. While this regulation was aimed primarily at ACM in schools, it has become a standard for accepted practice. This regulation also states that response actions are completed when clearance air samples have fiber concentrations of less than or equal to 0.01 f/cc of air. Changes to this regulation in 1994 modified training requirements and added applicability to public and commercial buildings, including government-owned buildings. The OSHA regulations refer to 40 CFR 763 in some of their criteria, especially for training requirements.

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4. Texas Department of Health

Texas has enacted an asbestos contractor licensing law that you can find in the Texas Administrative Code (TAC). You can find these requirements in Title 25, Part 1, Chapter 295, paragraphs 31 through 73 (25 TAC 295.31-295.73). Any contractor performing asbestos-related work in public buildings must have appropriately trained and licensed personnel planning, supervising, and conducting the work.

The TDH also has primary responsibility for enforcement of EPA NESHAP regulations within the state under authority delegated by the EPA.

5. Texas Commission on Environmental Quality

The TCEQ has established requirements for the disposal of asbestos waste. Texas has designated ACM as a Class 1 waste. You can find this designation in Title 30, Part 1, Chapter 335, Subchapter R, paragraphs 501 through 521 (30 TAC 335.501-335.521). Dispose of any ACM waste generated at JSC in accordance with all Texas requirements found in 30 TAC 335, Industrial Solid Waste and Municipal Solid Waste.

6. Harris County

Harris County Health and Environmental Department has issued no asbestos control regulations.

7. City Of Houston

The City of Houston has issued no asbestos control regulations that apply to activities on federal property.

8. NASA Policy

NASA Headquarters, in a February 18, 1983, letter on “Hazard Assessment and Abatement in NASA Buildings,” summarized their position with respect to the presence of asbestos in NASA facilities:

a. Asbestos SAI must not be removed from surfaces of NASA buildings simply because of its presence nor should other abatement techniques be implemented.

b. All areas containing asbestos SAI must be visually inspected at least annually for damage and signs of deterioration.

c. Air sampling and analysis for airborne fibers must be performed annually or more frequently, as warranted, in areas containing asbestos SAI.

d. Where hazard assessments reveal asbestos SAI to be in an unacceptable condition so that the health of building occupants may be threatened, corrective actions nust be taken promptly to eliminate or control the source of contamination.

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e. Accurate and up-to-date records must be maintained of all asbestos identification, work area surveillance, and abatement activities. Employees must have access to these records in accordance with OSHA requirements. Access to medical surveillance records will be in accordance with NASA Privacy Regulations on Medical Records.

9. JSC Policy

JSC's policy is to meet, or exceed, all of the above requirements. Part 12 and federal, state, and local regulations form the basis of the requirements for all asbestos-related activities undertaken at JSC. JSC expects any organization or contractor performing asbestos-related work at JSC to also meet, or exceed, these same requirements.

To ensure familiarity with the requirements, JSC requires that any organization, activity, or contractor performing asbestos-related work at JSC have copies of Part 12 of this Handbook as well as the following standards in their possession:

29 CFR 1910.1001

29 CFR 1926.1101

29 CFR 1910.134

40 CFR 61.140 - 61.157

40 CFR 763

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Chapter 12.5
General Asbestos Work Requirements

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2. Medical surveillance requirements

a. You can find medical surveillance requirements in three OSHA regulations. Refer to the listed regulations for details and specifications of these requirements. However, all three regulations require a physician's written opinion. These three regulations are:

- The Construction Industry Standard for Asbestos (29 CFR 1926.1101) requires employees who perform Class I, II, and III asbestos work for 30 or more days per year, or those who are exposed to airborne concentrations of asbestos at or above the PEL to be enrolled in a medical surveillance program. Medical examinations are required before asbestos work/exposure (pre-placement) and annually thereafter.
- The General Industry Standard for Asbestos (29 CFR 1910.1001) requires all employees who are exposed to airborne concentrations of asbestos at or above the PEL to be enrolled in a medical surveillance program. Medical examinations are required before asbestos work/exposure (pre-placement), annually, and upon termination of employment.
- The Respiratory Protection standard (29 CFR 1910.134) specifies that any employee required to wear respiratory protection equipment while performing his or her job must receive a medical evaluation. Medical examinations are required to determine an employee's ability to use a respirator before the employee is fit tested or required to use a respirator.

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b. The frequency of medical evaluations for asbestos workers and respirator wearers at JSC is also listed in Chapter 3.6 of this Handbook.

c. The medical support contractor will provide medical surveillance of JSC civil service employees. On-site support contractor employees receive medical surveillance in accordance with the provisions of their contract. Fixed-price contractors must provide the required medical surveillance from medical resources other than JSC.

d. No ambient levels of asbestos fibers have been identified within JSC facilities that would expose building occupants to even a significant fraction of the JSC action level. Therefore, no requirement exists for building occupants to be placed on an asbestos-related medical surveillance program.

3. Training requirements

a. The following subparagraphs list the JSC minimum training requirements for Class I, II, III, and IV asbestos work. The OSHA Construction Industry Standard for Asbestos at 29 CFR 1926.1101(k)(9) provides the basis for this training. Complete the training for your appropriate Class of asbestos work before or at the time of your initial assignment and take refresher training at least annually thereafter.

b. **All Class I Work:** Training equivalent to the EPA Model Accreditation Plan asbestos abatement worker training specified in 40 CFR 763, Subpart E, Appendix C. This is a 4-day training class that includes specific lecture topics and demonstrations, hands-on training, a current individual respirator fit test, a course review, and a written test. Individuals who possess a current certificate issued under 25 TAC 295.42 for an Asbestos Abatement Worker have demonstrated they have met this requirement. Currency in this training expires exactly 12 months after the date of the initial or last refresher training and individuals may not perform Class I work activities until they have again received refresher training in this topic. Any individual who lets more than 24 months lapse since the date of their last training must retake the 4-day initial training.

c. **Class II Work which uses critical barriers and/or negative pressure enclosures:** Training equivalent to the EPA Model Accreditation Plan asbestos abatement worker training specified in 40 CFR 763, Subpart E, Appendix C. This is a 4-day training class which includes specific lecture topics and demonstrations, hands-on training, a current individual respirator fit test, a course review, and a written test. Individuals who possess a current certificate issued under 25 TAC 295.42 for an Asbestos Abatement Worker have demonstrated they have met this requirement. Currency in this training expires exactly 12 months after the date of the initial or last refresher training and individuals may not perform Class II work activities until they have again received refresher training in this topic. Any individual who lets more than 24 months lapse since the date of his or her last training must retake the 4-day initial training.

d. **All other Class II Work:** For work only involving ACM roofing materials, flooring materials, siding materials, ceiling tiles, or transite, training must be equivalent to the requirements specified in 29 CFR 1926.1101(k)(9)(iv). This training includes specific

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topics listed in 29 CFR 1926.1101(k)(9)(viii) and work practices/procedures from 29 CFR 1926.1101(g). This training shall take a minimum of 8 hours. Currency in this training expires exactly 12 months after the date of the initial or last refresher training and individuals may not perform Class II work activities until they have again received refresher training in this topic. Any individual who lets more than 24 months lapse since the date of his or her last training must retake the initial training. These workers must also have a current respirator fit test.

e. **Class III Work and Class IV Emergency Response Work:** Training equivalent to the requirements specified in 29 CFR 1026.1101(k)(9)(v) and 40 CFR 793.92(a)(2). This 16-hour training class includes specific topics, work practices, respiratory protection, and hands-on training. Currency in this training expires 12 months after the date of the initial or last refresher training. Individuals who can demonstrate they are scheduled for refresher training may continue to perform Class III and Class IV Emergency Response asbestos-related work on-site at JSC until receiving the scheduled refresher training, but not longer than 14 months after the date of their last training. Any individual who lets more than 24 months lapse since the date of their last training must retake the initial training. These works must also have a current respirator fit test. When emergency response involves a clean-up of a major fiber release episode, then the responders must have training meeting the requirements of Class I asbestos work (see above).

f. **Restricted Class III Asbestos Operations and Maintenance Work:** All employees (contractor or civil service) at JSC who work in ceiling plenums, mechanical rooms, beneath computer floors, and anywhere that ACM could potentially be disturbed must complete the 6 hour JSC "Class III Asbestos Operations and Maintenance (O&M) (Restricted)" course offered at the JSC Safety Learning Center. This course along with medical surveillance/evaluation and a current respirator fit test are required before conducting restricted Class III activities at JSC. Refresher training requires completion of the 2-hour JSC "Class III Asbestos Operations and Maintenance (O&M) (Restricted)(Refresher)" course offered at the JSC Safety Learning Center. Additional discussion about this JSC training is provided in the following bullets.

- The work is considered restricted because it is limited to the specific areas and specific conditions at JSC where activities have the potential to disturb asbestos-containing SAI or to disturb dirt/dust containing SAI debris, but does not include removal of any ACM. This encompasses work in ceiling plenums, mechanical rooms, beneath computer floors, and anywhere that ACM could potentially be disturbed. For example, entry into ceiling plenums to "pull cables" or install electrical utility lines in buildings with SAI falls under this classification.
- The JSC Class III Asbestos O&M (Restricted) initial and refresher courses do not address and do not train workers to perform the other types of Class III asbestos-related work, such as glovebag removal or spot abatement of ACM. If you perform actual removal of ACM for operations and maintenance activities, you must meet the appropriate training requirements for asbestos Class I, Class II, or Class III Work as described in the paragraphs above.

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- The JSC Class III Asbestos O&M (Restricted) course is required for all workers performing this type of work on-site at JSC regardless of any other asbestos training they may have received, since it acquaints them with the conditions found at JSC.
- Currency in the JSC Class III Asbestos O&M (Restricted) training expires 12 months after the date of the initial or last refresher training. Individuals who can demonstrate they are scheduled for refresher training at the Safety Learning Center may continue to perform restricted Class III asbestos-related operations and maintenance work on site at JSC until receiving the scheduled refresher training, but not longer than 14 months after the date of their last training. If you let more than 24 months lapse since the date of your last training, you must retake the initial training.

g. **Class IV Work (except Emergency Response):** Training equivalent to the requirements specified in 29 CFR 1926.1101(k)(9)(vi) and 40 CFR 793.92(a)(2). This 2-hour awareness training class includes specific topics and work practices. If you are involved in housekeeping and custodial activities at JSC in areas with ACM (e.g.: acoustical or decorative treatments and flooring materials), you must meet this training requirement. If you are a JSC custodial worker, use HEPA vacuum cleaners and methods to avoid the generation of asbestos fibers from flooring materials as referenced in 29 CFR 1010.1001(k) and 29 CFR 1926.1101(l).

h. Training for any employees likely to be exposed above the PELs for asbestos shall meet the minimum training requirements specified in both 29 CFR 1910.1001(j)(7) and 29 CFR 1926.1101(k)(vii) and (viii).

i. Training for employees required to wear respiratory protection for any level of work involving asbestos materials shall meet the requirements of 29 CFR 1910.134.

j. Fixed-price contractors subject to these training requirements must provide documented proof of the required training for their workers and supervisors before proceeding with work identified within Part 12.

k. Building occupants will receive asbestos awareness training through the annual JSC requirement for Hazard Communication Training.

4. Respiratory protection requirements

a. JSC policy requires the use of respirators when they are necessary to protect the health of the employee and reduce the risk of asbestos exposure during asbestos-related activities. Locate the basic OSHA requirements in 29 CFR 1910.134; they are also referenced in this Handbook. If you wear respiratory protection for any level of asbestos work, you must have an annual individual respirator fit test.

b. JSC will provide respirators at no cost to civil service employees. Respiratory protection for on-site support contractor employees will be provided in accordance with the provisions of their contract. Fixed-price contractors subject to these requirements must furnish their own equipment, and provide documented proof of fit testing, medical

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surveillance, and training for their workers and supervisors before proceeding with work identified within Part 12.

c. If you perform any Class I, II, or III asbestos work at JSC, you must wear appropriate respiratory protection. If you perform Class IV asbestos work, you may be required to wear respiratory protection. Select respirators based on the requirements stated in either 29 CFR 1926.1101(h) or 29 CFR 1910.1001(g). Additionally, any employer requiring employees to wear respiratory protection shall develop a written Respiratory Protection Program plan meeting the criteria detailed in 29 CFR 1910.134. The JSC Occupational Health Officer or his designated representative must approve the written Respiratory Protection Program plan.

d. Select all respiratory protection devices from those approved by NIOSH. If you must wear a respirator, you must not wear a beard or other facial hair that would interfere with the facial seal with the face piece. Any job superintendent, a designated competent person, or a Certified Industrial Hygienist who determines that an employee's existing facial hair prevents the effective use of a respirator will preclude the employee from working in any job requiring a respirator until the facial hair is removed. Do not wear contact lenses while wearing respiratory protection devices. Eyeglasses require special mounts inside full-face respirators. Under no conditions, allow eyeglass temple pieces to penetrate the face seal of the respirator. Any breathing air for supplied air respirators or self-contained breathing apparatus must meet Grade D breathing air specification of 29 CFR 1910.134.

5. Personal protective clothing and equipment

a. Provide personal protective clothing and equipment require for employees engaged in asbestos-related activities as specified in Part 12. You can find basic information on PPE in this Handbook. If workers are exposed to hazardous noise, they may also find information on hearing protection in this Handbook. Additionally, you can find OSHA requirements on PPE in the following standards:

- 29 CFR 1910.132, General Requirements for Personal Protective Equipment
- 29 CFR 1910.133, Eye and Face Protection
- 29 CFR 1910.135, Head Protection
- 29 CFR 1910.136, Foot Protection
- 29 CFR 1910.138, Hand Protection
- 29 CFR 1910.95, Hearing Protection

b. Wear protective clothing and equipment during asbestos-related work to protect from gross contamination of the body, hair, etc., and to provide protection from other physical hazards in the workplace. The proper use of protective clothing, coupled with the appropriate use of decontamination showers, as required, and HEPA-filtered vacuum

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cleaners, will minimize your chance of bringing asbestos out of the work area and into your general environment and your home.

c. Use protective equipment such as hard hats and eye protection in those activities in which there is risk of head injury from falling objects or eye injury from foreign objects. If you're required to wear a half-mask respirator, you will be provided with safety glasses with side shields or safety goggles. As determined by the designated competent person, the job supervisor, or the JSC Safety Reliability and Quality Assurance (SR&QA) Directorate, if you work in areas where there is a possible danger of head injury from impact, from falling or flying objects, or from electrical shock or burns, you must wear a protective helmet.

d. Protective clothing does not include street clothes (or shoes), T-shirts, blue jeans, sweatbands, kneepads, and socks. If you use any of these items inside the work area, you must remain there until the job is completed and either be decontaminated using HEPA-filtered vacuum cleaners or wet wiping or alternatively disposed of as asbestos-contaminated waste.

e. Keep other protective clothing/items such as hard hats and safety shoes/boots, if required, or other appropriate footwear in the work area for the duration of the project. Upon project completion, you can clean these items, place them in a plastic bag, label them as containing asbestos, and take them to the next project. If these items cannot be decontaminated, dispose of them at the end of the project as asbestos-containing waste.

f. Protective clothing for asbestos-related work will consists of disposable coveralls. These are normally paper or a synthetic material (i.e., Tyvek®) coverall. They include hoods and booties. After each use, discard these items as asbestos-contaminated waste. Disposable coveralls, such as Tyvek®, are extremely vulnerable to hot surfaces or open flames. They burn rapidly and some plastic materials may melt and severely damage exposed skin.

6. Decontamination

a. Visible signs of asbestos will not be tolerated in areas serving building occupants. Therefore, everyone must go through the decontamination sequence after leaving a regulated asbestos work area for any reason.

b. The degree of decontamination necessary is directly proportional to the potential of exposing someone outside the work area. For the majority of JSC jobs, where disposable clothing is worn and where an enclosure will not be required, first use a HEPA-filtered vacuum on or wet wipe the protective clothing, then carefully remove the protective clothing, and bag it as asbestos-containing waste. Bag contaminated materials for disposal as asbestos waste.

c. When it is necessary to work within a large enclosure, in-process through a "hygiene unit" or "clean room" to change from street clothes into work clothes and out-process through the decontamination and/or hygiene units to remove contaminated work clothing, decontaminate, and change back into street clothes.

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7. Secure electrical, fire alarm, and HVAC systems

a. Secure or deactivate all electrical, fire alarm, and HVAC systems in the work area before a major abatement activity, especially when it is necessary to construct a large enclosure. Activities involving small-scale or incidental asbestos exposure will generally not require securing the electrical, fire alarm, or HVAC systems; however, you will need to evaluate this on a case-by-case basis. Regardless, you will need to coordinate any outage of electrical or HVAC systems through work control using established procedures.

b. The amended water used to saturate ACM creates a humid environment. To eliminate the potential hazard, you must de-energize the electrical systems serving the work area, and control their operation, before any wet operations begin.

c. Fire alarm sensors are triggered during abatement activities. You must disable them before and throughout the project. The Fire Protection Coordination Office must approve all fire alarm sensor outages.

d. The HVAC system, if left operational in an asbestos work area, represents a potential route and means for spreading ACM fibers into other areas of the facility and therefore increases the risk of employee exposure. You must shut down, isolate, and control the HVAC in the work area before and during any asbestos-related activity. All vents and air ducts inside the work area must be covered and sealed with two layers of 6-mil plastic and tape. If the HVAC system supplying the work area supplies other areas in the building that are still operational, de-energizing the system may not be feasible; you must develop an alternate method of isolating the work area portion of the HVAC.

e. Control electrical and HVAC systems shut down or de-energized at the point of isolation with an orange JSC Form 19A “WARNING - DO NOT OPERATE” tag and a lock (the lock must be a color other than red). Use this tag and the operation/energy control procedures found in Chapter 8.2 of this Handbook to ensure the systems are controlled.

8. Electrical power hazards

One of the most common hazards, and one that gives the least warning, is electrical power. Incorrect wiring, improper grounding, and lack of proper shielding in the wet environment of asbestos-related activities can significantly increase the workers' risk. To lessen the risk of injury, refer to the requirements in this Handbook, and take the following actions.

a. De-energize as much of the work electrical system as possible.

b. Use portable light systems.

c. Use nonconductive scrapers, tools, and vacuum attachments.

d. Use hot-line covers over energized cables and power lines when possible.

e. Use caution to avoid damaging power cable insulation with scrapers, shovels, scaffolding, and wheeled equipment.

f. Avoid stringing electrical wiring across floors. Elevate wiring, if possible, to keep it away from later on the floor, physical abuse, and damage from equipment use.

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g. Use stable, wooden or fiberglass ladders - not metal.

h. Consider electrical equipment and lines to be energized unless tested and determined otherwise.

i. Extension cords used with portable electric tools and appliances will be of the three-wire type and connected to a ground fault circuit interrupter (GFCI).

j. All 120-volt, single phase, 15 and 20 ampere receptacle outlets in the work area that are not part of the permanent wiring of the building or structure will be equipped with an approved GFCI.

k. Establish and implement an assured equipment grounding conductor program covering all cord sets and receptacles that are not part of the permanent wiring of the building or structure, and equipment connected by cord and plug, which is available for use or used by employees on asbestos-related activities covered by Part 12.

9. Slips, trips, and falls

Asbestos-related projects, particularly abatement projects, are inherently dangerous for numerous reasons: the presence of multiple layers of plastic sheeting on the floor, the accumulation of debris, poor lighting, and the need to work from ladders and scaffolds. To deal with these problems, take steps to prevent slips and falls in the work areas.

a. Install the first layer of floor sheeting as tight and flat as possible. Secure the second layer of plastic to the first with tape, spray adhesive, or other means. (This will reduce the chance of the two layers from sliding over one another.)

b. Keep electrical lines off the work floor by taping them high on the wall, behind the wall plastic if possible.

c. Do not allow debris from abatement activities to pile up or lay about. Pick up and place the material in appropriate containers at the time of generation.

d. Select a secure area out of the normal traffic pattern for the temporary storage of waste bags.

e. For plastic floor sheeting on stairs, install a nonskid surface over the plastic on each tread. Do not cover stairs unless they require protection from water damage.

f. Ensure that all workers in the work area wear a good quality protective shoe or boot. Rubber boots that provide good traction are preferred. Rubber boots also provide some protection from electrical shock as well as being easy to clean. Workers should not wear Tyvek booties on the outside of their work shoes.

g. Always follow established procedures for the installation and use of ladders and scaffolds.

h. Most abatement work requires the worker to be constantly looking at the ceiling or pipes overhead. Thus, every worker must always be on the lookout for tools, cable equipment, etc., left lying about the work area that may trip them as they move about.

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10. Confined spaces

Confined spaces may be encountered in asbestos-related activities. *A confined space is a space that, by design, has limited openings for entry and exit, that has unfavorable natural ventilation, which could contain asbestos fibers, other hazardous materials or is oxygen deficient, and that is not intended for continuous employee occupancy.* Confined spaces can include, but are not limited to, storage tanks, process vessels, pits, vats, degreasers, security vaults, boilers, underground utility tunnels/vaults, and pipelines. This Handbook and the OSHA requirements in 29 CFR 1910.146 govern entry into confined spaces during asbestos-related activities. Anyone working in a confined space at JSC must complete the JSC Confined Space Training Course at the JSC Safety Learning Center before working in a confined space at JSC. Any asbestos-related work in a confined space, including the underground utility tunnels, requires a confined space procedure and permit approved by the OHS Contractor and the Institutional Safety contractor.

11. Ladders and scaffolds

Asbestos-related activities specified in Part 12 routinely use ladders and scaffolds. Both items represent potential safety hazards. Use ladders and scaffolds at JSC in accordance with the requirements of this Handbook, and the OSHA requirements of 29 CFR 1910.25, 1910.26, 1926.450-454, and 1926.1053.

12. Heat Stress

a. Control employees' total heat exposure when conducting JSC asbestos-related activities so that workers are not exposed to combinations of metabolic and environmental heat, which produce unacceptable heat stress. Heat stress, for the purpose of Part 12, is the total effect of environmental and physical factors that make up the total heat load imposed on the body. Unacceptable heat stress is defined as any combination of metabolic and environmental heat, which produces any symptom or adverse effect.

b. Several biological effects can occur from heat stress. They include, in increasing order of severity, heat rash, heat cramp, heat exhaustion, and heatstroke. Heatstroke is an acute medical emergency and requires immediate medical attention. If you are a work area supervisor, you must be familiar with the signs and symptoms of these conditions and take appropriate action whenever any worker shows signs of heat stress.

c. The major factors affecting heat exchange between a person and the environment are air temperature and humidity, skin temperature, air velocity, evaporation of sweat, radiant temperature, and type, amount, and characteristics of clothing. Summer weather in Houston is both hot and humid.

d. Protective clothing required for asbestos-related activities serves as a barrier against gross contamination of the body by asbestos materials and the potential spread of asbestos to uncontrolled environments. The protective clothing system also alters the rate and amount of heat exchange between the skin and the ambient air and, thus, increases the stress of both metabolic and environmental heat.

