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 indicate that, there had been a change in the chemical make-up; this 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. Applicability of this chapter

You are required to 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 Clinical Services 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 shall:

a. Decide which category—I, II, III, or IV—your operation belongs in and follow the appropriate certification requirements. 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

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operation or that are listed on the permit.

d. Use the “buddy system” with at least one standby person in one of these ways:
   1. One of you does the job and the other watches from the immediate area of the job to
      make sure the “worker” is safe.
   2. Two of you do the job and you keep in constant contact with a standby person
      electronically, mechanically, or visually. The standby person shall remain in the
      immediate area where you are working.
   3. 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 need to be.

e. Take extra care, as a supervisor, to recognize and respond to dangerous situations when:
   1. Your employees work in hazardous areas they aren’t normally assigned to.
   2. 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. Category I jobs include, but are not limited to, those
listed in the table on the following page. Chapter numbers given are for chapters in this
Handbook. For Category I jobs, you shall have at least the following:

a. Classroom or on-the-job training or both for initial certification, and then as needed.

b. Written examination. Many chapters in this 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 permit (HOP), hot work permit (HWP), or confined space
   entry permit (CSE)) or physiological training if necessary.

f. Physical examination if required by the Clinical Services Branch. See Chapter 3.6,
   “Occupational Healthcare Program,” of this Handbook for more details on physical
   examinations. Physiological training may also be required.
### 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 shall determine the certification and recertification requirements with the concurrence of the Safety and Test Operations Division or the Clinical Services Branch. Category II 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 . . .

<table>
<thead>
<tr>
<th>Activity</th>
<th>Permit req’d</th>
<th>Physio trng req’d?</th>
<th>Med. exam req’d?</th>
<th>Follow requirements in . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating altitude chambers</td>
<td>HOP</td>
<td>yes</td>
<td>yes</td>
<td>Chapter 6.9</td>
</tr>
<tr>
<td>Operating heavy equipment and rigging loads</td>
<td>none</td>
<td>no</td>
<td>yes</td>
<td>Chapter 8.5 and equipment manuals</td>
</tr>
<tr>
<td>Operating high-pressure liquid, vapor, or gas systems</td>
<td>none</td>
<td>no</td>
<td>no</td>
<td>n/a</td>
</tr>
<tr>
<td>Working with high-voltage electricity</td>
<td>HOP</td>
<td>no</td>
<td>no</td>
<td>Chapters 8.1 and 8.2</td>
</tr>
<tr>
<td>Servicing and maintaining equipment with hazardous energy</td>
<td>none</td>
<td>no</td>
<td>no</td>
<td>Chapter 8.2</td>
</tr>
<tr>
<td>Operating hyperbaric chamber</td>
<td>HOP</td>
<td>yes</td>
<td>yes</td>
<td>Chapter 6.9</td>
</tr>
<tr>
<td>Operating powder-actuated tool</td>
<td>HOP</td>
<td>no</td>
<td>noise only