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e. The effects of heat stress can be increased if the individual is using alcohol, therapeutic drugs, or social drugs while being exposed to high heat stress in the work environment. Many drugs prescribed for therapeutic purposes also affect the body's mechanisms for adapting and adjusting to heat stress. If you require therapeutic medication, you may not work asbestos-related activities which may represent heat stress unless you are under the supervision of a physician who provides a written opinion that you will not be adversely affected by the heat stress of the proposed work activity.

f. To the extent possible, only employees acclimated to heat stress will be used in asbestos-related activities requiring full protective clothing and work area enclosures.

13. Prohibited activities

While in a regulated asbestos work area, no employee will:

a. Smoke

b. Eat

c. Drink

d. Chew gum or tobacco or use snuff

e. Apply cosmetics

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Chapter 12.6
Notification Requirements

1. Introduction

All JSC asbestos-related activities will require some level of notification. The level of notification required for each job is specified below. Resolve any questions or notification before beginning asbestos-related activities.

Some jobs require notification of state or federal agencies before beginning jobs. The JSC Center Operations Directorate, Environmental Management Office (JA131), will make all notifications to state or federal agencies for asbestos-related activities at JSC.

2. JSC offices to be notified

The job originating office must notify the following JSC offices of proposed or planned asbestos-related activities. Failure to provide this notification may result in delay, work stoppage, or discontinuance of the job by the APM, the Occupational Health Officer, and/or the NASA Safety representative. Notification requirements are summarized in Table 12.6-1 below.

a. Notify the Facility Manager and work area supervisor of all planned Asbestos Class I, II, or III work, in sufficient time for the Facility Manager or Supervisor to inform building occupants.

b. Notify the OHS Contractor—orally at extension 3-6726 or written by fax at extension 3-3395—before all Asbestos Class I, II, and III activities and for any Class IV asbestos emergency response clean-up activities. Use Job Procedures Requirements Permit and Notification Form shown in Appendix 12A for written notification. For telephone (oral) notification, include all information found in Table 12.6-2 at the end of this chapter.

c. Notify the JSC Environmental Office (JA131)—orally at extension 3-3120 or written by fax at extension 3-3048—when any Asbestos Class I or II activities will cause the removal or abatement of more than 260 linear feet, 160 square feet, or 35 cubic feet of ACM; or will cause the demolition of a building or portion thereof, regardless of whether ACM has been identified or not. At least 15 working days before the start of the activities, provide the information contained in the most current revision of the TDH Renovation/Demolition Notification Form, Form APB#5. You can download a copy of this form and instructions for filling it out from the TDH Asbestos Programs Home Page <http://www.tdh.state.tx.us/beh/asbestos/>. A copy of this form is reproduced in Appendix 12A.

d. The JSC Environmental Office (JA131) will make all required notifications to external state and federal governmental agencies.

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3. Abatement contractor work plan requirements

a. Contractors hired to perform asbestos Class I or Class II abatement work at JSC must provide the JSC APM with a work plan/design before beginning work. To meet the requirements of both OSHA (under 29 CFR 1926.1101(g)) and EPA (under 40 CFR 763.90(g)), the contractor developing the work plan will ensure the plan has been reviewed and approved by an accredited Project Designer meeting the requirements of 40 CFR 763, Appendix C, Model Accreditation Plan. The JSC APM and/or designated representative will review and approve the work plan/design for implementation at JSC. The work plan must:

- Provide information necessary for JSC to make required notices to all federal, state, and local agencies responsible for enforcement of the National Emission Standard for Asbestos or other applicable regulation within the required time period, if the abatement project involves greater than 260 linear feet of pipe insulation, or greater than 160 square feet of sprayed, troweled, or material otherwise applied to building structures, coverings, or components, or greater than 35 cubic feet of any ACM.
- Submit documentation that required permits, site location, and arrangements for transport and disposal of asbestos-containing waste have been made, in accordance with JMI 8837.1, latest revision.
- Retain a detailed work plan outlining the sequence of events, including days/shifts per event, and procedure(s) to be followed.
- Submit documentation that the contractor's employees, including foremen, supervisors, and any other company personnel or agents who may be exposed to airborne asbestos fibers or who may be responsible for any aspect of the abatement action, have received all necessary training that includes, at a minimum, the training requirements of 29 CFR 1926.1101.
- Submit documentation that all employees or agents who may be exposed to airborne asbestos in excess of the PEL of 29 CFR 1926.1101 or who will be required to wear respiratory protection have been medically examined in accordance with the provisions and requirements of the regulation to determine whether they are physically capable of working while wearing a respirator without suffering adverse health effects or whether they have any condition that might be aggravated by exposure to asbestos.
- Submit shop drawings for layout and construction of decontamination enclosure systems and barriers to isolate the work area. Drawings will include negative-pressure equipment location as detailed in the project specifications and required by regulation.
- Submit manufacturer's certification that HEPA-filtered vacuums, negative-pressure ventilation units, and other local exhaust ventilation equipment conform to ANSI Z9.2-79.

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- Retain a copy of the written notification to owners of rental equipment to be used in abatement areas or to transport asbestos waste.
- Document NIOSH approvals for all respiratory protective devices to be used on site. If supplied-air respirators are used, document that the air source has been checked and qualified to provide breathing air meeting the requirements of the Compressed Gas Association, Specification G-7, for D grade air.
- Submit documentation of respirator fit testing for all contractor employees and agents who must enter the restricted and/or enclosed area. This fit testing will meet the requirements of 29 CFR 1926.1101 and 29 CFR 1910.134, as a minimum.
- Retain necessary documentation to demonstrate compliance with the applicable paragraphs of Part 12 and applicable federal, state, and local regulatory requirements.

b. During major, large-scale abatement activities, upon request, contractors must provide the JSC APM, or his designee, with:

- Job progress reports detailing abatement activities, progress on previously established milestones and schedules, major problems and actions taken, injuries, equipment and bulk material used, and air sampling results taken by the contractor or a representative, and any OSHA compliance monitoring results.
- Copies of daily work site entry logs with information on worker and visitor access.

Table 12.6-1

Notification Requirements

	Asbestos Class			
Notifications Made to:	I	II	III	IV*
Facility Manager and Work Area Supervisor	X	X	X	X
Occupational Health Services Contractor (SD33)	X	X	X	X
JSC Environmental Office (JA131): must provide written notice 15 working days prior when exceed limits	X	X		

* Asbestos Class IV notifications only required for emergency response

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Table 12.6-2 **Telephonic/Oral Notification Requirements**
a. Name and Telephone Number of caller
b. Organization/Employer
c. Job Location: Building Number and Room Number
d. Asbestos JPR and description of activity
e. Start Day/Time
f. Estimated job completion time Day/Time
g. Name and Telephone Number of the Competent Person
h. Amount of ACM that will be removed in either linear feet, square feet, or cubic feet
i. Assurance the following items on the work permit are current or are available at the work site: • Medical exams and respirator fit test • Training of workers • Respirators and personal protective equipment/clothing • Materials to establish the regulated area • Equipment to perform the JPR and perform cleanup/decontamination • Hazard warning signs

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Chapter 12.7
Competent Person

1. Requirement

a. JSC requires that all asbestos-related work, which meets the definition of construction work in 29 CFR 1910.12 and 29 CFR 1926.1101(a), be conducted under the supervision of a ***competent person***.

> *A **competent person** is one who is capable of identifying existing and predictable hazards in the work area or unsanitary, hazardous, or dangerous working conditions, and who has authority to take prompt corrective measures* (29 CFR 1926.32(f)).

b. In addition, 29 CFR 1926.1101(b) requires that the ***competent person*** be capable of selecting the appropriate strategy to control asbestos exposures. The ***competent person*** must ensure that all work is performed in accordance with the approved work practices and work plans.

c. The duties of the ***competent person*** to supervise asbestos-related work and to perform inspections and other activities are detailed in 29 CFR 1926.1101(o). According to JSC policy, if you are a ***competent person***, you must be capable of performing the Class of asbestos-related work over which you have control. Per Part 12, as a ***competent person,*** sign the "Job Procedure Requirements and Notification Form" (see Chapter 12.1). If the assigned ***competent person*** is not at the job site, he/she should visit the job site periodically during the course of the work.

2. Qualifications

a. Class I and Class II Competent Person

- If you are designated a competent person for any Class I and Class II asbestos work, you must demonstrate current training meeting the requirements of EPA's Model Accreditation Plan (40 CFR 763, Subpart E, Appendix C) for supervisor, or its equivalent. This 5-day training course includes specific lecture topics, demonstrations, at least 14 hours of hands-on training, individual respirator fit testing, a course review, and a written test. Individuals who possess a current license issued under 25 TAC 295.46 for an Asbestos Abatement Supervisor have demonstrated they have met this requirement.
- Currency in this training expires exactly 12 months after the date of the initial or last refresher training; you may not perform as a Class I or Class II competent person until you have again received refresher training in this topic. If you have let more than 24 months lapse since the date of your last training, you must retake the 5-day initial training.

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b. Class III and Class IV Competent Person

- As a Competent Person for any Class III and Class IV asbestos work, you must demonstrate current training meeting the requirements of 40 CFR 763.92(a)(2) for custodial and maintenance staff. This training consists of at least 16 hours in specific topics, demonstrations, and hands-on training in the use of respiratory protection, other personal protective measures, and good work practices.
- As a Competent Person for Class III and Class IV work, you must also complete the 6-hour "Class III Asbestos Operations and Maintenance (O&M) (Restricted)" course offered at the JSC Safety Learning Center. This training is required to familiarize you with JSC policies and procedures as well as the conditions to be found at JSC.
- As a Competent Person for Class III and Class IV work, you must take the 2-hour "Class III Competent Person (Refresher)" course offered periodically at the JSC Safety Learning Center to remain current as a Class III/IV Competent Person. Taking this refresher course will also fulfill the refresher training requirements for the Class III Asbestos O&M (Restricted) course.
- Currency in this training expires 12 months after the date of your initial or last refresher training. If you can demonstrate you're scheduled for refresher training at the Safety Learning Center, you may continue to perform as a Class III or Class IV Competent Person on site at JSC until receiving the scheduled refresher training, but no longer than 14 months after the date of your last competent person refresher training. If you let more than 24 months lapse since the date of your last training, you must retake the 16-hour initial training.

c. You must have sufficient authority to take prompt corrective measures to ensure compliance with OSHA, EPA, TDH, and TCEQ regulatory requirements and guidelines.

d. You must be qualified to use respiratory protection (see requirements in Chapter 12.5).

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Chapter 12.8
Asbestos Worker and Regulated Area Air Sampling

1. Air sampling objectives

a. Air sampling for airborne asbestos]s is done to meet a variety of needs. These include ensuring the protection of employees outside any asbestos-regulated work area, ensuring asbestos-regulated-area barriers maintain their integrity, documenting the exposures to asbestos workers, and meeting OSHA compliance requirements. These needs are met through a combination of the following types of air sampling: worker exposure, random area, work area, indoor ambient air, barrier, and clearance air sampling.

b. Perform air sampling and analysis at various stages of asbestos-related activities specified in Part 12 to establish and document that procedures limit the spread of airborne ACM. Collect and evaluate all samples taken to meet the requirements of this chapter following the procedures specified in the OSHA Reference Method, 29 CFR 1926.1101, Appendix A, NIOSH Method 7400, or NIOSH Method 7402. Conduct all sampling under the supervision of a Certified Industrial Hygienist or by an individual who has completed the air monitoring technician training requirements of 25 TAC 295.64(g) and who meets the requirements for licensing to perform air monitoring under 25 TAC 295.

2. Air sampling plans

a. Every ACM abatement or removal project requires an objective review of the air sampling requirements. Project planners must determine the number and type of samples during the preparation of the work plan in consultation with the OHS Contractor (ext 3-6726). Each project may include the following air sampling requirements:

- Pre-job air sampling (background ambient air)
- During-the-job air sampling (worker/personal, work area, barrier integrity)
- Post-job air sampling (clearance)

b. Air sampling will be conducted for any Class I and Class II asbestos abatement activity using critical barriers and may be conducted for other asbestos-related activities listed in Part 12. The OHS Contractor will establish and conduct random or periodic sampling of routine Class III and Class IV asbestos work activities. The OHS Contractor is responsible for determining the effectiveness of control procedures identified in Part 12 by periodically air sampling work activities.

3. Worker exposure air sampling

a. Determine employee exposures from breathing zone air samples that are representative of the 8-hour TWA as well as the 30-minute TWA short-term excursion limit of each

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employee. Take breathing zone samples by attaching a sample collection device, generally a filter cassette, to the front collar of the worker's uniform.

b. If you are a contractor performing Asbestos Class I and Class II work, you will conduct worker exposure air sampling on your employees as required by 29 CFR 1926.1101. Provide copies of your sampling results to the OHS Contractor, who may also perform air sampling on contractor employees as a “spot check” of the contractor’s procedures. The OHS Contractor will provide copies of their results to the asbestos work contractor.

c. The OHS Contractor has a database of worker exposure air sampling for most of the Class III and Class IV asbestos activities. This database indicates that employees performing activities following the Class III and Class IV procedures in Part 12 must have exposures less than the OSHA PEL of 0.1 f/cc of air. Any on-site or off-site contractors performing asbestos-related work may use the OHS database to meet the “initial exposure assessment” and “negative exposure assessment” requirements of either 29 CFR 1910.1001 or 29 CFR 1926.1101. The OHS Contractor will periodically perform additional worker air sampling of Class III and Class IV activities to maintain and update their database, and will provide copies of results to the employer or supervisor of the monitored employee. If you area an on-site contractor performing Class III or Class IV work on JSC, you’re encouraged to perform your own personnel air sampling. If you do so, you must provide copies of your sampling results to the OHS Contractor. If you’re an off-site contractor performing Class III asbestos-related work on JSC, conduct worker exposure air sampling on your employees as required by 29 CFR 1926.1101, and provide copies of sampling results to the OHS Contractor.

d. Notify the employee(s) affected by air sampling results individually, as outlined in the current applicable OSHA regulation. Maintain a copy of each individual's air sampling results in accordance with OSHA Record Keeping Requirements (29 CFR 1910.20, 29 CFR 1910.1001, 29 CFR 1926.1101).

4. Background and other ambient air sampling

a. The OHS Contractor will conduct background ambient air sampling in buildings prior to any Class I or Class II asbestos abatement project where critical barriers and enclosures are to be erected. The OHS Contractor will conduct background ambient air sampling prior to any other project which may disturb spray-on asbestos insulation and has the potential to affect any building’s ambient conditions; e.g., roofing projects.

b. The OHS Contractor will conduct building ambient air sampling during any project which may disturb spray-on asbestos insulation and has the potential to affect any building’s ambient conditions; e.g., roofing projects. This sampling is in addition to the routine building ambient sampling discussed in Chapter 3, paragraph 6, of Part 12. Ambient air sampling results will be compared to the background samples and to the EPA “safe occupancy” level of 0.01

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5. Regulated area barrier/containment integrity air sampling

a. The OHS Contractor will conduct perimeter area surveillance during all Class I and Class II asbestos abatement projects as required by 29 CFR 1926.1101. The purpose of this surveillance is to ensure no asbestos exposures occur in adjacent areas and that any critical barriers do not leak.

b. The OHS Contractor may conduct periodic perimeter area surveillance of routine Class III and Class IV asbestos work to ensure established procedures control asbestos releases.

c. All barrier air sampling results will be compared to the EPA "safe occupancy" level of 0.01 f/cc.

6. Work Area Air sampling

The OHS Contractor may perform air sampling inside regulated areas where critical barriers are not used or may perform air sampling adjacent to glovebag abatement/removal activities. The purpose of this sampling is to "spot check" procedures and to ensure asbestos is being controlled.

7. Clearance air sampling

a. The JSC Occupational Health Officer, or his designee(s), and the OHS Contractor are the only parties on JSC who may declare an area safe for re-occupancy when clearance air sampling is conducted on asbestos abatement, repair, or emergency response activities. The decision will be based on the results of visual inspection and clearance air sampling.

b. The OHS Contractor will perform clearance air sampling on all Class I and Class II asbestos abatement activities to ensure the area is safe for re-occupancy. If enclosures or critical barriers are erected, then the OHS Contractor may use aggressive sampling techniques to collect clearance air sampling air samples before the enclosures/critical barriers are disassembled. The enclosures or critical barriers will not be disassembled until the JSC Occupational Health Officer or the OHS Contractor determines the area is safe for re-occupancy and gives approval to disassemble the enclosures or critical barriers.

c. The OHS Contractor may perform clearance sampling on Class III asbestos activities. The decision to perform this sampling is dependent upon the specific task and the professional judgment of the industrial hygienist regarding the potential health hazard to other building occupants. This sampling may also be performed to "spot check" procedures and to ensure asbestos is being controlled. If clearance air sampling is conducted, the regulated area will not be disassembled, nor will demarcation removed, until the JSC Occupational Health Officer or the OHS Contractor determines the area is safe for re-occupancy.

d. The OHS Contractor may perform clearance air sampling on emergency response asbestos cleanup activities. The decision to perform this sampling will depend on the amount of asbestos material spilled, whether a room or area was closed off, and the

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professional judgment of the industrial hygienist regarding the potential health hazard to other building occupants. If clearance air sampling is conducted for emergency response activities, the regulated area will not be disassembled, nor will demarcation removed, until the JSC Occupational Health Officer or the OHS Contractor determines the area is safe for re-occupancy.

e. All clearance air sampling results will be compared against the EPA “safe occupancy” level of 0.01 f/cc.

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Chapter 12.9
Regulated Areas and Site Preparation

1. Introduction

This chapter outlines the asbestos work requirements for regulated areas and site preparation. Organizations and contractors performing these tasks for asbestos work must follow industry accepted practices and procedures and comply with applicable OSHA and EPA regulations.

2. Regulated areas

a. Conduct all Class I, Class II, Class III, and Class IV Emergency Response asbestos-related work at JSC within a regulated area. The methods and systems for establishing a regulated area are described in paragraph 3 below.

The OSHA definition (29 CFR 1926.1101) of a regulated area is:

> ***An area established to demarcate areas where asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos, exceed or there is a reasonable possibility they may exceed the permissible exposure limit.***

b. Demarcation. Mark the regulated area in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, demarcate the regulated area with the barriers or enclosures. Provide signs and display as required by Chapter 12.10 of this Handbook.

c. Access. Limit access to regulated areas to people who are authorized and trained to perform asbestos work and who are wearing protective clothing and equipment. Establish a list of authorized personnel prior to job start and post in the unrestricted clean area of the job site. The job site superintendent and/or on-site competent person will have control of site access.

d. Respirators. Supply all persons entering a regulated area, where employees are required to wear respirators, with a respirator selected in accordance with OSHA standards 29 CFR 1926.1101(h) and 29 CFR 1910.134.

e. Prohibited activities. People inside a regulated area will not eat, drink, smoke, chew tobacco or gum, or apply cosmetics.

3. Methods and systems used to establish a regulated area

a. Every regulated area used for asbestos-related activities specified in Part 12 will use at least one of the methods or systems described below to prevent visible emissions from the work site and to prevent the escape of airborne asbestos fibers into the general environment. Any method used shall meet the engineering control requirements of 29

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CFR 1926.1101(g). Submit a work plan for any task requiring a large-scale enclosure to the APM per the notification requirements of Part 12.

b. The methods and systems, for Part 12 and the job performance requirements, are classified into the following four systems:

- Barrier with floor covering
- Glovebag
- Small enclosure or mini-enclosure
- Large enclosure

c. You may use barriers with no enclosure if there is little risk of spreading asbestos into the general area or if there is minimal risk to individuals who may pass into the work area unknowingly. Barriers are used when the primary concern is to keep building occupants or other employees from inadvertently getting into the work area where there might be a localized risk of asbestos exposure. The barriers may be any marker (i.e., signs, tapes, barricades) that visually identifies the area and warns employees or visitors to stay out of the work area. These systems are used with polyethylene floor coverings to prevent localized contamination.

d. Use glovebags when the work is small enough to be completed in the bag. These are usually restricted for use on pipes, joints, and valves, but may be used for spot abatement of small amounts of spray applied asbestos insulation. NEVER PERFORM GLOVEBAG REMOVAL ON HOT PIPES! This may cause the bag or gloves to melt over the workers' hands and arms. Devise special procedures if glovebags are used on hot pipes.

e. Use small enclosures when the work area is larger than what a glovebag will accommodate or is needed to provide more protection than a barrier system. The small enclosure is generally limited in size and used for small-scale, short-duration activities. A small enclosure may not involve the use of negative pressure systems, but will have an entrance chamber or multiple entry flaps. Small enclosures rely on HEPA-filtered vacuums and wet methods to control fiber concentrations. You may use small enclosures for any repair or maintenance activity that may disturb ACM and release airborne asbestos fibers.

f. Use large enclosures for asbestos-related projects that a small enclosure cannot accommodate. Large enclosures will usually include the use of a negative-pressure air filtration system to isolate the work area from the general building area that is not involved in the asbestos-related activity. The large enclosure may involve the use of ancillary contamination controls (e.g., showers, change/clean rooms, waste load out chambers, decontamination rooms, contaminated equipment rooms, etc.). Large enclosures for Class I and Class II asbestos work must pass inspection by the OHS Contractor before the asbestos-related activities start.

g. The OSHA regulations in 29 CFR 1926.1101 use the term “critical barrier.” A critical barrier consists of “one or more layers of plastic sealed over all openings into a work area

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or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a work area from migrating to an adjacent area." Critical barriers are most often used on doorways, windows, and ventilation system openings. They are required for Class I and II asbestos work, but may also be used on Class III work.

h. Table 12.9-1 below indicates the regulated area methods and systems that are appropriate for each Class of asbestos work. Please note that containment for Emergency Response could involve any of the four methods and depends upon the judgment of the responders. Essentially, an emergency response to a major fiber release episode could involve procedures meeting the requirement of Class I or Class II asbestos abatement/removal.

4. Site preparation

Prior to any asbestos-related activity, prepare the work site for follow-on actions. Take the following steps to define the regulated area and limit contamination of furniture and equipment.

a. Post warning signs and barriers. Place warning signs and temporary barriers, if an enclosure is not required, at all entrances and approaches to the regulated area. Warning signs will meet the requirements specified in Chapter 12.10.

b. Cleaning and removal of furnishings and equipment. Remove all non-stationary items that can feasibly be taken from the work area to prevent damage or contamination of the items.

- Before storing these items outside the work area, clean them of visible debris with a HEPA-filtered vacuum and/or wet wipe them to remove any asbestos-containing dust.
- Thoroughly pre-clean the designated work area before beginning containment construction. If carpets in the work area remain, vacuum them with a HEPA-filtered vacuum and then cover them with 6-mil polyethylene sheeting. You may use plywood between the layers of polyethylene to help protect the carpets from damage and maintain the containment integrity.

c. Sealing of stationary items.

- If it is not feasible to remove items from the work area, completely cover them with a minimum of one layer of 6-mil polyethylene. For Class I and Class II activities, seal these covers and secure them with duct tape.
- If stationary equipment such as electrical transformers, refrigeration equipment, or other electrical heat-generating equipment must continue to operate during the asbestos-related activity, make special provisions to prevent creating a fire hazard. Such items must have constant ambient airflow or they may overheat. In these situations, provide a separate framework to support the polyethylene sheeting, with provision for separate air intake and exhaust outside the defined work area.

Table 12.9-1

Regulated Area Methods/Systems Used With Asbestos Work Classes

Verify this is the correct version before you use it by checking the on-line version.

	Asbestos Class			
Methods/Systems:	I	II	III	IV*
Barrier/floor covering			X	X
Glovebag			X	X
Small enclosure	X	X	X	X
Large enclosure	X	X	X	X
Critical barriers	X	X		X
* Only required for Asbestos Class IV emergency response				

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Chapter 12.10
Signs, Warnings, and Communications of Hazards

1. Requirement

Communicate the hazards of working with or around asbestos materials to employees and building occupants by signs, labels, and employee information and training. Information in this chapter is based on the OSHA requirements found in 29 CFR 1926.1101.

2. Signs and labels for regulated areas and asbestos waste

a. Post signs as required in this section and 29 CFR 1926.1101, at a distance far enough away from the immediate regulated area to permit an employee to read the sign and take the necessary protective measures to avoid exposure.

b. Additional signs may need to be posted as directed by the competent person after construction of workplace enclosures or during asbestos-related activities.

c. All regulated areas for Class I, II, and III work and for Class IV Emergency Response will be barricaded by ropes, tapes, or enclosures and will have signs that bear the following legend:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING ARE

REQUIRED IN THIS AREA

The purpose of this sign is to alert employees and building occupants of the existence of the regulated area, minimize the number of people in the area by alerting them to the requirement that they must have authorization to enter and that they must take appropriate protective measures before and during entry.

d. Label all asbestos products and containers of asbestos products with the following information:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

AVOID BREATHING ASBESTOS

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e. Signs for waste containers are discussed in Chapter 12.13. All signs and labels will be legible, in English, and prominently displayed on the container. You may use commercially available signs and labels if they meet the above requirements.

f. No label is required in those instances where:

- Asbestos fibers have been modified by a bonding agent, coating or binder, or other material that prevents exposure above the action level (NOTE: This exemption is not applicable to removal operations.).
- Asbestos is present in a product concentration at less than 1%.

3. Information and training for asbestos workers

All employees who may be exposed to airborne asbestos concentrations in the course of their daily work assignments, or in excess of the PEL, will receive training in accordance with the provisions of Chapter 12.5 of this Hanbook, and 29 CFR 1926.1101, prior to, or at the time of, initial assignment.

4. Communication to employees

a. Each NASA or contractor organization that undertakes asbestos-related work must inform facility occupants and employees of the nature of their work, and the requirements pertaining to regulated areas, or any other restrictions.

b. This requirement can be met by notifying and working with the appropriate facility manager and the work area supervisor(s), manager(s), or the division chief(s) responsible for the area(s) within the affected facility. Never start or continue an asbestos-related activity if affected building occupants have not been notified.

5. Awareness training for building occupants

Cover general awareness training about the presence of asbestos in buildings and the “dos and don’ts” concerning regulated areas and suspected asbestos debris in the annual hazard communication training required of all site employees.

6. Labeling of mechanical rooms and conference rooms with exposed asbestos-containing materials

a. Post the following sign on the exterior door(s) of mechanical rooms with exposed SAI:

Danger

Verify this is the correct version before you use it by checking the on-line version.

Authorized Personnel Only

Asbestos Insulation is Present in This Area

Cancer and Lung Disease Hazard

Avoid Creating Dust

Work Practices which disturb asbestos materials must be in accordance with

29 CFR 1926.1101 and Part 12, "Asbestos Control Requirements," of JPG 1700.1.

For More Information Contact the JSC Asbestos Program Manager

Extension 33120

b. Place danger labels in English and Spanish near the ceiling in areas and rooms with exposed acoustical or decorative SAI. These labels will read:

Ceiling Materials Contain Asbestos

DO NOT DISTURB - AVOID CREATING DUST

DANGER!

Cancer and Lung Disease Hazard

ANY activity disturbing ASBESTOS

must comply with OSHA

7. Labeling of buildings with asbestos-containing materials

In buildings at JSC that have ACM, post the following sign on the exterior doors.

Notice

This Building contains Materials Which Contain Asbestos Fibers.

Periodic air monitoring by JSC has shown that airborne fiber concentrations in this building satisfy OSHA and EPA standards.

Asbestos Fibers May be Present in the Following Building Materials

Sprayed Applied Insulation

Thermal System Insulation

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Chapter 12.11
Wet Removal of Materials

1. Requirement

a. Remove asbestos materials at JSC only using wet removal procedures. Other techniques require specific prior approval by the APM. Wet removal procedures require wetting the material before removal begins and keeping it wet as it is removed and while it is being bagged. These procedures reduce the generation of airborne fibers during removal and lessen the effort required to remove the material. Wet removal also increases the settling rate of released fibers and prevents the re-suspension of fibers when the ACM is bagged.

b. Do not use dry removal at JSC without specific authorization from the JSC APM. You must make a written request to the JSC APM to use dry removal techniques. Justify why dry techniques must be used and include methods to protect workers and other building occupants.

c. Dry removal methods require prior TDH approval in accordance with 40 CFR, Part 61.145. If such methods are proposed, you must give sufficient lead-time to obtain all necessary approvals.

d. Following removal, abated areas must have an encapsulant applied to ensure against fiber release, and to bond any edges that are not within the scope of the task. Encapsulants, either penetrating or bridging, must be approved by the EPA or OSHA/NIOSH.

2. Amended water

Adding a wetting agent to the water further enhances the positive effects of wet removal. The wetting agent, a combination of chemicals, aids in the penetration of ACM and increases the probability of individual fiber wetting.

3. Wetting procedures

The first step in the removal process is to thoroughly wet the ACM with a low-pressure spray of amended water. Lightly spray the material with amended water to initially wet the surface, and then spray to saturate it. High-pressure water may cause elevated airborne fiber concentrations; therefore, low-pressure systems must be used. After spraying with amended water, wait before beginning removal to allow the water to thoroughly penetrate the materials.

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Chapter 12.12
Cleanup, Clearance Inspection/Air Sampling, and Release

1. General

a. Determining the successful performance of individual asbestos-related jobs and projects is very important. Specific work practices and surveillance during the project are essential to the accomplishment of a successful job. After workers have completed all asbestos work, the regulated area must be cleaned to remove any remaining residue that may have been left as a result of asbestos-related activities. The regulated asbestos work area must pass a clearance inspection, and, depending on the Class of asbestos work, clearance air sampling may be performed. Clearance inspection and air sampling determine the effectiveness of work practices and surveillance. Do not remove work area controls (e.g., HEPA, barriers, enclosures, etc.) until the area is satisfactorily cleaned and the area passes the required level of inspection and air sampling. Critical barriers, where used, will be the last control removed. When the regulated area passes the clearance inspection and air sampling, where required, release the area for return to other activities. Where clearance air sampling is required or used, only the OHS Contractor, or his/her designee, will release the regulated area to return to normal activities.

b. Each of the steps for cleaning, clearance inspecting and air sampling, and final activities after release are outlined in paragraphs 2 through 7 below. These outlines list steps for large-scale work enclosures. Tailor them for smaller-scale activities. These outlines are not meant to provide a detailed "how-to" for each activity. Table 12.12-1 shows the suggested steps for each type of containment systems discussed in Chapter 12.9.

c. Individuals and organizations performing any Class of asbestos work are expected to follow industry-accepted practices and standards, based on OSHA and EPA regulations and procedures, for cleaning the regulated area(s).

2. Gross cleanup

Perform the following steps, in the order shown, to conduct a gross cleanup of the regulated area. The negative-pressure air filtration unit, if used, remains in place and operates for the remainder of the cleanup operation, except as noted below.

a. <u>Remove Gross Contamination From Walls.</u>

- The first cleaning task is the removal of any gross contamination from the walls. Do this by using HEPA vacuuming, for non-porous surfaces, and using amended water to wet wipe walls.
- For enclosures with two or more layers of polyethylene on the walls, the top-most contaminated sheet can be removed at this point instead of being cleaned. Lightly mist the contaminated sheet, and gently detach it and fold it inward to minimize

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airborne fiber release. Remove any visual debris behind the first layer of polyethylene with a HEPA-filtered vacuum and/or by wet wiping.

- The last polyethylene layer must be free of all visible debris and residue to pass visual inspection and for subsequent clearance sampling. It is strongly recommended that at least two polyethylene layers be included in large-scale enclosures to minimize subsequent cleanup time.

b. Remove Gross Contamination From Work Area Equipment**.** Next, remove gross contamination from the exteriors of the equipment inside the work area. Special attention must be given to scaffolds and man-lifts. Clean using a combination of HEPA vacuuming and/or wet wiping. Change the filters that need replacement on negative-pressure air filtration units.

c. Remove Gross Contamination From Floor Covering.

- Any plastic sheeting that has been used to cover the floor area must be HEPA vacuumed and wet mopped to remove any visible contamination.
- At this point, for enclosures with two or more layers of polyethylene on the floors, remove the top-most contaminated sheet instead of cleaning it. Lightly mist the contaminated sheet and gently detach it and fold it inward to minimize airborne fiber release. Remove any visual debris under the first layer of polyethylene with a HEPA-filtered vacuum and/or by wet mopping.

3. Perform initial visual inspection

a. Inspect all surfaces for evidence of contamination. Inspectors will use the American Society of Testing and Materials (ASTM), Standard Practice for Visual Inspection of Asbestos Abatement Projects, ASTM E-1368-00 (or most current version). The basic standard of cleanliness is “no visible debris.”

b. For large-scale Class I and II asbestos abatement work, the OHS Contractor will conduct this inspection. The activity competent person may perform this inspection for small-scale, Class I and Class II spot removals/abatements and for Class III asbestos work. Re-clean areas not passing inspection as necessary until they meet ASTM E-1368-00 standards.

4. Final cleanup

Perform the following steps, in the order shown, to conduct the final cleanup of the regulated area.

a. Perform Final Wipe Down of Equipment/Remove From Work Area. After the area passes the initial visual inspection, thoroughly clean all equipment. Wet wipe tools such as scrapers, brooms, utility knives, and brushes and seal in plastic bags for the next job or discard as asbestos-contaminated waste. Remove equipment not needed for completion of the non-asbestos portions of the job from the work area.

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b. Clean Substrate and Apply Sealants. After cleaning, spray all surface areas in the containment area with an encapsulant or sealant to fix any remaining fibers to the surfaces. Wait 12-24 hours before performing the next step.

c. Remove Polyethylene From Walls. Wait 12-24 hours. This period allows the airborne materials to settle. The polyethylene draped over lighting fixtures and covering the interior walls of the work area can be misted and carefully taken down, folded inward to form a bundle, and packaged for disposal. All critical barriers on doors, windows, and vents remain in place.

d. HEPA Vacuum Walls. HEPA vacuum all uncovered walls and hard to reach places. Pay attention to window and door trim ledges, shelving, etc.

e. Remove Floor Covering/Remove Carpet. Mist and carefully fold polyethylene floor covering. If carpet is to be removed, cut/fold/remove carpet and wrap in polyethylene.

f. HEPA Vacuum Floor. After floor area is uncovered, HEPA vacuum the floor with special emphasis on corners and crevices.

g. Wet Wipe Walls and Wet Mop Floors/HEPA Vacuum Carpet. Next, wet wipe the walls and mop the floors. If a carpet remains in the work area, thoroughly vacuum it with a HEPA-filtered unit. Treat wastewater from the wet wiping and mopping operations as asbestos-containing water and dump it in the shower drain or place it in a barrel for disposal.

h. Wait 12-24 Hours and Repeat Paragraph 4.g. The next day, repeat the wet wiping of the walls and wet mopping of the floors. If carpet remains, HEPA vacuum the carpet again and steam clean it. Let area dry.

5. Perform final visual inspection

a. Inspect all surfaces for evidence of contamination. Give special attention to pipes, beams, and irregular surfaces that may have corners and areas that are difficult to reach. Surfaces behind obstructions (for example, pipes or ducts) are suspect areas and must be checked. Re-clean as necessary until area passes a visual inspection.

b. Inspectors will use the ASTM Standard Practice for Visual Inspection of Asbestos Abatement Projects, ASTM E-1368-00 (or most current version). The basic standard of cleanliness is “no visible debris.”

c. For large-scale Class I and II asbestos abatement work, the OHS Contractor will conduct this inspection. The activity competent person may perform this inspection for small-scale, Class I and Class II spot removals/abatements and for Class III asbestos work.

6. Clearance air sampling

a. The OHS Contractor will conduct clearance air sampling when required by the Class and type of asbestos work. The air sampling determines the airborne concentration of asbestos fibers remaining in the work area. Visual inspection cannot determine the level

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of residual asbestos fibers in the air. Thus air sampling must be used with visual inspection to be sure the work site is clean. Do not conduct clearance air sampling until the work site has passed a thorough visual inspection. Clearance air sampling is required for any major abatement activity for which a large-scale enclosure was erected, or when major fiber release occurs from an ACM spill and the APM and/or the OHS Contractor declared an emergency cleanup. Where small-scale enclosures are required, the OHS Contractor will determine to need for clearance monitoring and will conduct this monitoring before the enclosure is taken down. Class III asbestos work does not normally require clearance air sampling. Use aggressive air sampling techniques where warranted. See additional information in Chapter 12.8 of this Handbook.

b. The clearance air sampling results must be less than the EPA "safe occupancy" level, 0.01 f/cc of air. When sampling results meet this level in the regulated area, the area may be released for re-occupancy. If the area does not pass the clearance level, then re-clean the area, and repeat clearance air sampling. Repeat this cycle until the air sampling results pass the clearance level.

c. The JSC Occupational Health Officer, or his designee(s), and the OHS Contractor are the only parties on JSC who may declare an area safe for re-occupancy when clearance monitoring is conducted on asbestos abatement, repair, or emergency response activities. The decision will be based on the results of visual inspection and clearance monitoring. OHS will notify the job superintendent, the area supervisor, and Facility Manager as appropriate.

7. Reestablish the area

Reestablishment of the work area will only occur following completion of all asbestos-related activities in conformance with these procedures, after clearance by visual inspection and air sampling, if required, and after the area has been released.

a. Uncover any fixed items isolated before the start of activities and dispose of the plastic sheeting as asbestos-contaminated waste.

b. Clean and disassemble the negative air filtration unit and the decontamination facility, if installed. Dispose of plastic sheeting as asbestos-contaminated waste.

c. Remove any remaining critical barriers, if installed, from doors, windows, vents, etc.

d. Reestablish any HVAC/electrical systems locked out at start of activities, if needed.

e. Complete all non-asbestos-related activities involving renovation or repair.

f. Replace all items or equipment that were removed from the area.

g. Call the Work Control Center to dispose of asbestos waste (see Chapter 12.13).

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Table 12.12-1

Cleaning, Inspection and Air Sampling Steps Required by Type of Regulated Area

	Type of Regulated Area			
Procedural Steps	Large Enclosure	Small or Mini-Enclosure	Barrier & Floor Covering	Glovebag
1. Remove gross contamination	X	X	X	X
2. Remove gross contamination from walls	X	X		
3. Remove gross contamination from equipment	X			
4. Remove gross contamination from floor	X	X		
5. Perform initial visual inspection	X	X	X	X
6. Final clean of equipment	X	X	X	X
7. Clean substrate/apply encapsulant	X	X	X	X
8. Remove polyethylene walls covering	X	X		
9. HEPA vacuum walls	X	X		
10. Remove polyethylene floor covering and carpeting	X	X	X	X
11. HEPA vacuum floor	X	X	X	
12. Wet wipe walls/mop floors/HEPA vacuum carpeting	X	X		
13. Repeat - wet wipe walls/wet mop floors/ and HEPA vacuum and steam clean carpeting	X	X		
14. Final visual inspection	X	X	X	X
15. Perform clearance air sampling	X	A/R	A/R	
16. Clean and disassemble air filtration and decontamination units.	X	A/R		
17. Remove critical barriers	X	X	X	
18. Reestablish normal work area	X	X	X	X
19. Call work control center to remove asbestos waste	X	X	X	X

A/R = ***A***s ***R***equired by procedure, OHS Contractor, or industry accepted practices/procedures

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Chapter 12.13
Waste Disposal

1. Introduction

This chapter addresses the handling, packaging, labeling, and disposal of all ACM and asbestos-contaminated waste generated on site. The ACM or asbestos-contaminated waste generated by JSC activities are disposed of in accordance with the Texas Administrative Code, Title 30 Environmental Quality, Part 1 Texas Commission on Environmental Quality (TCEQ), Chapter 330 Municipal Solid Waste, Subchapter F Operational Standards for Solid Waste Land Disposal Sites, Rule 330.136 Disposal of Special Wastes (30 TAC 330.136).

2. Types of waste

In addition to the actual ACM that has been removed during an asbestos-related job or abatement, a number of other materials and items must be disposed of as asbestos-contaminated waste. These include, but are not limited to, the following:

a. Cloths and mops used during wet cleaning operations

b. Disposable coveralls, hoods, booties, and other clothing items worn in the work area, unless they can be completely decontaminated using a HEPA-filtered vacuum. Work shoes and boots may be cleaned at the end of the project but must be removed and stored in labeled plastic bags between projects.

c. Contaminated respirator filters and towels used by workers after showering

d. Ceiling tiles taken from suspended ceilings where friable asbestos was applied above the tile, unless properly decontaminated

e. All plastic sheeting used for critical barriers, air locks, decontamination chambers, and area containments.

f. Excess wastewater generated from wet wiping/mopping along with shower wastewater from the decontamination chamber. JSC permits wastewater to be discarded into a sanitary drain if it has first been filtered to no greater than a 5-micron particle size.

g. All air and water filters used in control devices

3. Waste handling procedures

a. Package all asbestos waste for disposal using one of the following sealed, leak tight, methods:

- Double bagged in at least 6-mil polyethylene bags
- Sealed in plastic lined, cardboard or metal or fiber drums, boxes, or containers meeting USDoT, TCEQ, and TDH specifications
- Double wrapped in at least 6 mil polyethylene sheeting (e.g.; for the removal of ACM-contaminated components or piping)

b. Wet asbestos waste, scrap, debris, bags, containers of asbestos-contaminated equipment, clothing, vacuum cleaner bags, filters, etc., consigned for disposal with amended water

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until it is sufficiently wet and to prevent emission of airborne fibers if the container were to break open.

c. When waste is double-bagged in 6-mil plastic bags, then use a HEPA-filtered vacuum to remove the excess air from the bags.

d. Do not fill bags so that the neck of the bag cannot be tightly gathered, folded over, and securely taped or so that the weight of the bag is too heavy for one person to carry.

e. Cut to size ACM containing sharp edges, including wire-lath ceilings, while adequately wet and packaged in a manner to prevent penetration/puncture of the container's seal.

f. Filter all asbestos-contaminated water collected from wetting, cleaning, or decontamination to no greater than a 5-micron particle size before disposal into the sanitary sewer.

g. If a separate waste-removal air lock system is installed in an enclosure, construct it like a decontamination chamber, using double 6-mil polyethylene plastic floors and walls and triple door flaps. Keep the entrance to this air lock tightly sealed until the air lock is to be used for the transfer of waste material.

4. Labeling

a. Label waste containers with the following:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

b. Bags may be preprinted or separate labels affixed to the bags. In all instances, label bags before being filled with waste materials. Assume anything placed into an ACM labeled bag to be ACM or asbestos-contaminated waste and dispose of accordingly.

c. The generator of the asbestos waste will additionally mark all waste containers with the generator's name, organization, and removal location.

5. Disposal

a. Properly package and label waste asbestos materials generated by JSC organizations and support contractors and then dispose of them by calling the Work Control Center, extension 32038. Note the Work Control Number assigned by the Work Control Center on the Asbestos Work Permit.

b. Make special arrangements for Construction of Facilities and other large asbestos abatement projects, special arrangements for lined, roll-off containers to accumulate the packaged asbestos waste through the Work Control Center.

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Chapter 12.14
Emergency And Mishap Procedures

1. Introduction

The paragraphs below discuss planning for, reporting, and investigating emergencies, injuries, and mishaps that may happen during asbestos-related activities, and also discuss emergency response to asbestos fiber releases.

2. Requirement for emergency planning

a. Plan and conduct all asbestos-related activities will be so as to:

- Take all reasonable and proper actions to prevent or limit exposures and injury to personnel and damage to or loss of equipment and property.
- Report such occurrences to appropriate JSC offices in a timely manner and in compliance with Part 12.
- Conduct investigations of all mishaps to determine the actual or probable cause(s), take appropriate actions to avoid reoccurrence, and document and disseminate relevant information.

b. Generally, incidents involving fire or personal safety will use the procedures established by JSC's Emergency Preparedness Program and this Handbook.

c. Incidents involving an unexpected release or threatened release of asbestos, which do not involve personal injury, fire emergencies, or personal safety, will be considered an environmental release.

3. Non-enclosed work area

For asbestos-related activities specified in Part 12 that do not require the use of an enclosure, the existing procedures for reporting medical and fire emergencies and guidelines for general emergency action and planning in this Handbook are applicable.

4. Enclosed work area

a. For asbestos-related activities specified in Part 12 requiring an enclosure to control airborne asbestos fibers, the reporting procedures and general guidelines specified above are also applicable.

b. In the case of large-scale abatement tasks, emergency procedures will be in written form and provided with the work plan. Prominently post emergency procedures in the clean change area of the enclosure, with telephone numbers of emergency response personnel.

c. All employees required to be in the work area will read and sign these procedures prior to first entry to acknowledge understanding of the work site layout, location of emergency exits, and emergency procedures.

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d. If the integrity of the enclosure is breached at any time during the project, the work crew must immediately implement fiber control using a wetting agent, repair the breach with polyethylene sheeting and/or tape, and call OHS (extension 36726), the APM (extension 33120) and the Work Control Center (extension 32038).

5. Personal injury procedure

a. For non-life-threatening situations, employees injured or otherwise incapacitated will be decontaminated following normal procedures with assistance from fellow workers if necessary, before exiting the workplace to obtain medical treatment.

b. For life-threatening injury or illness, worker decontamination will take low priority. Measures necessary to stabilize the injured worker, removal from the work place, and medical treatment will take top priority. Inform emergency response personnel providing medical treatment or transportation of the existence of asbestos contamination on the injured or ill worker.

c. If the injured or ill worker is to be moved off JSC while wearing contaminated work clothing, a knowledgeable person from the work site will accompany the worker to provide information to the receiving medical unit, and assist in controlling the further spread of asbestos contamination outside the enclosed area.

6. Emergency reporting

Report a fire, medical, or other emergency associated with an asbestos-related activity specified in Part 12 by calling the JSC EOC at extension 33333 (281-483-3333) for JSC and SCTF and by calling extension 44444 (281-244-4444) at Ellington Field.

7. Mishap notification, investigation, reporting, and record keeping

The notification, investigation, reporting, and record keeping of mishaps that occur during asbestos-related activities specified in Part 12 will be in accordance with this Handbook and the record keeping requirements of all applicable OSHA regulations and standards.

8. Emergency response to fiber release for environmental cleanup

a. When ACM fiber releases (spills) are located, immediately evacuate personnel and seal off the exposed area. Contact OHS at extension 36726 and the Work Control Center at extension 32038 to expedite cleanup activities and to determine source and control measures.

b. Responding COSS Environmental Support and OHS personnel will determine control measures to be established. OHS will determine the need to perform clearance air sampling.

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c. COSS contractor personnel responding to a fiber release will not proceed with the cleanup until they ensure that OHS has been notified.

d. Activities for performing site cleanup and decontamination will be as outlined in JPR IV-4 (see Appendix 12B, Attachment 12G). The competent person for the cleanup will determine if the cleanup will be conducted under OSHA Class I, II, III, or IV asbestos work procedures.

e. If spills are small and COSS contractor personnel establish the regulated area, the COSS personnel will disestablish the area after final cleanup and inspection and will be responsible for removing barrier tape/warning signs. If OHS establishes the regulated area or decides that clearance air sampling is required, then OHS will disestablish the area after final cleanup and inspection and will be responsible for removing barrier tape/warning signs.

f. Communication with all affected parties in the affected area is very important. Therefore, the organization responsible establishing the regulated area will ensure that the Facility Manager and work area supervisor have been informed about the response activity, the cleanup process and clearance air sampling to be performed (if required), and the approximate duration of the cleanup. This notification may be verbal but must occur before the start of the cleanup. Ask the Facility Manager and work area supervisor to inform the occupants of the affected area. Additionally, inform occupants/employees in nearby areas about the cleanup activity and the expected duration.

g. The organization responsible establishing the regulated area and for removing the barrier tape and warning signs will provide courtesy notification to the EOC Security Dispatcher at the non-emergency extension 34658 at the start and completion of the cleanup. Additional notification to JSC Management will be made at the discretion of the responders.

h. The organization responsible for removing the barrier tape and warning signs will also be responsible for notifying the Facility Manager and work area supervisor that the area is clean and operations may return to normal. These notifications must be made in writing within two hours of the cleanup completion; e-mail notification is acceptable.

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Chapter 12.15
Job-Specific Performance Requirements - General Information

1. Introduction

a. Attachments 12A-12G, in Appendix 12B, of Part 12 contain individual JPRs for the most common jobs at JSC that potentially involve ACM. Table 12.15-1 below lists the activities by Class of asbestos work as defined in Chapter 12.4 of this Handbook. Beginning with the January 2004 revision, JPR numbers were revised to reflect the Class of asbestos work being performed. Table 12.15-1 provides the new JPR Number as established in Part 12 and lists the attachment from Appendix 12B that describes the performance requirements. Each description in the appendices provides sufficient information to determine which jobs fit within the procedure.

b. Following the job description in each attachment is a listing of minimum requirements for completing the described asbestos work. These listings may not be complete and trained asbestos workers are expected to perform all Classes of asbestos-related work using industry accepted work practices and controls. Work supervisors and competent persons will need to exercise discretion on some requirements; e.g., determining the size of containment system/enclosure for Class I asbestos work.

c. Table 12.15-1 also lists the minimum training requirements needed to perform each JPR. The training abbreviations shown in the table, and their meanings from Chapter 12.5, paragraph 3, are:

- 32-hour worker: training specified in 40 CFR 763, Subpart E, Appendix C, for all Class I work and Class II work involving critical barriers and negative pressure enclosures.
- 16-hr O&M: training specified in 29 CFR 1926.1101(k)(9)(v) and 40 CFR 763(a)(2) for Class III operations and maintenance work.
- JSC 6-hr: training for Restricted Class III Asbestos Operations and Maintenance Work as shown in Chapter 12.5, paragraph 3. This training does not allow workers to perform removal of any amount of ACM.
- 2-hr: Class IV awareness training required by 29 CFR 1926.1101(k)(9)(vi) and 40 CFR 763(a)(2) for housekeeping and custodial activities.

d. If you do not find the asbestos-related work in one of the listed procedures in Table 12.15-1 or Attachments 12A-12G, in Appendix 12B, the job will be defined by the Class of asbestos work as found in Chapter 12.4 of this Handbook or in 29 CFR 1926.1101.

e. Plan all asbestos-related work following the procedures in Chapter 12.1 and 12.2 of Part 12 of this Handbook.

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2. Exposure control program

a. The underlying assumptions behind the development of the exposure controls reflected in the JPRs are:

- All tasks involving potential asbestos exposure require some degree of control. Hence, the removal of even one ceiling tile in a building known to contain asbestos SAI is covered by Part 12. The degree of control is tailored to the potential of exposure to workers and to building occupants.
- When it is necessary to open an area of suspended ceiling in a building containing SAI, such that a total of 32 square feet or more (i.e., the 4th contiguous ceiling tile) is exposed, you must erect a small enclosure.
- Spot removals of less than one (1) contiguous square foot do not require the erection of a small enclosure, provided that safeguards such as wetting and catching the material close to the scrape and protection of underlying areas are taken and the total waste generated does not exceed the capacity of a standard asbestos waste bag.
- Spot removals between 1 and 3 contiguous square feet require the erection of a small enclosure, but do not require specific decontamination facilities such as showers. Place the enclosure under local negative pressure using a HEPA-filtered vacuum cleaner or negative-pressure systems as described within Part 12. Klean Kubes, or equivalent units, are commercially available for this purpose.
- Any job that requires the removal of 3 contiguous square feet or greater of asbestos from a surface (other than a pipe surface if glovebag procedures are used), or which has a sufficient number of small-scale spot removals such that the cumulative amount of insulation removed exceeds 35 cubic feet, 160 square feet, or 260 linear feet of pipe is, under this program, a major asbestos removal operation. Major removals require the submission of a work plan to the APM, which details how the enclosure, decontamination, monitoring, record keeping, and clearance requirements are to be satisfied.

b. The above assumptions represent JSC's best effort in interpreting the OSHA/EPA guidelines, which are based on specific fiber concentrations, and establishing a workable program for controlling asbestos exposure. The OHS Contractor will monitor various jobs to determine whether the degree of control described above provides adequate environmental and health protection. Therefore, the performance requirements may be revised. For example, it may be necessary to reduce the small enclosure criteria to below 32 square feet, if controls are inadequate.

3. Waivers to job performance requirements

a. Except for JPR III-13 (see Attachment 12F), no waivers to the JPR procedures in Appendix 12B, Attachments 12A-12G will be issued.

b. In buildings with SAI, raised computer floors and sub-floors may contain SAI debris from activities performed in the building before asbestos work was regulated at JSC. The

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entry into any computer floor or sub-floor, in a building containing SAI, is normally considered Class III asbestos work governed by JPR III-13. The JSC Occupational Health Officer, or his designee, may issue a waiver releasing workers from these Class III requirements under the following conditions:

- The area can be easily delineated above and below the raised flooring into "clean" and "dirty" sections. Normally, the delineation will be done by rooms defined by hard walls above the floor. The Occupational Health Officer, or his designee, may establish other delineation in special cases.
- Clean the area below the raised floor (as well as any equipment or cabling below the floor), the flooring support structure, and the flooring tiles using wet wiping/mopping methods and HEPA vacuuming. Clean any items removed from the sub-floor area by wet wiping and/or HEPA vacuuming as they are removed from the floor. Clean following the procedures shown in JPR III-13. Workers performing these activities will wear protective clothing and respiratory protection.
- The JSC Occupational Health Officer, or his designee, will perform a visual inspection of the sub-floor area after cleaning. The basic standard of cleanliness for the sub-floor area is no visible dust or debris.
- When the JSC Occupational Health Officer, or his designee, is satisfied about the cleanliness of the sub-floor area, he/she will issue a JPR III-13 Waiver for the specific area cleaned. Post the waivers on the JSC Total Health Home page and file them with the OHS Contractor. The waivers, once issued, do not expire.
- Personnel entering an area with a JPR III-13 Waiver are encouraged to use a HEPA vacuum for periodic housekeeping under the sub-floor.

c. Even though a waiver to JPR III-13 procedures may be issued, there may be other installed suspect ACM beneath the sub-floor. These materials may include, but are not limited to, cementitious pipe chase materials, transite board, sub-floor stanchion mastic, firewalls, floor tiles and mastic, etc. If any sub-floor activities are planned, which may disturb these materials the asbestos content must be determined, or presumed, and other appropriate JPR requirements followed.

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Table 12.15-1 **Job Performance Requirements Listing**				
Asbestos Work Class	**Task Title**	**JPR No.**	**Reference App. 12B Atch No.**	**Min. Req'd Training**
Class I				
	Large scale removal of structural or ceiling insulation (SAI or acoustical) (>3 sq ft contiguous or >160 sq ft cumulative)	I-1	12A	32-hr worker
	Small scale removal of structural or ceiling insulation (SAI or acoustical) (1 to 3 sq ft contiguous and <160 sq ft cumulative)	I-2	12A	32-hr worker
	Spot removal of structural or ceiling insulation (SAI or acoustical) (<1 sq ft contiguous and <160 sq cumulative, or waste exceeds capacity of standard waste bag)	I-3	12A	32-hr worker
	Large scale removal of piping and vessel insulation (Piping: >3 ft continuous or > 260 ft cumulative) (Vessel: >3 sq ft contiguous or >160 sq ft cumulative or >35 cu ft cumulative) (Glovebag not technically feasible)	I-4	12A	32-hr worker
	Small scale removal of piping and vessel insulation (Piping: <3 ft continuous and < 260 ft cumulative) (Vessel: <3 sq ft contiguous and <160 sq ft cumulative or <35 cu ft cumulative) (Glovebag not technically feasible)	I-5	12A	32-hr worker
Class II				
	Removal of or modification to wallboard, plaster, transite, ceiling tiles, flooring, roofing, or siding containing asbestos (Friable material; airborne concentrations ≥0.01 f/cc)	II-1	12B	32-hr worker
	Removal of or modification to wallboard, plaster, transite, ceiling tiles, flooring, roofing, or siding containing asbestos (Airborne concentrations <0.01 f/cc)	II-2	12B	32-hr worker

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Table 12.15-1 (continued)

Asbestos Work Class	Task Title	JPR No.	Reference App. 12B Atch No.	Min. Req'd Training
Class III				
Class III Glovebag	Repair steam, chilled water, hot waterlines, and valves with asbestos-containing material	III-1	12C	16-hr O&M
Class III Barrier & Floor	Modification to structural steel members in close proximity to SAI (barrier and floor covering <32 sq ft)	III-2	12D	16-hr O&M
Covering	Removal of wall partitions or plaster ceilings in close proximity to ACM (barrier and floor covering <32 sq ft)	III-3	12D	16-hr O&M
	Removing/replacing of ACM or non-ACM ceiling tile(s) below ceiling plenum in buildings with spray-applied asbestos insulation/fireproofing (SAI) (ceiling opening <32 sq ft)	III-4	12D	JSC 6-hr
	Removing ACM ceiling tiles in Buildings without SAI (waste limited to one standard waste bag)(ceiling opening of <32 sq ft)	III-5	12D	JSC 6-hr
	Any activity in plenum above suspended ceiling tiles in buildings with spray-applied asbestos insulation or fireproofing (SAI) (ceiling opening <32 sq ft)	III-6	12D	JSC 6-hr
	Spot removal of SAI (<1 sq ft contiguous and <160 sq cumulative) (waste limited to one standard waste bag)	III-7	12D	16-hr O&M
Class III Enclosure	Modification to structural steel members in close proximity to SAI (control zone ≥ 32 sq ft)	III-8	12E	16-hr O&M
	Removal of wall partitions or plaster ceilings in close proximity to ACM (control zone ≥ 32 sq ft)	III-9	12E	16-hr O&M
	Removing/replacing of non-ACM ceiling tile(s) below ceiling plenum in buildings with spray-applied asbestos insulation/fireproofing (SAI) (ceiling opening ≥32 sq ft)	III-10	12E	JSC 6-hr
	Removing ACM ceiling tiles (Waste limited to one standard waste bag) (Ceiling opening ≥ 32 sq ft)	III-11	12E	JSC 6-hr
	Any activity in plenum above suspended ceiling tiles in buildings with spray-applied asbestos insulation or fireproofing (SAI) (Ceiling opening ≥ 32 sq ft)	III-12	12E	JSC 6-hr

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Table 12.15-1 (Continued)

Asbestos Work Class	Task Title	JPR No.	Reference App. 12B Atch No.	Min. Req'd Training
Class III Other	Any activity below raised computer floor and sub-floor in buildings with spray applied fireproofing or ACM acoustical ceilings	III-13	12F	JSC 6-hr
	Replace ACM valve gasket	III-14	12F	16-hr O&M
	Maintenance of equipment used in asbestos work	III-15	12F	16-hr O&M
	Repair of equipment with ACM insulation	III-16	12F	16-hr O&M
Class IV				
	Changing air filters in HVAC system air handling units	IV-1	12G	2-hr
	Custodial work in areas with exposed, friable ACM	IV-2	12G	2-hr
	Custodial work involving ACM flooring	IV-3	12G	2-hr
	Emergency response action to incidental fiber release	IV-4	12G	32-hr worker

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Appendix 12A

Forms

The following forms listed in this appendix are available electronically at the following web addresses:

a. JSC Form 664 Job Procedure Requirements Permit and Notification Form
http://forms.jsc.nasa.gov/ (via form search).

b. Form APB#5 TDH Renovation/Demolition Notification Form
http://www.tdh.state.tx.us/beh/asbestos/

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Appendix 12B

Asbestos
Job Performance Requirements
and
Asbestos Glossary

This appendix contains the following attachments:

12A	Class I - Asbestos Work
12B	Class II - Asbestos Work
12C	Class III - Asbestos Work - Glovebag
12D	Class III - Asbestos Work - Regulated Area Defined by a Barricade With Floor Covering
12E	Class III - Asbestos Work - Regulated Area Defined by an Enclosure
12F	Class III - Asbestos Work - Other
12G	Class IV - Asbestos Work
12H	Asbestos Glossary

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Attachment 12A

Class I – Asbestos Work

Class I Asbestos Work: Removal of structural or ceiling insulation (SAI or acoustical) or removal of other surfacing material and removal of piping and vessel insulation.

JPR I-1: Structural, large-scale: removal of ceiling insulation (SAI or acoustical), or other surfacing material, of greater than 3 square feet of contiguous area, or cumulative total of spot removals greater than or equal to 160 square feet, of materials that have been identified as containing greater than 1% asbestos. The materials being removed constitute a significant source of ACM, and abatement could reasonably be expected to contaminate adjoining areas.

JPR I-2: Structural, small-scale: spot removal of ceiling insulation (SAI or acoustical), or other surfacing material, with between 1 and 3 square feet of contiguous area with cumulative total of spot removals less than 160 square feet of materials that have been identified as containing greater than 1% asbestos. The materials being removed constitute a potentially significant source of ACM, and abatement could reasonably be expected to contaminate adjoining areas.

JPR I-3: Structural, spot: spot removal of ceiling insulation (SAI or acoustical), or other surfacing material, of less than 1 square foot in contiguous area with cumulative total of spot removals less than 160 square feet of materials that have been identified as containing greater than 1% asbestos. The materials being removed constitute a potential source of ACM, and abatement could reasonably be expected to contaminate adjoining areas if proper work practices are not followed. Waste generated exceeds the capacity of a standard asbestos disposal bag.

JPR I-4: Piping/Vessel, large-scale: removal of piping insulation greater than 3 linear feet, or a cumulative total of spot removals of pipe insulation greater than or equal to 260 linear feet; or removal of vessel (e.g.; boiler) insulation greater than 3 square feet, or a cumulative total of vessel spot removals greater than or equal to 160 square feet or greater than 35 cubic feet. These removals involve materials that have been identified as containing greater than 1% asbestos. The materials being removed constitute a significant source of ACM, and abatement could reasonably be expected to contaminate adjoining areas. Because of the size or geometry of the equipment involved, a glovebag is not a technically feasible method for removal.

JPR I-5: Piping/Vessel, small-scale: removal of piping insulation of less than 3 linear feet, or a cumulative total of spot removals of pipe insulation of less than 260 linear, or removal of insulation from vessels of less than 3 square feet, or a cumulative total of vessel spot removals less than 160 square feet or less than 35 cubic feet. These removals involve materials that have been identified as containing greater than 1% asbestos. The materials being removed constitute a significant source of ACM, and abatement could reasonably be expected to contaminate adjoining areas. Because of the size or geometry of the equipment involved, a glovebag is not a technically feasible method for removal.

To accomplish these Class I asbestos work activities, a number of sequential and concurrent steps are required. The most prominent of these are listed below. Find specific details for

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performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person must verify training, medical, and PPE requirements are complete and current.
2. Notify and coordinate task with proper officials (Facility Manager, work area supervisor, OHS, Environmental Office as needed).
3. Notify OHS at least two weeks before job start to coordinate inspections and air sampling.
4. Notify JSC Environmental Office at least 15 working days before the job start if project exceeds EPA (Clean Air Act/NESHAP) criteria (260 linear feet, 160 square feet, or 35 cubic feet) for removal of ACM for them to make required regulatory notifications to the TDH.
5. Ensure supervision by a properly qualified competent person.
6. Establish regulated area, post warning signs, and rope off area with barricade tape.
7. Shut down and isolate the HVAC system. Control operation/energy with a JSC Form 19A, "WARNING - DO NOT OPERATE" tag.
8. Secure and isolate the electrical system and control its operation/energy with a JSC Form 19A, "WARNING - DO NOT OPERATE" tag. Disable the fire alarm systems as necessary and obtain approval for outages from the Fire Protection Coordination Office.
9. Clean and remove furniture and fixtures.
10. ***Preclean work area.***
11. Seal stationary items with polyethylene.
12. Install containment system, critical barriers, coverings, and air locks (air locks mandatory for large enclosures; double entrance curtain ("Z" flap) mandatory for small enclosures).
13. Secure work area.
14. Install change room, shower, and waste load-out facilities (large-scale enclosure).
15. Install negative-pressure air system (large-scale enclosure).
16. Install negative-pressure air or HEPA vacuum system for negative pressure (small-scale enclosure).
17. Arrange for OHS Contractor to pre-inspect the enclosure.
18. Maintain HEPA vacuum system in standby mode (spot-removal surfacing).
19. Wet ACM.
20. Remove ACM

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Attachment 12A

Class I – Asbestos Work (cont.)

21. Conduct personnel and area sampling concurrently with removal of ACM.
22. Bag removed ACM.
23. Prepare bagged ACM for disposal.
24. Conduct cleaning and inspection following procedures in Chapter 12.
25. Arrange for OHS Contractor to perform initial inspection.
26. Reclean, as necessary.
27. Conduct final cleanup following procedures in Chapter 12.
28. Apply encapsulant/"lockdown" to abatement and contiguous areas.
29. Arrange for OHS Contractor to conduct clearance visual inspection and clearance air sampling.
30. Decontaminate personnel and equipment by HEPA vacuum removal of disposable clothing, and bag as asbestos waste.
31. Disassemble enclosure/decontaminated system after approval from OHS Contractor.
32. Call Work Control Center to dispose of all ACM and asbestos-contaminated waste. Record Work Control Number on Asbestos Work Permit.
33. Disestablish regulated area.
34. OHS to provide written notification to Facility Manager that area can be returned to routine activities.
35. Abatement contractor to write report/provide records to Environmental Office/Asbestos Program Manager, as required.

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Attachment 12B

Class II – Asbestos Work

Class II - Asbestos Work: Removal of, or modification to, wallboard, transite board, plaster, ceiling tiles, wall tiles, floor tiles and sheeting, and roofing and siding shingles containing asbestos.

Tasks under Class II consist of removing wallboard, transite board, asbestos concrete, plaster, ceiling tiles, wall tiles, floor tiles and sheeting, roofing and siding shingles (i.e.; ACM other than TSI and surfacing materials), regardless of quantity, where these materials have been identified as containing greater than 1% asbestos. Although these materials contain in excess of 1% asbestos, they are typically classified as nonfriable. The removal of these materials is separated into two categories.

JPR II-1: The first is where work activities will destroy the integrity of the ACM and cause the release of asbestos fibers. The airborne concentrations are likely to equal or exceed 0.01 f/cc. The materials being removed constitute a significant source of ACM and abatement could reasonably be expected to contaminate adjoining facilities and create airborne concentrations if proper controls are not followed. These removal projects will require the use of small or large enclosures.

JPR II-2: The second is where work activities will not compromise or damage the integrity of the ACM. Any airborne concentrations are expected to be less than 0.01 f/cc. The materials being removed do not constitute potentially significant airborne fibers if properly removed and controlled. An enclosure may be necessary, but is not always required.

To accomplish these tasks, a number of sequential and concurrent steps are required. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person must verify training, medical, and PPE requirements are complete and current.
2. Notify and coordinate task with proper officials (Facility Manager, work area supervisor, OHS, Environmental Office as needed).
3. For routine and scheduled O&M work, notify OHS at least two weeks before job start to coordinate inspections and air sampling.
4. Notify JSC Environmental Office at least 15 working days before the job if project exceeds EPA (Clean Air Act/NESHAP) criteria (260 linear feet, 160 square feet, or 35 cubic feet) for removal of ACM for them to make required regulatory notifications to the TDH.
5. Ensure supervision by a properly qualified competent person.
6. Establish regulated area, post warning signs, and rope off area with barricade tape.
7. Shut down and isolate the HVAC system. Control operation/energy with a JSC Form 19A, “WARNING - DO NOT OPERATE” tag.

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Attachment 12B

Class II – Asbestos Work (cont.)

8. Secure and isolate the electrical system and control its operation/energy with a JSC Form 19A, "WARNING - DO NOT OPERATE" tag. Disable the fire alarm systems as necessary and obtain approval for outages from the Fire Protection Coordination Office.
9. Clean and remove furniture and fixtures.
10. ***Pre-clean work area***.
11. Seal stationary items with polyethylene.
12. Install containment system, critical barriers, coverings, and air locks (air locks mandatory for large enclosures; double entrance curtain ("Z" flap) mandatory for small enclosures).
13. Secure work area.
14. Install change room, shower, and waste load-out facilities (as necessary).
15. Install negative-pressure air or HEPA vacuum system for negative pressure (as necessary).
16. Arrange for the OHS Contractor to pre-inspect the enclosure.
17. Wet ACM.
18. Remove ACM.
19. Conduct personnel and area sampling concurrently with removal of ACM.
20. Bag removed ACM.
21. Prepare bagged ACM for disposal.
22. Conduct cleaning and inspection following procedures of Chapter 12.12.
23. Arrange for OHS Contractor to conduct initial visual inspection.
24. Reclean, as necessary.
25. Conduct final cleanup following procedures in Chapter 12.12.
26. Apply encapsulant/"lockdown" to abatement and contiguous areas.
27. Arrange for OHS Contractor to conduct clearance visual inspection and clearance air sampling.
28. Decontaminate personnel and equipment by HEPA vacuum removal of disposable clothing, and bag as asbestos waste.
29. Disassemble enclosure/decontamination system after approval from OHS Contractor.
30. Call Work Control Center to dispose of all ACM and asbestos-contaminated waste.
31. Disestablish regulated area. Record Work Control Number on Asbestos Work Permit.
32. OHS to provide written notification to Facility Manager that area can be returned to routine activities.
33. Abatement contractor to write report/provide records to Environmental Office, as required.

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Attachment 12C

Class III – Asbestos Work – Glovebag

Class III - Asbestos Work -- Glovebag: Removal of piping insulation using a glovebag to control the expected airborne asbestos.

JPR III-1: Repair steam, chilled water, hot water lines and valves with asbestos-containing insulation (glovebag removal). This job consists of conducting repairs and maintenance to pipes, lines, and valves. To gain access to the defective part of the pipe, line, or valve, it may be necessary to remove asbestos insulation from the item. The normal high asbestos content of these materials makes it reasonable to expect airborne concentrations of asbestos in potentially significant levels when these materials are disturbed. If the item to be worked on is small enough to fit in a glovebag and there is sufficient room for tools and necessary manipulation, use the glovebag method.

If the operation cannot be conducted in a glovebag, or if the total asbestos waste exceeds the capacity of one glovebag or one standard asbestos disposal bag, the work must be done following procedures under Class I Asbestos Work, JPRs I-4 or I-5.

Accomplishing this job requires a number of sequential and concurrent steps. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person to verify that training, medical and PPE requirements are complete and current.
2. Notify and coordinate job task with proper officials (Facility Manager, Work Area Supervisor, and OHS).
3. Establish regulated area, post warning signs, and rope off area with barricade tape.
4. Shut down and isolate HVAC system, if possible without undue interruption of normal work activities or install critical barriers on HVAC diffusers/vents/openings.
5. Secure electrical systems, if possible without undue disruption to work activities if in close proximity to work area. If necessary, disable fire alarm system by coordinating with the Fire Protection Coordination Office.
6. Pre-clean the work area.
7. Seal stationary items with polyethylene.
8. Cover surface areas under abatement area with 6-mil polyethylene.
9. Don protective equipment.
10. Perform glovebag operations.
    a. Install glovebag.
    b. Establish containment negative-pressure air flow with HEPA vacuum.
    c. Remove ACM.
    d. Scrub and wipe down exposed piping/valves.

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Attachment 12C

Class III – Asbestos Work – Glovebag (cont.)

e. Use encapsulant or “lockdown” on abatement and contiguous areas.

f. Remove glovebag.

11. Clean area.
12. Perform inspection and conduct final cleanup following procedures in Chapter 12.12.
13. Decontaminate and remove protective equipment.
14. Call Work Control Center to dispose of all ACM and ACM-contaminated materials. Record Work Control Number on Asbestos Work Permit.
15. Disestablish regulated area.
16. Notify Facility Manager of job completion.

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Attachment 12D

Class III – Asbestos Work – Regulated Area Defined By Barricade with Floor Covering

Class III - Asbestos Work – Regulated Area Defined by: A Barricade With Floor Covering:

This set of Class III Asbestos work requires a regulated area defined by barrier or tape and warning signs. The regulated area does not require an enclosure but does require appropriate covering of horizontal surfaces with polyethylene sheeting.

If at any time during the tasks described below, ACM is noted as delaminating or creating airborne fibers, stop the project and immediately upgrade it to Class I or Class II asbestos work.

JPR III-2: Modifying building steel/concrete structure/decking that is in close proximity to SAI/fireproofing.

a. This job consists of modifying building components (e.g.; steel or concrete structural members; steel or concrete decking) which is in close proximity to SAI for which drilling, hammering, or similar activities could be reasonably expected to disturb the ACM.

b. For the purposes of this task, it is assumed that the area requiring the incorporation of control techniques is less than (<) 32 square feet around the spot of penetration or disturbance. When it is necessary to drill through or hammer steel in proximity to ACM that could be disturbed by the construction or maintenance activity, take precautions to minimize the quantity of asbestos released. Precautions would include evacuation of nonessential personnel within the area of the activity, and wetting of ACM before work to prevent fiber release.

c. In those instances where modifications are made to structural members covered with SAI, then Class I asbestos work, JPRs I-1, I-2, or I-3 will apply.

JPR III-3: Removing wall partitions and/or plaster ceilings in close proximity to areas with ACM.

a. This job consists of removing and/or replacing wall partitions or plaster ceilings in close proximity to asbestos materials and could be reasonably expected to disturb the ACM. Airborne asbestos concentrations are expected to be minimal if proper control procedures are followed. The size of the job dictates the degree of control.

b. For the purposes of this task, it is assumed that the area is accessible and the area requiring the incorporation of control techniques is less than (<) 32 square feet near the removal.

c. If it is necessary to spot remove ACM in order to enhance accessibility, the controls identified in JPR I-3 will apply.

JPR III-4: Removing/replacing ACM or non-ACM ceiling tile(s) below areas with SAI.

a. This job consists of removing and/or replacing suspended ceiling tiles below areas with SAI. It only applies to those tiles that can reasonably be expected to be removed without causing significant dust generation. Once the tiles are removed, other work activities can

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be performed in the plenum areas. Airborne asbestos concentrations are expected to be minimal, if proper control procedures are followed. However, the potential exists to disturb the SAI or to disturb asbestos-laden dust on the top of the ceiling tiles.

b. This task is limited to less than (<) 32 square feet of contiguous square footage opening in the ceiling. If the area affected is greater than or equal to (≥) 32 contiguous square feet, then an enclosure is required (see JPR III-10)

JPR III-5: Removing ACM ceiling tiles in buildings without SAI.

a. This job consists of removing suspended ceiling tiles known to contain greater than 1% asbestos and the removal occurs below areas which do not have asbestos-containing SAI. This task only applies to those tiles that can reasonably be expected to be removed without causing significant generation of asbestos debris or causing the tiles to become friable.

b. The task is further limited to less than (<) 32 square feet of contiguous square footage opening in the ceiling and the amount of asbestos waste cannot exceed the capacity of one standard asbestos waste bag.

c. If the affected area is greater than or equal to (≥) 32 contiguous square feet, then an enclosure is mandatory (see JPR III-11)

d. If waste generated exceeds the capacity of standard disposal bags, then JPR II-2 must be used.

JPR III-6: Work activities above suspended ceilings in the plenum space in buildings with SAI.

a. This job consists of work activities required to be performed in plenums; e.g., system inspections, system repairs, system installations, and pulling cables across the top of ceiling tiles or in a cable tray. Partial to whole body entry into the plenum is required. This task does not include the cutting or removal of ACM to mount cables or spot removals of ACM to penetrate floors or walls. Concentrations are reasonably expected to be low if proper precautions and procedures are incorporated into job planning.

b. This task is limited to less than (<) 32 square feet of contiguous square footage opening in the ceiling. If the area affected is greater than or equal to (≥) 32 contiguous square feet, then at least a small enclosure is required (see JPR III-12).

JPR III-7: Spot removing ceiling insulation (SAI or acoustical) of less than 1 square foot in contiguous area, the waste generated does not exceed the capacity of a standard asbestos waste bag, and cumulative total of spot removals is less than 160 square feet. The materials being removed have been identified as containing greater than 1% asbestos, constitute a potential source of ACM, and abatement could reasonably be expected to contaminate adjoining areas if proper work practices are not followed. Wet methods are mandatory and the ACM must be captured close to the removal activity and transferred to a waste bag. If waste exceeds to capacity of a standard asbestos waste bag, then Class I Asbestos work, JPR I-3 must be used.

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Attachment 12D

Class III – Asbestos Work – Regulated Area Defined By Barricade with Floor Covering (cont.)

Accomplishing these jobs requires a number of sequential and concurrent steps. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person to verify that training, medical and PPE requirements are complete and current.
2. Notify and coordinate job tasks with proper officials (facility manager, work area supervisor, and OHS).
3. Place barricades and signs around work area. Barricades must be placed a sufficient distance beyond the work zone to capture all debris from work activities and to ensure that no asbestos concentration exceeds applicable limits.
4. Move employees in the immediate work area out of the regulated area.
5. Shut down HVAC system if possible without unduly interrupting facility work force. The HVAC system must be shut down when disturbance of ACM or ACM containing debris could reasonably be expected to migrate to other areas.
6. Don protective equipment.
7. Conduct personnel and area sampling as required.
8. Place one layer of 6-mil polyethylene beneath work area. The polyethylene must extend beyond the work zone a sufficient distance to catch/trap any asbestos debris that may fall. The polyethylene must not extend beyond the boundary of the regulated area.
9. When removing ceiling tiles:
    a. Place ladder below first ceiling tile.
    b. As tile is lifted, HEPA vacuum the tile grid supports.
    c. Remove one ceiling tile. Lower carefully, maintaining horizontal orientation.
    d. HEPA vacuum and wet wipe surface facing plenum and exposed side(s).
    e. Wet wipe and HEPA vacuum tile hanger assembly.
    f. HEPA vacuum next tile to be removed, remove next tile, and wet wipe and HEPA vacuum tile hanger assembly.
    g. Repeat for a maximum of three tiles (less than 32 square feet).
    h. If unable to decontaminate tile, or if tiles are ACM, place in asbestos waste disposal bag.
10. If performing spot removals/abatements:
    a. Spray spot and surrounding area with amended water and let it soak into the ACM.
    b. Cut with sharp knife or other tool so as not to generate asbestos fibers. Use a HEPA vacuum adjacent to the cutting tool to capture asbestos fibers/dust.

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Attachment 12D

Class III – Asbestos Work – Regulated Area Defined By Barricade with Floor Covering (cont.)

c. Catch asbestos waste in container held close to removal spot/area.

d. Clean substrate, as applicable.

e. Spray/mist substrate and exposed side(s) of ACM with approved encapsulant.

11. If applicable, modify structural components so as not to disturb surrounding ACM.
12. If applicable, carefully remove wall partitions or plaster ceiling materials so as to not disturb surrounding ACM. Remove material and dispose of as normal waste or as directed.
13. As applicable, perform work in plenum above suspended ceilings.
14. Wet wipe all cables, wires, conduit, and piping as they are removed from plenum area. HEPA vacuum all other items as they are removed from plenum area.
15. HEPA vacuum work area.
16. Visually inspect above ceiling and around work area, to ensure that there is no remaining visible ACM dust/debris.
17. Replace ceiling tiles.
18. Visually inspect and clean the regulated area and all equipment below ceiling to ensure there is no visible ACM dust/debris. Follow cleaning and inspection procedures of Chapter 12.12.
19. Decontaminate personnel and all equipment by HEPA vacuum.
20. HEPA vacuum and wet wipe polyethylene placed beneath work area. If unable to decontaminate, carefully gather plastic and dispose as asbestos-contaminated waste. Follow cleaning and inspection procedures of Chapter 12.
21. Conduct final visual clearance inspection. Reclean as necessary.
22. Decontaminate disposable coveralls, remove, and dispose of as asbestos-contaminated waste.
23. Remove respirator.
24. Call Work Control Center to dispose of all ACM and ACM-contaminated materials. Record Work Control Number on Asbestos Work Permit. Notify area supervisor that task is complete.
25. Remove barricades and signs and disestablish regulated area.
26. Notify Facility Manager of job completion.

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Attachment 12E

Class III – Asbestos Work – Regulated Area Defined by an Enclosure

Class III - Asbestos Work – Regulated Area Defined by an Enclosure:

If at any time during the tasks described below, ACM is noted as delaminating or creating airborne fibers, stop the project and immediately upgrade it to Class I or Class II asbestos work.

JPR III-8: Modifying building steel/concrete structure/decking that is in close proximity to SAI/fireproofing.

a. This job consists of modifying building components (e.g.; steel or concrete structural members; steel or concrete decking) that is in close proximity to SAI for which drilling, hammering, or similar activities could be reasonably expected to disturb the ACM. When it is necessary to drill through or hammer steel that is in proximity to ACM that could be disturbed by the construction or maintenance activity, take precautions to minimize the quantity of asbestos released. Precautions would include evacuating nonessential personnel within the area of the activity, and wetting ACM before work to prevent fiber release.

b. For the purposes of this task, it is assumed that the area requiring the incorporation of control techniques requires greater than or equal to (≥) 32 contiguous square feet. In those instances where modifications are made to structural members covered with SAI, then Class I asbestos work, JPRs I-1, I-2, or I-3 will apply.

JPR III-9: Removing wall partitions and/or plaster ceilings in close proximity to areas with ACM.

a. This job consists of removing and/or replacing wall partitions or plaster ceilings in close proximity to asbestos materials and could be reasonably expected to disturb the ACM. Airborne asbestos concentrations are expected to be minimal if proper control procedures are followed. The size of the job dictates the degree of control.

b. For the purposes of this task, it is assumed that the area requiring the incorporation of control techniques requires greater than or equal to (≥) 32 contiguous square feet. If it is necessary to spot remove in order to enhance accessibility, the controls identified in JPR I-3 will apply.

JPR III-10: Removing/replacing ACM or non-ACM ceiling tile(s) below areas with SAI.

a. This job consists of removing and/or replacing suspended ceiling tiles below areas with SAI. It only applies to those tiles that can reasonably be expected to be removed without causing significant dust generation. Once the tiles are removed, other work activities can be performed in the plenum areas. Airborne asbestos concentrations are expected to be minimal, if proper control procedures are followed. However, the potential exists to disturb the SAI or to disturb asbestos laden dust on the top of the ceiling tiles.

b. For the purposes of this task, it is assumed that the area requiring the incorporation of control techniques is greater than or equal to (≥) 32 contiguous square feet.

JPR III-11: Removing ACM ceiling tiles in building without SAI.

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Class III – Asbestos Work – Regulated Area Defined By An Enclosure (cont.)

a. This job consists of the removal of ceiling tiles known to contain greater than 1% asbestos. This task only applies to those tiles that can reasonably be expected to be removed without causing significant generation of asbestos debris or causing the tiles to become friable. The amount of asbestos waste cannot exceed the capacity of one standard asbestos waste bag.

b. For the purposes of this task, it is assumed that the area requiring the incorporation of control techniques is greater than or equal to (≥) 32 contiguous square feet. If waste generated exceeds the capacity of a standard disposal bag, then JPR II-2 must be used.

JPR III-12: Work activities above suspended ceilings in the plenum space in buildings with SAI.

a. This job consists of work activities required to be performed in plenums; e.g., system inspections, system repairs, system installations, and pulling cables across the top of ceiling tiles or in a cable tray. Partial to whole-body entry into the plenum is required. Concentrations are reasonably expected to be low if proper precautions and procedures are incorporated into job planning. This task does not include cutting or removing ACM to mount cables or spot removals of ACM to penetrate floors, decks, or walls.

b. For the purposes of this task, it is assumed that the area requiring the incorporation of control techniques is greater than or equal to (≥) 32 contiguous square feet.

Accomplishing these jobs requires a number of sequential and concurrent steps. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person must verify that training, medical and PPE requirements are complete and current.
2. Notify and coordinate job tasks with proper officials (Facility Manager, Work Area Supervisor, and OHS).
3. Place barricades and signs around work area.
4. Move employees in the immediate work area out of the regulated area.
5. Shut down HVAC system if possible without unduly interrupting facility work force. The HVAC system must be shut down when disturbance of ACM or ACM containing debris could reasonably be expected to migrate to other areas.
6. Don protective equipment
7. Conduct personnel and area sampling as required.
8. Construct enclosure with polyethylene, incorporate an air-lock or double entrance curtain (“Z” flap).
9. Pre-clean area as necessary.
10. As necessary, use HEPA vacuum to create a negative pressure inside enclosure.

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Attachment 12E

Class III – Asbestos Work – Regulated Area Defined By An Enclosure (cont.)

11. If removing ceiling tiles:
    a. Place ladder below first ceiling tile.
    b. As tile is lifted, HEPA vacuum the tile grid supports.
    c. Remove one ceiling tile. Lower carefully, maintaining horizontal orientation.
    d. HEPA vacuum and wet wipe surface facing plenum and exposed side(s).
    e. Wet wipe and HEPA vacuum tile hanger assembly.
    f. HEPA vacuum next tile to be removed, remove next tile, and wet wipe and HEPA vacuum tile hanger assemble
    g. Wet wipe and HEPA vacuum tile hanger assembly.
    h. Repeat as necessary for all tiles to be removed.
    i. If unable to decontaminate tile, or if tiles are ACM, place in asbestos waste disposal bag.
12. If applicable, modify structural components so as not to disturb surrounding ACM.
13. If applicable, carefully remove wall partitions or plaster ceiling materials so as to not disturb surrounding ACM. Remove material and dispose of as normal waste or as directed.
14. As applicable, perform work in plenum above suspended ceilings.
15. Wet wipe all cables, wires, conduit, and piping as they are removed from plenum area. HEPA vacuum all other items as they are removed from plenum area.
16. HEPA vacuum work area.
17. Visually inspect above ceiling, around work area, to ensure that there is no remaining visible ACM dust/debris.
18. Replace ceiling tiles.
19. Perform first visual inspection of the regulated area and all equipment below ceiling to ensure there is no visible ACM dust/debris.
20. Decontaminate personnel and all equipment by HEPA vacuum.
21. Clean, inspect, decontaminate enclosure following Chapter 12.12 procedures.
22. Conduct visual clearance inspection. Reclean as necessary.
23. Disassemble enclosure, perform final visual inspection of area, clean as necessary.
24. Decontaminate disposable coveralls, remove, and dispose of as asbestos-contaminated waste.
25. Remove respirator.
26. Call Work Control Center to dispose of all ACM and ACM-contaminated materials. Record Work Control Number on Asbestos Work Permit.
27. Remove signs and disestablish regulated area.
28. Notify Facility Manager of job completion.

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Attachment 12F

Class III – Asbestos Work – Other

Class III - Asbestos Work – Other: Other Class III asbestos-related work where the activities cannot be easily grouped into a specific type of regulated area.

JPR III-13: Activities required to be performed under raised computer floor and sub-floor areas (i.e., system inspections, system repairs, system installations, cable installations or removals, and sub-floor cleaning) in buildings with SAI/fireproofing or exposed acoustical decoration.

a. This job consists of removing and/or replacing raised computer floor tiles for activities to be performed in sub-floor areas. The potential for asbestos dust exists in these areas. If proper control measures are followed, airborne asbestos concentrations are expected to be minimal.

b. Requirements of this JPR do not apply if activities do not require physical entry into sub-floor areas (physical entry is defined as happening when any part of a human body (arm, foot, head) breaks the plane of the flooring). For example, inspections of sub-floor areas from above the floor surface are not regulated under this JPR or Part 12.

Accomplishing this job requires a number of sequential and concurrent steps, regardless of the number of tiles to be removed. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person must verify that training, medical and PPE requirements are complete and current.
2. Notify and coordinate job tasks with proper officials.
3. When feasible, shut down under floor HVAC systems in the area. Perform operation/energy control procedures as needed (see Chapter 8.2 of this Handbook).
4. Remove floor tile panel and HEPA vacuum underside of panel.
5. Wet wipe and/or HEPA vacuum floor tile support assembly.
6. HEPA vacuum the under-floor area where work is to be performed.
7. If activity is for removal of any under-floor equipment or cabling, then HEPA vacuum and/or wet wipe all items as they are removed from the floor cavity.
8. Replace tiles as necessary.
9. Conduct visual clearance inspection.
10. HEPA vacuum work area.
11. Call Work Control Center to dispose of asbestos-contaminated waste. Record Work Control Number on the Asbestos Work permit.
12. Notify area supervisor that task is complete.

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JPR III-14: Replace ACM valve gasket.

This job consists of removing ACM gasket materials from valves. This job does not include removing ACM from the outside of the valve. (Removing ACM from outside of the valves will be conducted under Class I asbestos work, JPRs I-4/I-5, or Class III asbestos glovebag work, JPR III-1, as appropriate). Airborne concentrations of asbestos fibers are reasonably expected to be low if proper controls are followed.

This job requires a number of sequential and concurrent steps. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person to verify that training, medical and PPE requirements are complete and current.
2. Place barricades and signs around work area and place polyethylene sheeting under work area.
3. Disassemble valve.
4. HEPA vacuum/wet wipe valve-gasket interfaces.
5. Scrape off and collect ACM gasket materials using wet methods.
6. Bag ACM.
7. HEPA vacuum/wet wipe valve surface.
8. Install new gasket.
9. Reassemble valve.
10. HEPA vacuum/wet wipe outside of valve and surrounding area.
11. HEPA vacuum and visually inspect regulated area.
12. Place all rags, materials and vacuum cleaner bags into ACM waste bags.
13. HEPA vacuum work clothes, respirator and exterior of ACM waste bag.
14. Remove, clean and store respirator.
15. Call Work Control Center to dispose of asbestos-contaminated waste. Record Work Control Number on Asbestos Work Permit.
16. Notify supervisor that task is complete.
17. Remove barricades and signs.

JPR III-15: Maintenance of equipment used in asbestos abatement or decontamination.

This task includes replacing filters and maintaining equipment used in ACM abatement and decontamination operations. This would generally include negative-pressure air filtration, water filters, and HEPA-equipped vacuum cleaners. These filters would generally be expected to contain significant quantities of ACM; consequently, these units may need to be serviced within

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a small enclosure. When not in service, secure HEPA vacuum cleaners and negative-pressure, air filtration equipment with plastic on each inlet and exhaust opening to the unit.

Accomplishing these jobs require a number of sequential and concurrent steps. The most prominent of these are listed below. Specific details for performing all required activities may be found by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person to verify that training, medical and PPE requirements are complete and current.
2. Coordinate job tasks with proper officials.
3. Secure HVAC and electrical systems, as necessary. Ensure equipment is de-energized. Perform lock out/tag out (LO/TO) procedures as appropriate.
4. Move employees in the immediate work area out of controlled area.
5. Place barricades and signs around work area. Build enclosure as needed. Place polyethylene sheeting on work surface.
6. Open filter unit.
7. HEPA vacuum/wet wipe filter unit covers and duct.
8. Spray filter with mist of water or a tack coating.
9. Ensure complete filter surface is covered.
10. Place filter into plastic bag, seal bag, label as asbestos waste.
11. HEPA Vacuum/wet wipe filter installation area.
12. Install new filter.
13. Close unit.
14. Clean and inspect work area following procedures in Chapter 12.12.
15. HEPA vacuum work area including plastic sheeting placed beneath work area.
16. Disassemble enclosure.
17. Collect decontaminated plastic sheeting placed beneath work area, place in waste bags, dispose of as normal refuse.
18. Conduct visual clearance inspection.
19. Call work Control Center to dispose of asbestos-contaminated waste. Record Work Control Number on Asbestos Work Permit.
20. Notify area supervisor that task is complete.
21. Remove barricades and signs.

JPR III-16: Repair of equipment with ACM insulation.

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Attachment 12F

Class III – Asbestos Work – Other (cont.)

This JPR addresses equipment (motors, engines, relays, ovens, file cabinets, etc.) that has ACM inside the unit. It does not cover equipment with ACM insulation on the outside, which must be removed before gaining access to the interior of the unit. Airborne concentrations of asbestos fibers are reasonably expected to be less than 0.1 f/cc.

If equipment is known to contain asbestos, and there is no intention of servicing the equipment, or removing the asbestos, the equipment must be disposed of as asbestos waste through the COSS Environmental Support contractor (i.e., cannot be disposed of or declared excess through JSC/Logistics Division).

Accomplishing this job requires a number of sequential and concurrent steps. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person to verify that training, medical and PPE requirements are complete and current.
2. Notify proper offices.
3. Ensure equipment is unplugged or de-energized. Follow all appropriate LO/TO procedures as required by this Handbook.
4. Place warning signs and barricades.
5. Place one layer of 6-mil polyethylene under (around, if equipment is floor mounted) equipment to be repaired.
6. Open equipment.
7. HEPA vacuum interior.
8. Wet ACM material.
9. Remove ACM (if necessary) and place in ACM waste bag, if being discarded.
10. Replace with non-ACM if feasible.
11. HEPA vacuum interior.
12. Close up equipment.
13. HEPA vacuum polyethylene and work area.
14. HEPA vacuum protective clothing and respirator.
15. Clean and inspect work area following procedures in Chapter 12.12.
16. Disestablish regulated area.
17. Call Work Control Center to dispose of asbestos-contaminated waste. Record Work Control Number on Asbestos Work Permit.
18. Notify supervisor that task is complete.
19. Re-energize equipment as appropriate.

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Attachment 12G

Class IV – Asbestos Work

Class IV - Asbestos Work:

The permit requirements, established in Chapter 12.1, are categorically waived for activities falling within this attachment. Notifications as required in Chapter 12.6 are waived unless debris is spotted and an Emergency Cleanup initiated.

JPR IV-1: Changing air filters in comfort cooling or clean room systems in buildings with SAI /fireproofing.

a. Air conditioning systems contain filters that must be routinely replaced. Comfort units usually have a 1- to 2-inch-thick polyethylene pad media. Some units have roll media that is advanced automatically based upon pressure differential. Units serving computers and electronics usually have a polyethylene-pad pre-filter and a 65% efficiency secondary filter. Clean room units usually have a pre-filter, a 65 % efficiency secondary, and a HEPA final filter. All pre-filters are changed on a periodic schedule established in the COSS contractor's preventive maintenance procedure. Secondary and HEPA filter are changed at established pressure differential points.

b. If units are above ceilings in a building with SAI, then perform this activity using the appropriate Class III asbestos procedures from Appendix 12B, Attachments 12D and 12E.

Accomplishing these jobs requires a number of sequential and concurrent steps. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Competent person to verify that training, medical and PPE requirements are complete and current.
2. Coordinate job tasks with proper officials.
3. Secure HVAC and electrical systems. Perform operation/energy control procedures as needed (see Chapter 8.2 of this Handbook).
4. Open air handling unit filter bank/holder(s).
5. HEPA vacuum/wet wipe filter unit covers.
6. Wet mist/spray filters as they are removed from the filter holders.
7. Place filters from building air conditioning systems or similar applications in plastic bags and seal; you can dispose of them as normal refuse, since they would not be expected to contain ACM.
8. HEPA vacuum/wet wipe filter installation area and duct.
9. Install new filter and close unit.
10. HEPA vacuum work area outside air handing unit.
11. Reestablish air conditioning unit operation.

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JPR IV-2: Custodial work in rooms/areas with exposed sprayed-applied asbestos insulation or acoustical decoration. Some administrative work areas, conference/meeting rooms, and building lobbies have exposed ACM materials. While this ACM is not normally expected to delaminate or to cause airborne asbestos fibers, take precautions to ensure that custodial staff cleaning these areas are protected and do not cause any debris to become airborne. All of these areas are posted with notifications about the hazard. The custodial staff must follow the following steps/procedures:

1. Verify that asbestos awareness training requirements are complete and current.
2. Do not poke at, dust, or disturb the exposed SAI or acoustical material.
3. Use a properly maintained HEPA vacuum, with attachments, to clean floors and furniture. Do not, REPEAT DO NOT, use a regular vacuum in these areas.
4. Have the COSS Environmental Support Contractor change the HEPA vacuum filters when needed.
5. If you spot any asbestos debris, actual or suspected, in these areas, have the Facility Manager contact the COSS Environmental Support Contractor and/or OHS Contractor for an inspection and cleanup.

JPR IV-3: Custodial work involving asbestos-containing flooring (sheeting or floor tiles). Some buildings at JSC have floor tile or sheeting that contains asbestos. While this material is normally non-friable, take care to avoid disturbing the surface of the material in a manner that would generate asbestos fibers and cause exposures to custodial staff. If you are custodial staff, follow the following steps/procedures:

1. Verify that asbestos awareness training requirements are complete.
2. Do not sand, abrade, grind on floor material.
3. When polishing the flooring with a polishing machine, spray the floor with a water mist to prevent dry rubbing of the floor surface, and use a machine that turns with a speed of less than 300 revolutions per minute.
4. If you spot any asbestos debris, actual or suspected, in these areas, have the Facility Manager contact the COSS Environmental Support Contractor and/or the OHS Contractor for an inspection and cleanup.

JPR IV-4: Emergency response action to an asbestos fiber release.

a. This job consists of the cleanup and/or decontamination of an area that has been subjected to an incidental minor or major fiber release of either a known ACM or a material that is reasonably expected to contain over 1% asbestos. Immediate control measures can prevent further contamination of surrounding areas or adjoining facilities.

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b. Responding COSS Environmental Support and OHS personnel will determine control measures to be established. OHS will determine the need to perform clearance air sampling.

c. COSS contractor personnel responding to a fiber release will not proceed with the cleanup until they ensure that OHS has been notified.

d. The competent person for the cleanup will determine if the cleanup will be conducted under Class I, II, III, or IV asbestos work procedures.

e. If spills are small and COSS contractor personnel establish the regulated area, the COSS personnel will disestablish the area after final cleanup and inspection and will be responsible for removing barrier tape/warning signs. If OHS establishes the regulated area or decides that clearance air sampling is required, then OHS will disestablish the area after final cleanup and inspection and will be responsible for removing barrier tape/warning signs.

f. Communication with all parties in the affected area is very important. Therefore, the organization responsible for establishing the regulated area will ensure that the Facility Manager and work area supervisor have been informed about the response activity, the cleanup process and clearance air sampling to be performed (if required), and the approximate duration of the cleanup. This notification may be verbal but must occur before the start of the cleanup. The Facility Manager and work area supervisor should be asked to inform the occupants of the affected area. Additionally, occupants/employees in nearby areas should be informed about the cleanup activity and the expected duration.

g. The organization responsible for establishing the regulated area and for removing the barrier tape and warning signs will provide courtesy notification to the EOC Security Dispatcher at the non-emergency extension 34658 at the start and completion of the cleanup. Additional notification to JSC Management will be made at the discretion of the responders.

h. The organization responsible for removing the barrier tape and warning signs will also be responsible for notifying the Facility Manager and work area supervisor that the area is clean and operations may return to normal. These notifications must be made in writing within two hours of the cleanup completion; e-mail notification is acceptable.

Emergency response clean-up requires a number of sequential and concurrent steps. The most prominent of these are listed below. Find specific details for performing all required activities by referring to accepted industry practices and procedures based on requirements found in 29 CFR 1926.1101, 29 CFR 1910.1001, and 40 CFR 763, as amended.

1. Evacuate personnel and establish regulated area.
2. Notify COSS Environmental Support Contractor and OHS Contractor (SD33) of the contamination. Provide courtesy notification to EOC Security Dispatcher at non-emergency extension 34658.

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Attachment 12G

Class IV – Asbestos Work (cont.)

3. Responding COSS Environmental Support and OHS personnel will determine control measures to be established and will establish the requirements for OHS clearance air sampling.
4. The COSS competent person will determine if the cleanup will be conducted as OSHA Class I, II, III, or IV asbestos-related work.
5. Competent person will verify that training, medical, and PPE requirements are complete and current.
6. Place barricades and signs around work area.
7. Build small or large enclosure as needed/as appropriate: seal all entrances and exits with 6-mil polyethylene, construct air lock or "Z-flap" entrance, and install negative pressure on containment, if needed.
8. Shut down and isolate HVAC system. Perform operation/energy control procedures as needed (see Chapter 8.2 of this Handbook).
9. Secure electrical and fire alarm systems. Perform operation/energy control procedures as needed (see Chapter 8.2 of this Handbook). If necessary, disable fire alarm system by coordinating with the Fire Protection Coordination Office.
10. Conduct personnel and area sampling as directed by the OHS Contractor.
11. Apply appropriate JPR to abate or repair ACM fiber release source, as needed.
12. HEPA vacuum and wet wipe contaminated area(s) and contaminated furnishings.
13. Bag contaminated items that cannot be decontaminated.
14. Perform gross and final cleaning as appropriate (see procedures in Chapter 12.12).
15. Visually inspect and reclean as required (See procedures in Chapter 12.12).
16. Contact OHS Contractor as required for clearance visual inspection. Reclean as required.
17. Decontaminate personnel and equipment with HEPA vacuum and package contaminated materials; i.e., suits, cartridges, rags, etc, for disposal.
18. Prepare bagged ACM for disposal.
19. Remove bagged ACM from the area.
20. Contact OHS Contractor to conduct clearance air sampling, as required.
21. COSS or OHS personnel will disestablish regulated area and remove barrier tape and warning signs, as agreed upon (see statements above).
22. COSS or OHS personnel, as agreed upon (see statements above), will provide written notification within 2 hours to the Facility Manager and the work area supervisor of task completion and return of area to normal operations. Provide courtesy notification to EOC Security Dispatcher that cleanup is complete.

Verify this is the correct version before you use it by checking the on-line version.

Attachment 12H

Asbestos Glossary

The following terms and definitions apply to Part 12.

Abatement - Procedures to control fiber release from any materials containing more than 1% asbestos such as surfacing materials, thermal insulating materials, and building and miscellaneous materials (roofing, siding, flooring, ceiling tiles, etc). It includes encapsulation, permanent enclosure, or removal of ACM during renovations and demolitions of facilities containing ACM.

ACM - asbestos-containing material. Any material containing more than one percent (1%) asbestos by weight.

ACBM – asbestos-containing building material. ACBM is surfacing ACM, TSI ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a building. A term used by the EPA. (40 CFR 763)

ACGIH – American Conference of Governmental Industrial Hygienists

AIHA - American Industrial Hygiene Association.

AIHA Accredited Laboratory - A certification given by the AIHA to an analytical laboratory that has been examined for quality control and proficiency and meets AIHA standards of performance and operation.

Airborne - Pertaining to materials that have been dispersed and are suspended or slowly falling in the air.

Air Lock - An opening through an installed barrier system, usually consisting of two polyethylene curtained doorways at least 3 feet apart, at an asbestos abatement activity that allows ingress and egress of workers and materials and restricts the movement of airborne material from the contaminated area to the clean area.

Air Sampling/Air Monitoring - The process of measuring the fiber content/concentration of a specific volume of air in a stated time.

Amended Water - Water to which a chemical wetting agent (surfactant) has been added to improve penetration into asbestos-containing material.

APM - Asbestos Program Manager. The individual responsible for managing all aspects of the Asbestos Control Program. At JSC this individual is the Environmental Officer (JA131).

Approved Respirator - Respiratory protection equipment tested and listed as satisfactory according to standards established by either NIOSH or the Mine Safety and Health Administration to provide respiratory protection.

Verify this is the correct version before you use it by checking the on-line version.

Attachment 12H

Asbestos Glossary (cont.)

Asbestos - The generic name for a variety of naturally occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separable into fibers. Six asbestos species were used commercially in large amounts: chrysotile, amosite, crocidolite, anthophyllite, tremolite, and actinolite. For the purposes of Part 12, "asbestos" includes PACM, as defined below.

Asbestos-Containing Materials (ACM) - A material containing more than 1% of any type or mixture of types of asbestos.

Asbestos-Containing Building Material (ACBM) - ACBM is surfacing ACM, TSI ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a building. A term used by the EPA. (40 CFR 763)

Asbestos Fibers - Fibers longer than five microns (length-to-width ratio of 3:1) generated from an ACM.

Asbestos Program Manager – The individual responsible for managing all aspects of the Asbestos Control Program. At JSC this individual is the Environmental Officer (JA131).

Asbestos Removal - The physical removal of ACM or PACM from an area.

Asbestos Worker - A JSC civil servant or resident support contractor employee who is routinely engaged in asbestos-related activities.

ANSI – American National Standards Institute

ASTM – American Society for Testing and Standards

Barrier - Any surface, warning tape, or sign that separates the asbestos-regulated area to inhibit the movement of fibers or unauthorized personnel.

Browncoat - A layer of plaster-like material, usually brown, covering the plaster ceiling to which the ACM coating is applied.

Certified Industrial Hygienist - A person having a college or university degree in industrial hygiene, chemistry, engineering, physics, or medicine or related biological sciences who, by virtue of special studies or training, has acquired competence in the practice of industrial hygiene ***and*** who has successfully completed examinations administered by the American Board of Industrial Hygiene, which certifies individuals in either the Comprehensive Practice of Industrial Hygiene or in an Industrial Hygiene Aspect (e.g.; chemistry, indoor environmental quality, etc.)

CFR – Code of Federal Regulations

Class I Asbestos Work - activities involving the removal of thermal system insulation (TSI), surfacing ACM, and presumed ACM (PACM). (29 CFR 1926.1101)

Verify this is the correct version before you use it by checking the on-line version.

Attachment 12H

Asbestos Glossary (cont.)

Class II Asbestos Work - activities involving the removal of ACM that is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics. (29 CFR 1926.1101)

Class III Asbestos Work - means repair and maintenance operations where ACM, including TSI and surfacing ACM and PACM, is likely to be disturbed. (29 CFR 1926.1101)

Class IV Asbestos Work - maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities involving the cleanup of dust, waste, and debris from Class I, II, and III activities. (29 CFR 1926.1101)

Clean Area – see Clean Room.

Clean Change Room – see Clean Room.

Clean Room – A clean room is an uncontaminated room/area having facilities for the storage of asbestos workers' street clothing and uncontaminated materials and equipment. The clean room shall be equipped with a locker or appropriate storage container for each employee's use. Following showering, employees change into street clothing in the clean room area.

Clearance - Before release of an area upon completion of asbestos-related activities, visual inspections and/or clearance air sampling will be performed to ensure that no residual asbestos debris or airborne asbestos fibers remain.

Clearance Air Sampling/Air Monitoring - Air sampling, to verify that the airborne fiber concentration is less than 0.01 f/cc, done before releasing an asbestos removal area.

Competent Person - A person who meets the requirements of Chapter 12.7 of this Handbook and is designated as such by the employer.

Controlled Area - A term used within Part 12 to define an area that is not considered a regulated area under OSHA, but is subject to certain control procedures prescribed within Part 12 to minimize the potential asbestos exposure of employees, workers, and building occupants.

Custom Containment Bag – see Glovebag.

Decontamination - The process of removing contaminates that have accumulated on personnel and equipment to prevent exposure of the people or contamination of otherwise uncontaminated people, areas, or equipment.

Decontamination Area - A decontamination area is an enclosed area adjacent and connected to the regulated area consisting of an equipment room, shower area, and clean room, used to decontaminate workers, materials, and equipment that are contaminated with asbestos. The enclosure for this area is typically constructed of plastic, with curtained doorways between adjacent rooms; however, it may be a portable, prefabricated unit.

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Demolition - The wrecking or removing of any component, system, finish or assembly of a facility together with any related handling operations.

Disturb/Disturbance – A disturbance is an activity that disrupts the matrix of ACM or PACM, crumbles or pulverizes ACM or PACM, or generates visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM and PACM, no greater than the amount, which can be contained in one standard sized glove bag or waste bag in order to access a building component. (29 CFR 1926.1101)

Employee - A JSC civil servant or a support contractor.

Encapsulant - A liquid material that can be applied to ACM, which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (a bridging encapsulant) or by penetrating the material and binding its components together (a penetrating encapsulant).

Encapsulation - The treatment of ACM with a material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent the release of fibers; a bridging encapsulant or a penetrating encapsulant.

Enclosure (1) – As used in Part 12 and by OSHA, an enclosure means the construction of an airtight, impermeable, temporary barrier around a regulated area to control the release of asbestos fibers into the air where they could migrate into an adjacent area.

Enclosure (2) - As used by EPA for response actions, an enclosure means the construction of an airtight, impermeable, permanent barrier around ACM and ACBM to control the release of asbestos fibers into the air.

Environmental Office (JA131) – the office at JSC responsible for ensuring compliance with federal, state, and local environmental regulations.

Equipment Room – An equipment room is a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

EPA - Environmental Protection Agency

f/cc - the concentration of airborne fibers expressed as the total number of fibers per cubic centimeter of air

Fiber Count - A total number of fibers, of specified diameter and length, obtained by microscopic examination of a filter through which air has been drawn.

Fit Test - A test that usually exposes a person wearing a respiratory protection device to a gaseous or aerosol test mixture in a test environment to determine the fit or integrity of the face piece-to-face seal of the respirator. The test may be qualitative where the person tested

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determines by smell or taste whether the mask is leaking, or it may be quantitative where the concentration of the test mixture inside and outside the mask is determined by instrumentation.

Friable - A material that crumbles, pulverizes, or reduces to powder from hand pressure.

Glovebag - A sack, typically constructed of 6-mil transparent polyethylene or polyvinyl chloride plastic, with two inward-projecting long sleeve gloves, which is designed to enclose an object from which an ACM is to be removed.

Grade D Air - Breathing air which contains 19.5%-23% oxygen, no more than 5 micrograms per cubic meter of condensed hydrocarbons, no more than 20 parts per million (ppm) of carbon monoxide, no pronounced odor, and a maximum of 1000 ppm carbon dioxide. The Compressed Gas Association, Specification G-7, is the consensus standard for Grade D breathing air criteria.

HEPA Filter - A high-efficiency particulate air (HEPA) filter capable of trapping and retaining 99.97% of particulates greater than 0.3 micron in size.

HEPA Filtered Vacuum - A vacuum cleaner with a HEPA filter capable of trapping and retaining 99.97% of all particulates larger than 0.3 microns.

Holding Area - The air lock between the shower room and the clean room in a worker decontamination system.

HVAC - Heating, ventilation, and air conditioning, generally denoting the air-handling unit and ductwork system found in buildings.

Hygiene Facility – the incorporation into an asbestos removal enclosure clean rooms, equipment rooms, shower rooms, and decontamination rooms.

Lagging - Strips of insulating materials with which boilers, cylinders or pipes are covered. Sometimes it also refers to insulating mud and final overlays (cloth or metal).

Large Enclosure - An enclosure providing an airtight, impermeable barrier around a job involving the removal of more than 260 linear feet, 160 square feet, or 35 cubic feet of ACM. Large enclosures will most likely incorporate air locks, negative air filtering systems, hygiene facilities, contaminated equipment rooms, and waste load out rooms.

LO/TO – Lock Out/Tag Out

Lock Out/Tag Out – (LO/TO) the process for ensuring an item of equipment is secured, isolated, or shut down and to prevent its being energized. If such equipment was energized it would present a safety hazard to workers. Each worker affected by the equipment will place his/her own lock and tag on the equipment when entering an area affected by, or when starting maintenance on, the equipment. Building systems most often affected by LO/TO procedures at JSC are water distribution systems, electrical systems, HVAC systems, and fire alarm systems.

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Major Fiber Release - means the falling or dislodging of more than three (3) square or linear feet of friable ACM/ACBM. (40 CFR 763.91(f)).

Medical Examination - An evaluation of a person's health status conducted by a medical doctor.

Medical History - A person's past health record, including all the hazardous materials to which he or she has been exposed and any injuries or illnesses which might dictate future health status or work abilities.

Method 7400 - This is a NIOSH sampling and analytical method for evaluating airborne fiber concentrations using phase-contrast microscopy.

Method 7402 - This is a NIOSH sampling and analytical method for evaluating airborne fiber concentrations using transmission electron microscopy. Asbestos fibers are counted using the same fiber definitions as Method 7400.

Micron - A measurement of length equal to one millionth of a meter.

Mine Safety and Health Administration - The counterpart of OSHA for the mining industry.

Minor Fiber Release – means the falling or dislodging of 3 square or linear feet or less of friable ACM/ACBM. (40 CFR 763.91(f)).

NESHAP - National Emission Standards for Hazardous Air Pollutants under the Clean Air Act, EPA Regulation 40 CFR Part 61, as amended. The standard for asbestos emissions is found at 40 CFR 61, Subpart M, National Emission Standard for Asbestos, Sections 140-157 (40 CFR 61.140-157).

NIOSH - National Institute for Occupational Safety and Health, a division of the Centers for Disease Control and Prevention, U.S. Public Health Service, Department of Health and Human Services.

Negative Air Filtration Unit - A piece of equipment consisting of an air mover, usually electrically powered, and a HEPA filter. The unit maintains a negative pressure inside the regulated work area, a constant airflow from adjacent areas into the regulated work area, and exhausts that air to the outside.

Negative Pressure Respirator - A respirator in which the air pressure inside the respirator-inlet covering is positive during exhalation (in relation to the air pressure of the outside atmosphere) and negative during inhalation (in relation to the air pressure of the outside air).

Negative Pressure System - A local exhaust system capable of maintaining a constant, low-velocity air flow into the decontamination enclosure systems and work area from adjacent unsealed areas.

Verify this is the correct version before you use it by checking the on-line version.

OSHA - The Occupational Safety and Health Administration, a division of the U.S. Department of Labor established by the Occupational Safety and Health Act (OSH Act) of 1970. Regulations promulgated by OSHA govern occupational safety and health issues affecting the working population in the general industry, the construction industry, and other industrial classifications.

PACM – Presumed Asbestos-Containing Material. PACM most often is thermal system insulation (TSI) and surfacing material found in buildings constructed no later than 1980.

PAT Program - Proficiency Analytical Testing program, conducted by the AIHA. A program that, through the submission of unknown standardized samples (including asbestos samples) to analytical laboratories, determines the proficiency of the laboratory in conducting analytical tests.

PEL - Permissible Exposure Limit, as established by OSHA. The PEL for asbestos exposures is 0.1 f/cc, expressed as an 8-hour TWA concentration, as stated in 29 CFR 1910.1000 and 29 CFR 1926.1101.

Permissible Exposure Limit – (PEL) as established by OSHA. The PEL for asbestos exposures is 0.1 f/cc, expressed as an 8-hour TWA concentration, as stated in 29 CFR 1910.1000 and 29 CFR 1926.1101.

Personal Air Sampling/Air Monitoring - This is the sampling of the asbestos fiber concentration within the breathing zone of a worker in an asbestos work area.

Personal Protective Equipment – PPE.

Phase Contrast Microscopy - A technique, using a light microscope adapted with phase contrast optical elements to provide enhanced contrast between the fibers and the background, that counts fibers on filters through which a volume of air has been pulled. The technique does not distinguish fiber types. This is the standard technique recognized by OSHA.

PPE – Personal protective equipment.

Presumed Asbestos-Containing Material (PACM) – material presumed to be ACM. PACM most often is thermal system insulation (TSI) and surfacing material found in buildings constructed no later than 1980.

Protection Factor - The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of protection provided by a respirator to the wearer.

Plenum - An air compartment connected to one or more ducts as part of an air distribution system. In many buildings, the space between the building structure and a false ceiling is used as a return air plenum in the building HVAC system.

Verify this is the correct version before you use it by checking the on-line version.

Asbestos Glossary (cont.)

Regulated Area - An area established that identifies where airborne concentrations of asbestos fibers exceed, or may be expected to exceed, the PEL. Specific controls are required by OSHA regulation in conducting activities in these areas.

Removal – means taking out or stripping substantially all ACM/ACBM from a damaged area, a functional space, or a homogeneous area in a building. (40 CFR 763)

Repair – means returning damaged ACM/ACBM to an undamaged condition or to an intact state so as to prevent fiber release. (40 CFR 763)

Respirator - A respiratory protection device consisting of a face piece connected either to an air source or an air-purifying device.

Response Action – A term from the EPA that means a method, including removal, encapsulation, permanent enclosure, repair, operations and maintenance, that protects human health and the environment from friable ACBM. (40 CFR 763).

SAI - Spray-applied insulation, insulating materials containing one or more types of asbestos sprayed on, generally to the interior surfaces of buildings.

Scanning Electron Microscopy - A method of microscopic analysis that uses an electron beam directed at a sample and then collects the beams that are reflected to produce an image from which fibers can be identified and counted.

Self-Contained Breathing Apparatus - a respiratory protection device usually consisting of a face piece connected by a hose and a regulator to an air source (compressed air, compressed oxygen, or an oxygen-generating chemical) carried by the wearer.

Sealant - A chemical agent applied to ACM to fix the material and reduce the potential for fiber release into the ambient environment (see encapsulant).

Small Enclosure - An enclosure providing a control around a job larger than what a glovebag will accommodate, or is needed to provide more protection than a barrier system. The small enclosure is generally limited in size and used for small-scale, short-duration activities. A small enclosure may not involve the use of negative pressure systems, but will have an entrance chamber or multiple entry flaps. Small enclosures rely on HEPA-filtered vacuums and wet methods to control fiber concentrations.

Surfacing Material - includes material that is sprayed, troweled on, or otherwise applied to surfaces of ceilings, structural members, and other surfaces for fireproofing, acoustical, and other purposes.

Surfactant - A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

Verify this is the correct version before you use it by checking the on-line version.

TCEQ – Texas Commission on Environmental Quality. The TCEQ has established requirements for the disposal of asbestos waste.

TDH - Texas Department of Health (see below).

TLV – Threshold Limit Value, an airborne exposure guideline developed by the American Conference of Governmental Industrial Hygienists (ACGIH) (see below).

TNRCC - Texas Natural Resource Conservation Commission. The TNRCC was renamed the TCEQ on September 1, 2002.

TWA – time weighted average (see below).

Threshold Limit Value (TLV) – an exposure guideline developed by the by the American Conference of Governmental Industrial Hygienists (ACGIH) to assist in the control of health hazards. The TLV refers to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. The ACGIH TLV for asbestos is 0.1 fibers per cubic centimeter of air (f/cc), expressed as an 8-hour time weighted average (TWA) concentration.

Texas Department of Health (TDH) - The TDH mission is to protect and promote the physical and environmental health of the people of Texas from asbestos.

> The TDH Asbestos Programs Branch has two programs to meet these concerns. The Licensing Program issues licenses to persons qualified for asbestos-related work in public buildings. The Enforcement Program has regional inspectors available to monitor asbestos removal in buildings, and to respond to community concerns to ensure that public exposure is minimized. The TDH has established rules and regulations for asbestos in the Texas Administrative Code, Title 25, Health Services, Part I, Texas Department of Health, Chapter 295, Occupational Health (25 TAC 295). These regulations and other information can be found at the TDH Internet web site for asbestos programs URL: http://www.tdh.state.tx.us/beh/asbestos/
>
> The TDH has also been designated as the Texas regulatory agency to ensure compliance with the Clean Air Act, NESHAPS, and associated EPA standards and regulations. Asbestos emissions from abatement activities and building demolitions are regulated under NESHAPS.

Time Weighted Average (TWA) - The average concentration of a contaminant in air during a specific time interval.

Transmission Electron Microscopy - A method of microscopic analysis that focuses an electron beam onto a thin sample. As the beam penetrates (transmits) through the sample, the difference in densities produces an image on a fluorescent screen from which asbestos fibers can be identified and counted.

Verify this is the correct version before you use it by checking the on-line version.

Attachment 12H

Asbestos Glossary (cont.)

Wet Cleaning - The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, and other cleaning tools that have been dampened with amended water and of disposing of these cleaning tools as asbestos-contaminated waste.

Work Area - The room or space where asbestos-related work or removal operations are performed which is defined and/or isolated to prevent the spread of asbestos dust, fibers, or debris and to prevent entry by unauthorized personnel (see regulated area).

Worker - A person engaged in the abatement of asbestos, or performing a task in which asbestos exposure is likely. Distinguished from an asbestos worker, who is one routinely exposed to asbestos fiber concentration levels in excess of the action level of 0.1 f/cc on an 8-hour TWA.

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Glossary of terms and definitions

Verify this is the correct version before you use it by checking the online version.

The following definitions are used in this document:

Acceptable entry conditions - the circumstances that must exist in a permit-required confined space to allow authorized entrants to safely enter into and work within the space

Administrative control - any procedure that limits hazard exposure (such as noise) by control of work schedules

Affected employee - an employee who operates or directly uses equipment which is serviced or maintained under lockout/tagout

Air, makeup - outdoor air supplied to replace exhaust air

Air-purifying respirator - a canister, cartridge, dust mask or the like used to remove contamination from an atmosphere that contains a normal oxygen level

Article - a material that meets the following criteria:

- It is in a specific shape or design as a result of its manufacture
- It has end use function(s) dependent in whole or in part upon its shape or design during end use
- It doesn't release, or otherwise result in exposure to, a hazardous chemical under normal conditions of use

Asbestos - a group of naturally occurring minerals that separate into fibers; these include chrysotile, amosite, crocidolite, anthophyllite, tremolite, and actinolite

Asbestos abatement - management activities that occur when it is likely that the action level (0.1 fibers per cubic centimeter) will be exceeded, such as during encapsulation or removal

Asbestos-containing material (ACM) - any material which contains 1% or more, by weight, of asbestos

Asbestos worker - an employee who is involved in asbestos abatement activities

Attendant - an individual stationed outside one or more permit-required confined spaces who monitors the authorized entrants and who performs the attendant's duties

Audiogram - a chart, graph, or table resulting from an audiometric test; an audiogram shows an individual's hearing threshold level as a function of frequency

Authorized employee - a person who locks out or tags out machines or equipment to service or maintain that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include servicing or maintenance covered under this section.

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Authorized entrant - an employee who is authorized by the employer to enter a permit-required confined space

Battery - one or more cells in a single package to provide DC power source

Blanking or blinding - the absolute closure of a pipe, line, or duct by fastening a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that can withstand the maximum pressure of the pipe, line, or duct with no leakage beyond the plate

Bloodborne pathogens - pathogenic microorganisms that are present in human blood and can cause disease in humans; these pathogens include hepatitis B virus (HBV) and human immunodeficiency virus (HIV)

Bonding - minimizing potential difference between conductive objects to prevent static discharge

"Capable of being locked out" - an energy-isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which a lock can be attached, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy-isolating device or permanently alter its energy control capability.

Cell - basic unit for conversion of chemical energy to electrical energy and also for the reverse for rechargeable cells

Certifying officer - the person designated by the cognizant JSC line organization to administer the certification program

Chemical - any element, compound, or mixture of elements or compounds

Classes of fires -

- **Class A** - a fire involving ordinary combustible materials such as paper, wood, cloth, and some rubber and plastic materials
- **Class B** - a fire involving flammable or combustible liquids, flammable gases, greases and similar materials, and some rubber and plastic materials
- **Class C** - a fire involving energized electrical equipment
- **Class D** - a fire involving combustible metals such as magnesium, titanium, zirconium, sodium, lithium, and potassium

Close call - an occurrence in which there is no injury, no property or equipment damage, and no significant interruption of productive work, but which possesses a high potential for any of the mishaps as defined in Paragraph 106.3; for JSC, this will include mishaps resulting in only property damage less than $1,000 in value

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Combustible liquid - any liquid having a closed cup flash point at or above 100°F (37.8°C), but below 200°F (93.3°C), except any mixture having components with flash points of 200°F (93.3°C) or higher, the total volume of which makes up 99% or more of the total volume of the mixture; combustible liquids are subdivided as follows:

- **Class II** - those having flash points at or above 100°F (37.8°C) and below 140°F (60°C)
- **Class IIIA** - those having flash points at or above 140°F (60°C) and below 200°F (93.4°C)
- **Class IIIB** - those having flash points at or above 200°F (93.4°C)

Compensation - compensation payable under the Federal Employees Compensation Act includes lost wage replacements, scheduled awards, medical expenses, money paid on account of death, and payments for approved vocational rehabilitation to employees who are disabled as a result of their employment

Competent person (for Chapter 7.2 only) - a person who has demonstrated the knowledge and skills necessary to administer certain aspects of JSC's respiratory protection program, such as emergency rescue from confined spaces, hazard assessments, air monitoring, fit-testing and training

Confined space - a space of any size or shape that meets all the following conditions:

- It is large enough and so configured that an employee can enter and perform assigned work
- It has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may limit means of entry)
- It isn’t designed for continuous employee occupancy

Container - any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that may contain a hazardous chemical; in Chapter 9.2, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle aren’t considered to be containers

Contaminated - having the presence, or the reasonably anticipated presence, of blood or other potentially infectious materials on an item or surface

Continuation of pay (COP) - payment of employee’s regular wages by the employing agency for time lost due to job-related, disabling traumatic injuries, with no charge to employee's sick or annual leave; this period must never exceed 45 calendar days and doesn’t need to be consecutive days; in cases where there is no immediate time loss, the first time loss following, due to the injury, is the first day of COP; this time loss must be taken within 90 days from the date of injury to begin using any balance of the 45 COP days

Contracting Officer - a designated person who performs administrative functions listed in the NASA Procurement Regulations

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Contractor - a non-Federal employer working under a NASA contract, whether as prime contractor or subcontractor

Cooling tower - a system used to dissipate heat from a building, it removes heat from water-cooled condensers of air conditioning systems; the water in a closed loop is usually cooled by contact with outside air or by spray ponds

Costs (for Chapter 2.7 only) **-** direct costs of repair, retest, program delays, replacement, or recovery of NASA materials including hours, material, and contract costs, but excluding indirect costs of cleanup, investigation (either by NASA, contractor, or consultant), injury, and by normal operational shutdown; materials or equipment replaced by another organization at no cost to NASA will be calculated at "book" value, including those mishaps covered by insurance

Credible failure - a failure which can occur and is reasonably expected to occur; in this handbook, failures of structure, pressure vessels, and pressurized lines and fittings aren't considered credible failure modes if those elements follow applicable safety factor requirements

Critical system - any facility support system or test system whose loss could result in injury to test personnel, property damage, or failure to detect or shut off a hazardous condition

Cumulative trauma disorder (CTD) - a health disorder from repeated biomechanical stress due to ergonomic hazards; CTDs are a class of musculoskeletal disorder involving damage to the tendons, tendon sheaths, synovial lubrication of the tendon sheaths, and the related bones, muscles, and nerves of the hands, wrists, elbows, shoulders, neck and back

Decibel (dB) - a unit of measurement of sound pressure level; the decibel level of a sound is the logarithm of the ratio of sound pressure to a reference pressure; the dB has meaning only when the reference is known; the internationally accepted reference pressure used in acoustics is 20 micropascals

Decibels, A-weighted (dBA) - a sound level reading in decibels made on the A-weighted network of a sound pressure level meter (SLM) at slow response

Disability - loss of ability to perform work; such loss may be partial or total and temporary or permanent

Disinfect - to remove contaminants and inhibit the action of agents that cause infection or disease

Dive team - underwater swimmers and support employees involved in an underwater operation, including the designated person in charge

Diver - an employee swimming in water using underwater apparatus that supplies compressed breathing gas at the ambient pressure

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Double block and bleed - to close a line, duct, or pipe by:

- Closing and locking or tagging two in-line valves and
- Opening and locking or tagging a drain or vent valve in the line between the two closed valves

Drop line - a vertical line from a fixed anchorage, independent of the work surface, to which a lanyard is affixed

Emergency (for Chapter 6.10 only) - any occurrence, including any failure of hazard control or monitoring equipment, internal or external to the permit-required confined space that could endanger entrants

Emergency Preparedness Plan - a written document intended to: mitigate the effects of a hazard; prepare (including preplanning) measures to be taken which will preserve life and minimize damage; describe responses to emergencies requiring the use of JSC resources and provide necessary assistance; and establish a recovery system that returns the Center to normal operations after an incident

Emergency rescue services - the personnel designated to rescue employees from permit-required confined spaces

Employee Representative - any official of any labor bargaining unit (such as a union) that represents civil service or contractor employees

Employer - Under the JSC safety and health program, an "employer," as used by OSHA, is the company for contractor employees and the supervisor for civil service employees

Enclosed environment - a test environment in a closed structure that has no venting, flow-through, or introduction of outside gases

Energized - connected to an energy source or containing residual or stored energy. Any energy level above the magnitude listed below is automatically energized. Any lesser magnitude or form of energy not listed must be evaluated on a case-by-case basis to determine if this procedure is necessary to ensure safety.

- **Electrical** - 50 volts
- **Thermal** - 130°F
- **Radiation** - any regulated source of ionizing or non-ionizing radiation.
- **Chemical** - explosive, flammable, corrosive, or toxic solids, liquids, or gases
- **Mechanical** - flywheels, springs, suspended weights must be evaluated
- **Hydraulic or Pneumatic** - 150 p.s.i.

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Energy control - an Energy Isolating Device placed on a system to isolate that system from operation. This form of Energy Control is used on various occasions to include long term shut down of the system for maintenance, construction, mothball, or demolition of the system. [Note: This energy control will not be accepted as the lockout protection for any employee. Each employee must use his or her own lock and tag to provide personal protection.]

Energy-isolating device - a mechanical device that physically prevents the transmission or release of hazardous energy, including, but not limited to:

- A manually operated electrical circuit breaker
- A disconnect switch
- Manually operated switch where the circuit conductors can be disconnected from all ungrounded supply conductors and no pole can be operated independently
- A slide gate
- A slip blind
- A line valve
- A block
- Any similar device used to block or isolate energy

Devices not included:

- Push buttons
- Selector switches
- Other control circuit-type devices

Energy source - any source of electrical, hydraulic, pneumatic, chemical (toxic, flammable, or corrosive material), thermal, or other energy

Engineering controls (for Chapter 7.2 only) - any method of controlling employee exposures to toxic materials by eliminating or modifying the source or reducing the quantity of contaminants released into the work environment

Engineering controls (for Chapter 7.4 only) - any method for isolating or removing a hazard from the workplace

Engineering controls (for Chapter 5.5 only) - engineered CTD risk control measures which include, but aren't limited to, devices such as work stations, tables, chairs, equipment, tools, and physical modifications to work stations, equipment, tools, production processes, or any other aspect of the work environment

Engulfment - the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing

Verify this is the correct version before you use it by checking the online version.

Entry - the action by which a person passes through an opening into a permit-required confined space; entry includes work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space

Entry permit - the written document JSC Form 1476 which is a checklist that provides a systematic review of operational exposures in confined spaces

Entry procedure - the written document, which details the required procedures and equipment required for safe entry into a specific confined space

Entry supervisor - the person responsible for determining if acceptable entry conditions are present at a permit-required confined space where entry is planned, for authorizing entry, and overseeing entry operations, and for terminating entry as required by this program. (*NOTE: An entry supervisor may also serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this program for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.*)

Ergonomics - a multidisciplinary activity dealing with the interactions between a person and his total working environment, plus such traditional environmental elements as atmosphere, heat, light and sound as well as all tools and equipment of the workplace

Ergonomic hazard - any workplace condition that poses a biomechanical stress to the worker; such hazardous workplace conditions include faulty work station layout, improper work methods, improper tools, excessive tool vibration, and job design problems that include aspects of work flow, line speed, posture and force required, work/rest regimens, and repetition rate

Explosive - a chemical compound, mixture, or device that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature; the term includes, but isn’t limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, and igniters, any material determined to be within the scope of Title 18, United States Code, Chapter 40, "Importation, Manufacture, Distribution, and Storage of Explosive Materials," and also includes any material classified as an explosive by the Hazardous Materials Regulations of the U.S. Department of Transportation (NFPA 495, "Explosive Materials Code")

Exposure or **Exposed** - means that an employee is subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.), and includes potential (e.g. accidental or possible) exposure

Facility organization (for Chapter 6.9 only) - an organization that is responsible for operating and maintaining a test facility and that conducts tests for test-requesting organizations

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Fire area - an area of a building separated from the rest of the building by construction with a fire resistance of at least 1 hour and having all communicating openings properly protected by an assembly having a fire resistance rating of at least 1 hour

Fire extinguisher - a portable device containing powder, liquid, or gases that are expelled under pressure to suppress a fire

First aid - any one-time treatment, and any follow-up visit for the purpose of observation, for minor scratches, cuts, burns, splinters, and so forth, that don't ordinarily require medical care; such one-time treatment, and follow-up visit for the purpose of observation, is considered first aid even though provided by a physician or registered professional personnel

Fit factor - a quantitative measure of the fit or sealing performance of a particular respirator to a particular individual; usually expressed as the ratio of challenge concentration outside the respirator to the concentration inside the respirator

Fit test - a test to determine an individual's ability to obtain a good face-to-face piece fit with a particular respirator. The outcome determines whether the required fit factor was achieved under a given set of physical conditions

Fixed anchorage - a secure point of attachment, not part of the work surface, for attaching drop lines, lifelines, or lanyards

Flammable - a chemical that falls into one of the following categories:

- **Aerosol, flammable** - an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening
- **Gas, flammable** - (1) a gas that ignites at ambient temperature and pressure when in a mixture of 13% by volume or less of air; or (2) a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit
- **Liquid, flammable** - any liquid with a flash point below 100°F (37.8°C), except any mixture of components with flash points of 100°F (37.8°C) or higher, the total of which make up 99% or more of the total volume of the mixture (see classes below)

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- **Solid, flammable** - a solid, other than a blasting agent or explosive as defined in 1910.109(a), that could cause a fire through friction, absorbing moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard; a chemical must be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis

Flammable liquid - a liquid having a closed cup flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 psia (2068 mm Hg) at 100°F (37.8°C) must be known as a Class I liquid with subdivisions as follows:

- **Class IA** - those having flash points below 73°F (22.8°C) and having a boiling point below 100°F (37.8°C)
- **Class IB** - those having flash points below 73°F (22.8°C) and having a boiling point at or above 100°F (37.8°C)
- **Class IC** - those having flash points at or above 73°F (22.8°C) and below 100°F (37.8°C)

Flash point - the temperature at which a liquid gives off vapor sufficient to form an ignitable mixture with the air near the surface of the liquid or within the vessel used (as determined by appropriate test procedure and apparatus specified in NFPA 30) but insufficient to sustain a flame. It is also the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

- **Tagliabue Closed Tester** (see "American National Standard Method of Test for Flash Point by Tag Closed Tester," Z11.24-1979 [ASTM D 56-79]) for liquids with a viscosity of less than 45 Saybolt University Seconds (SUS) at 100°F (37.8°C), that don't contain suspended solids and don't have a tendency to form a surface film under test
- **Pensky-Martens Closed Tester** (see "American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester," Z11.7-1979 [ASTM D 93-79]) for liquids with a viscosity equal to or greater than 45 SUS at 100°F (37.8°C), or that contain suspended solids, or that have a tendency to form a surface film under test
- **Setaflash Closed Tester** (see "American National Standard Method of Test for Flash Point by Setaflash Closed Tester" [ASTMD 3278-78]) organic peroxides, which undergo auto accelerating thermal decomposition, are excluded from any of the flash point determination methods specified above

Flight hardware - hardware intended to be used in spaceflight

Food - any raw, cooked, or processed edible substance, ice, beverage, or ingredient used or intended for use or for sale in whole or in part for human consumption

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Food contact surface - those surfaces of equipment and utensils with which food normally comes in contact, and those surfaces from which food may drain, drip, or splash back onto surfaces normally in contact with food

Food service employee - individuals having supervisory or management duties and any other person working in a food service establishment

Food service establishment - any place where food is prepared and intended for individual portion service, and includes the site at which individual portions are provided

Government vehicle - a commercially leased or U.S. government agency-owned motor vehicle being used in support of Federal operations

Ground-level ambient atmosphere - the normal pressure and gas composition of the air surrounding the test facility or any other building

Grounding - minimize potential difference between object and ground to prevent static discharge

Hazard assessment - an evaluation by the Occupational Health and Human Test Support Office of the potential health hazards posed by a specific task or operation

Hazardous activity - one that involves credible risks or dangers to personnel or facilities and equipment of JSC; include, but aren't limited to, activities associated with human-tended hypobaric chambers, zero-g testing, and the Energy Systems Test Area

Hazardous atmosphere (for Chapter 6.10 only) - an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to escape unaided from a permit-required confined space, injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10% of its lower explosive limit (LEL)
- Airborne combustible dust at a concentration that meets or exceeds its LEL
- Atmospheric oxygen concentration below 19.5% or above 23.5%
- Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in 29 CFR 1910 Subpart G, "Occupational Health and Environmental Control," or in 29 CFR 1910 Subpart Z, "Toxic and Hazardous Substances," and which could result in employee exposure in excess of its dose or permissible exposure

NOTE: An atmospheric concentration of any substance that isn't capable of causing death, incapacitation, impairment of ability to escape unaided, injury, or acute illness due to its health effects isn't covered by this provision.

- Any other atmospheric condition that is immediately dangerous to life or health

NOTE: For air contaminants for which OSHA hasn't determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets, can provide guidance in establishing acceptable atmospheric conditions.

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Hazardous chemical - any chemical which is a physical danger or a health danger

Hazardous material - any element, chemical compound, or mixture of elements or compounds that pose a physical or health threat to personnel, the environment, or the general public through planned or unplanned events; included in this definition are articles which fail any of the three tests under the definition of "Article" above

Hazardous material (for Chapter 9.1 only) - a substance that poses a danger to human health, safety, or the environment, or which meets the definition of a "hazardous chemical" under the hazard communication program (see OSHA 29 CFR 1910.1200 and Chapter 9.2 of this handbook)

Hazardous noise - a danger from noise exists whenever an operation, process, or procedure generates noise of sufficient duration and intensity to be capable of producing a permanent loss of hearing in an unprotected person

Hazardous operation - an operation that involves materials, conditions, or equipment that could result in personnel or property damage if special precautions aren't followed

Hazardous test - a test where any test subject, test team member, observer, or member of the public is exposed to or has the potential to be exposed to a hazardous condition

Health hazard - a material "for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees; includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes" (29 CFR 1910.1200, Nov. 1983)

Hot-tap - a procedure that involves welding a piece of equipment while under pressure, to install connections or appurtenances.

Hot work permit - JSC Form 1475, "Hot Work, Welding, Cutting Permit" (Appendix 3B), which provides written authorization to perform operations (such as welding, riveting, cutting, burning, and heating) that could provide an ignition source

Human test facility - a facility testing hardware or procedures involving a human test subject

Hyperbaric environment - any atmosphere at an absolute pressure greater than ground-level ambient pressure by more than 0.1 psia

Hypobaric environment - see vacuum environment

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Immediately dangerous to life or health (IDLH) - any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit-required confined space *NOTE: Some materials—hydrogen fluoride gas and cadmium vapor, for example—may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possible fatal collapse 12-72 hours after exposure. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.*

Imminent danger - conditions or practices in any NASA/JSC or contractor workplace where a risk exists that could reasonably be expected to cause death or serious physical harm immediately or before the imminence of such risk can be eliminated through normal procedures; these will be identified by Risk Assessment Code (RAC) 1 (see Chapter 3.2)

Impulse or impact noise - variations in noise levels that involve peaks of intensity that occur at intervals of greater than 1 second; if the noise peaks occur at intervals of 1 second or less, the noise is considered continuous

Infectious waste - blood and blood products, contaminated sharps, pathological refuse and microbiological refuse

Inspection - a comprehensive survey of all or part of a workplace by qualified employees in order to detect safety or health hazards; inspections are normally performed during the regular work hours of the agency, except as special circumstances may require

Institutional program - a distinct institutional activity or task conducted on JSC or contractor property and which requires the use of government or contractor ground-based resources; examples include facility design, construction, modification, demolition, repair, facility operations, test operations, manufacturing (fabrication) operations, service operations, and maintenance operations; spaceflight program operations conducted on orbit are excluded from this definition

Isolation (for Chapter 6.10 only) **-** the process by which a permit-required confined space is removed from service and completely protected against the release of energy and material into the space by such means as blanking or blinding; misaligning or removing sections of line, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages

Label - any written, printed, or graphic material, displayed on or affixed to containers of hazardous chemicals

Label (for Chapter 9.3) **-** the written, printed, or graphic matter on or attached to a pesticide or device or any of its containers or wrappers

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Labeling - a paper or written, printed, or graphic matter prepared by a registrant

- Accompanying the pesticides or device at any time; or
- To which reference is made on a printed paper or tag or in literature accompanying or referring to a pesticide or device, except accurate, non-misleading references made to a current official publication of a Federal or State institution or agency authorized by law to conduct research in the field or pesticides

Laboratory (for Chapter 6.6 only) **-** a facility in which individually operated, small-scale chemical operations are conducted or performed

Laboratory - a facility concerned with the analysis of or the experimentation with materials, substances, and equipment; also included are certain equipment, repair, and calibration operations, and the processing of materials

Lanyard - a flexible line to secure a wearer of a safety belt or harness to a drop line, lifeline, or fixed anchorage

Lead - a heavy, soft, malleable, bluish-gray metal that may be in its metallic state, in inorganic compounds, and organic soaps; excluded are all other organic compounds (e.g., the standard isn't designed to protect you from exposure to leaded gasoline)

Lifeline - a horizontal line between two fixed anchorages, independent of the work surface, to which the lanyard is secured either by tying off or by means of a suitable sliding connection

Lock out - placing a lockout device on an energy isolating device under established procedures and ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout device - a device that uses a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

Lost time case - a nonfatal traumatic injury that causes any loss of time from work beyond the day or shift it occurred; or a nonfatal nontraumatic illness or disease that causes disability at any time; for civil service employees, the time lost may be less than a full, 8-hour workday; for all other employees, only a full workday lost is counted

Lost workday cases - injuries and illnesses that involve days away from work or days of restricted work activity; this classification applies to contractor or private sector employees, not to civil service employees

Lost workdays – away from work - the number of workdays (consecutive or not) during which the employee would have worked but couldn't because of an occupational injury or illness

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Lost workdays – restricted work activity - the number of workdays (consecutive or not) during which, because of injury or illness

- The employee was assigned to another job on a temporary basis;
- The employee worked at a permanently assigned job less than full time; or
- The employee worked at a permanently assigned job, but couldn't perform all duties normally connected with the job

Lower explosive limit (LEL) - the minimum concentration of a combustible or flammable gas or vapor that will ignite if an ignition source is present; the terms "lower explosive limit" and "lower flammable limit" have the same meaning

Material safety data sheet (MSDS) - written or printed material about a hazardous chemical that describes the characteristics, properties, associated hazards, and other relevant material

Medical care - for civil service employees, if an injury is accepted as compensable under FECA, the injured employee is entitled to all medical care that is required to cure, give relief, or reduce the degree or period of disability; it will be provided as long as the evidence indicates it is needed for the effects of the job-related injury

Medical treatment - treatment administered by a physician, or by licensed or registered professional personnel under standing orders of a physician, for an occupational injury or illness which doesn't result in days away from work or days of restricted work activity; doesn't include first aid treatment, even though provided by a physician or licensed or registered professional personnel; this definition applies to all employees, both civil servant and private sector

Mishap - any unplanned occurrence, event, or anomaly that meets one of the definitions below; injury to a member of the public while on JSC facilities is also defined as a NASA mishap

- **Type A mishap** - a mishap causing death or damage to equipment or property equal to or greater than $1,000,000; mishaps resulting in damage to aircraft or space hardware, i.e., flight and ground support hardware, meeting this criterion are included; this definition also applies to a test failure if the damage was unexpected or unanticipated or if the failure is likely to have significant program impact or visibility
- **Type B mishap** - a mishap resulting in permanent disability to one or more persons, or hospitalization, for other than observation of three or more persons, or damage to equipment or property equal to or greater than $250,000 but less than $1,000,000; mishaps resulting in damage to aircraft or space hardware which meet this criterion are included, as are test failures where the damage was unexpected or unanticipated
- **Type C mishap** - a mishap resulting in damage to equipment or property equal to or greater than $25,000 but less than $250,000, or causing occupational injury or illness which results in a lost workday case; mishaps resulting in damage to aircraft or space hardware and test failures that meet these criteria are also included

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- **Mission failure -** any mishap or event of such a serious nature that it prevents accomplishment of a majority of the primary mission objectives; a mishap of whatever intrinsic severity that, in the judgment of the Program Associate Administrator, in coordination with the Associate Administrator for Safety, Reliability, Maintainability, and Quality Assurance, NASA Headquarters, prevents the achievement of primary mission objectives as described in the Mission Operations Report
- **Incident -** a mishap consisting of less than Type C severity of injury to personnel, but more than first aid severity, or property damage equal to or greater than $1,000 but less than $25,000; events which have small property loss, less than $1,000, should be reported as incidents if they have significantly greater potential or high visibility

Mist - finely divided liquid suspended in air, usually generated by condensation or by dispersion of a liquid (e.g., by splashing, foaming, or atomizing)

Mixture - any combination of two or more chemicals if the combination isn't, in whole or in part, the result of a chemical reaction

Motor vehicle - a motor-propelled conveyance of a commercial design that provides transportation (personnel and cargo) and is capable of being licensed by the State or local authority having jurisdiction (Examples are automobiles, pickup trucks, buses, stake-bed trucks, and vans.)

Must - indicates that the rule is mandatory; noncompliance with a "must" statement requires approval of a variance

NASA employee - any person other than detailed members of the Armed Forces and contractor employees required to work by NASA

Neutral Buoyancy Facility - test facility designed for simulating weightless conditions underwater involving personnel either in a pressure suit or by scuba gear

Noise hazard area - any work area with a noise level of 85 dBA or greater

Nominal - the root mean square (RMS) of the voltage; the RMS is a value assigned to represent the effective voltage and current levels of a power system

Nonopen water operations - underwater operations conducted in controlled environments under carefully prescribed laboratory or test conditions (such as swimming pools) which don't exceed depths beyond the no-decompression limit and which meet the exemption criteria of OSHA 29 CFR 1910.401(a)(2), Subpart T

Non-permit-required confined space - a confined space that doesn't contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm

Occupancy -

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- **Assembly -** include, but aren't limited to, all buildings or portions of buildings used for gathering together 50 or more persons for such purposes as deliberation, entertainment, amusement, or awaiting transportation
- **Business -** those used for the transaction of business, for the keeping of accounts and records, and for similar purposes
- **Industrial -** facilities devoted to operations such as processing, assembling, mixing, packaging, finishing or decorating, and repairing, including, among others, laboratories, power plants, pumping stations, and hangars (for servicing or maintenance)
- **Storage -** all buildings or structures utilized primarily for the stocking or sheltering of goods, merchandise, products, or vehicles; included, among others, are warehouses, freight terminals, and hangars (for storage only)

Occupational illness - an abnormal condition produced by systemic infection, continued or repeated stress or strain, exposure to toxins, radiation, high noise levels, etc., or other continued and repeated exposure to conditions of the work environment over a period of time longer than 1 day or work shift

Open water operations - operations conducted under any of the following conditions:

- In uncontrolled environments such as the open sea, in waterways, in lakes, and in rivers, which are strongly influenced by changes in the local environment
- At depths beyond the no-decompression limit
- Not otherwise exempt by OSHA 29 CFR 1910.401(a)(2), Subpart T, "Commercial Diving Operations" (see Paragraph 220.4.2)

Occupational Safety and Health Administration(OSHA) recordable mishaps - an occupational death, injury, or illness that must be recorded subject to OSHA requirements in 29 CFR 1960 and 29 CFR 1904 on the Log of Occupational Injuries and Illnesses, OSHA Form 300; these are occupational deaths, nonfatal occupational illnesses, and those nonfatal occupational injuries that involve one or more of the following: loss of workdays: loss of consciousness; restriction of work or motion; transfer to another job; or medical treatment other than first aid; by OSHA definition, hospitalization of an employee for observation purposes only, without subsequent injury determination, isn't a recordable injury

Other employee - an employee whose duties are routinely performed in an area or facility where energy or material control procedures are used, but neither service nor operate the equipment requiring energy or material controls

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Other potentially infectious materials - includes

- Semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, and any body fluid that is visibly contaminated with blood
- Any unfixed tissue or organ (other than dead skin) from a human (living or dead)
- HIV- or HBV-containing cells or tissue cultures, organ cultures, and culture medium; and blood, organs, or other tissues from experimental animals infected with HIV or HBV

Oxygen-enriched environment - From ASTM G 63-99 1999, a fluid (gas or liquid) that contains more than 25 mol % oxygen (oxygen greater than 25% by volume).

Permissible exposure limit (PEL) - the maximum time-weighted concentration of asbestos generally considered or recognized as having no adverse long- or short-term effects; OSHA has established 0.2 f/cc on an 8-hour basis and a 1.0 f/cc excursion limit on a 30-minute basis as the PEL and has structured the regulatory program for control of asbestos accordingly

Permit-required confined space - a confined space that has one or more of the following characteristics:

- Contains, or has a potential to contain, a hazardous atmosphere
- Contains a material that has the potential for engulfing an entrant
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section
- Contains any other recognized serious safety or health hazard

Personal protective equipment (PPE) - clothes, padding, gloves, devices, equipment, or other items worn on or attached to the body, and used for the purpose of controlling CTD risk (lumbar supports aren't PPE)

Pesticide - a substance or mixture of substances intended to prevent, destroy, or mitigate any pest, or any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant

Physical hazard - a chemical for which there is scientifically valid evidence that it is a combustible liquid, a gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive

Physiological training - training to familiarize personnel who are exposed to a lowered or increased barometric pressure with the physiological stresses encountered and the means for overcoming these stresses

Powered air-purifying respirator - an air-purifying respirator that supplies cartridge filtered breathing air to the facepiece by means of a battery-operated pump

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Primary - cell or battery that isn't to be recharged

Primary cause - the major anomalous event immediately preceding a mishap in the absence of which the mishap wouldn't have occurred

Probability - the likelihood that an identified hazard will result in a mishap based on an assessment of such factors as location, exposure in terms of cycles or hours of operation, and affected population

Produce - to manufacture, process, formulate, or repackage

Prohibited conditions - any condition in a permit-required confined space that isn't allowed during the period when entry is authorized

Prohibited material - a hazardous material that is extremely hazardous to human health, safety, or the environment and must never be purchased or used for any purpose without a waiver from the Hazardous Review Subcommittee

Propellants - explosive substances that normally function by deflagration and are used for propulsion purposes; such substances may be Class A or Class B explosives, depending on susceptibility to detonation (Class A explosives pose detonating or otherwise maximum hazard, such as dynamite or desensitized nitroglycerin; Class B explosives pose flammability hazards, such as smokeless propellants or photographic flash powders.)

Protective clothing - an article of clothing worn essentially for personal safety and protection while performing work assignments in hazardous areas, under hazardous conditions, or under controlled environmental conditions of clean rooms, laboratories, etc. Typical items of protective clothing are steel toe shoes, hardhats, fire retardant and acid resistant clothing, cryogenic handler suits, gloves, aprons, etc.

Protective equipment - a device or item worn or used for the safety and protection of personnel or the public when entering or working in hazardous areas or under hazardous conditions; devices or items include, but aren't limited to, respirators and gas masks, welding helmets and shields, safety goggles and spectacles, safety belts and lifelines

Pyrophoric - a chemical that will ignite spontaneously in air at a temperature of 130°F (54.4 °C) or below

Qualified person - for purposes of verifying isolation under paragraph 9.b, this is an employee, which an employer has specifically identified as having sufficient training to verify previously energized parts are free of energy.

Reactive - a chemical which, in the pure state or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature

Verify this is the correct version before you use it by checking the online version.

Reprisal - any act of restraint, interference, coercion, or discrimination against any employee for exercising his or her rights under Executive Order 12196, 29 CFR 1960, or for participating in JSC's safety and health programs

Respirator users - personnel who use any type of respirator for any purpose, regardless of frequency (includes routine, emergency and escape only users)

Restricted material - a hazardous material identified as posing a significant risk to human health and safety, or the environment and therefore requiring the special attention of management.

Retrieval equipment - the equipment (including rescue line, chest or full body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit-required confined spaces

Safety and Health Inspector - a safety or occupational health specialist or other trained person authorized to carry out inspections and having the equipment and competence to recognize safety or health hazards in the workplace

Safety and health training - imparting safety and health knowledge or skills to an individual or group of individuals; this may be done by various methods, such as classroom instruction, safety meetings, videotape or multimedia programs, etc.

Safety belt or harness - a device for the specific purpose of securing, suspending, or retrieving a worker in or from a hazardous work area. Examples include the following:

- **Body belt** - a simple or compound strap with means for securing it about the waist and for securing a lanyard to it
- **Chest harness** - a design of simple or compound straps with means for securing it about the rib cage, with shoulder straps to ensure proper chest strap positioning, and with provisions for attaching a lanyard in the back between chest and shoulder level
- **Body harness** - a design of simple or compound straps that may be secured about the wearer in such a manner as to distribute the stopping forces over the thighs, buttocks, chest, and shoulders, or any combination thereof, and with provisions for attaching a lanyard in the back between chest and shoulder level
- **Suspension belt** - a design of simple or compound straps that may be secured about the wearer's body as an independent work support; these are commonly referred to as saddle belts, bosuns' chairs, or tree trimmers' belts

Sealed - free of cracks or other openings that allow moisture to enter or leave

Secondary - cell or battery which is rechargeable

Self-contained underwater breathing apparatus (SCUBA) - a respirator which supplies breathing air from a compressed air cylinder carried by the user

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SCUBA diving - a diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus

Serious - as used in "serious hazard," "serious violation," or "serious condition" means a hazard, violation, or conditions such that there is a substantial probability that death or life-threatening, or long-term or permanent disabling physical harm could result should a mishap occur while the hazard, violation, or conditions exist

Servicing or maintenance - constructing, installing, setting up, adjusting, inspecting, modifying, maintaining, or servicing equipment or machines. These activities include lubrication, cleaning, un-jamming, making adjustments to machines or equipment, or tool changes where an employee is exposed to unexpected energizing or startup of the equipment or release of hazardous energy.

Should - indicates that the rule is a recommendation, the advisability of which depends on the facts in each situation; implementation of a "should" statement is at the discretion of the local officials

Sound level meter (SLM) - an electronic instrument for measuring sound levels which conforms to the requirements for a Type II sound level meter as specified in ANSI S1.4-1971

Supplied air respirator - a respirator that supplies breathing air under positive pressure from a clean source to the face piece

Survivor benefits - survivors of employees who die as a result of job-related injuries or illnesses are entitled to income continuation and reimbursement for medical and burial expenses; the portion of the employee's salary awarded to survivors depends on the survivor number and dependency status; annual cost of living adjustments are provided

System (for Chapter 8.2 only) **-** Equipment such as piping, wiring, or ducting designed to store process or deliver utilities or commodities. Some examples of hazards associated with systems are fluid pressure, temperature, hazardous liquids and gasses, and electricity.

Tag out - placing a tagout device on an energy isolating device according to procedure to indicate that the energy-isolating device and equipment being controlled may not be operated until the tagout device is removed

Tagout device - a prominent warning device such as a tag and means of attachment which can be securely fastened to an energy-isolating device under an established procedure to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed

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Test - an activity conducted to accomplish any of the following where persons or hardware are subjected to one or more test environments:

- acquire data
- evaluate, qualify, or certify hardware
- train spaceflight crews
- demonstrate capabilities

Laboratory analysis, research, and experimentation which doesn't involve human subjects, flight hardware, prototype hardware, explosives, and oxygen enriched atmospheres isn't considered testing.

Test chamber - altitude chambers, vacuum chambers, and hyperbaric chambers, together with their ancillary systems and equipment, which provide an atmosphere deviating from ground-level ambient pressure or oxygen content or which involve a closed-loop life support system

Test environment - a condition to which a test system or test subject is subjected; a test environment may involve deviation from normal ground-level ambient atmosphere, the application of higher forces or energy levels (i.e., acoustic, potential, thermal, etc.) than normally experienced, or exposure to hazardous materials

Test facility - structures in which testing operations are conducted; the test facility includes the housing structure and all permanently installed systems specifically for test support; not included are generic utilities servicing other parts of the building or other facilities

Test facility support systems - permanently installed equipment that support testing operations

Test subject - a human being who is subjected to a test environment, often with little or no control over the test process

Testing - the process by which the hazards that may confront entrants of permit-required space are identified and evaluated, including specifying the tests that are to be performed in the space

Time-weighted-average (TWA) sound level - the sound level which, if constant over an 8-hour workday exposure, would result in the same noise dose as is measured

Users of hazardous material - Personnel who open the incremental hazardous material shipping container, and thereby expose the material for the purpose of mixing, transferring, burning, freezing, pouring, venting, reacting, disposing of, or otherwise using or altering the material

Vacuum environment - any atmosphere at an absolute pressure less than ground-level ambient pressure by 0.5 psia; also known as hypobaric environment

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Vapor - a gaseous form of a substance that is normally in the solid or liquid state at standard temperature and pressure

Variance - documented and approved permission to perform some act contrary to established requirements

Work area - a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present

Workplace (for Chapter 9.2 only) - an establishment, job site, or project, at one geographical location containing one or more work areas

Workplace - a physical location where NASA's work or operations are done

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Acronyms

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Acronyms

Acronym . . .	*Description . . .*
ACGIH	American Congress of Governmental Industrial Hygienists
ACM	asbestos-containing material
ANSI	American National Standards Institute
APM	Asbestos Program Manager
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CHP	chemical hygiene plan
COTR	contracting officer's technical representative
COTS	Commercial off the shelf
CTD	cumulative trauma disorder
dB	decibel
DOD	Department of Defense
DOT	Department of Transportation
DR	Discrepancy Report
DRD	data requirements description
DRL	data requirements list
DTP	detailed test procedures
EED	electroexplosive devices
EMT	emergency medical technician
EPA	Environmental Protection Agency
ESTA	Energy Systems Test Area
FAR	Federal Acquisition Regulations
FECA	Federal Employee Compensation Act

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Acronyms

Acronym . . .	*Description . . .*
GFCI	ground fault circuit interrupter
GOP	general operating procedures
HBV	hepatitis B virus
HIV	human immunodeficiency virus
HOP	hazardous operation permit
HVAC	heating, ventilation, and air conditioning
IDLH	immediately dangerous to life or health
IRB	Institutional Review Board
JHB	JSC Handbook
JMI	JSC Management Instructions
JPD	JSC Policy Directive
JPG	JSC Procedures and Guidelines
LEL	lower explosive limit
MMH	monomethylhydrazine
MO	medical officer
MPE	maximum permissible exposure
MR	medical representative
MSDS	Material Safety Data Sheet
MUCB	Materials Usage Control Board
NEC	National Electrical Code
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
NRA	non-ionizing radiation approval

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Acronyms

Acronym . . .	*Description . . .*
NRC	U.S. Nuclear Regulatory Commission
NSRS	NASA Safety Reporting System
OSHA	Occupational Safety and Health Administration, Dept. of Labor
OSHA	Occupational Safety and Health Act
PCB	polychlorinated bipenyl
PEL	permissible exposure limit
PPCE	personal protective clothing and equipment
PPE	personal protective equipment
QARSO	Quality Assurance, Reliability, and Safety Office
RAC	risk assessment code
RF	radio frequency
RSO	Radiation Safety Officer
SCBA	self-contained breathing apparatus
SCG	storage compatibility group
scuba	self-contained underwater breathing apparatus
SOW	statement of work
SPECSINTACT	specifications kept intact
SR&QA	Safety, Reliability, and Quality Assurance Office, JSC
SSPP	system safety program plan
TC	test conductor
TD	test director
TPS	Test Preparation Sheet
TRR	test readiness review
TRRB	test readiness review board
TSO	test safety officer

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Acronyms

Acronym . . .	*Description . . .*
TWA	time-weighted average
UL	Underwriters Laboratories
VPP	voluntary protection programs
WBS	work breakdown structure
WSTF	White Sands Test Facility
ZPP	zinc protoporphyrin

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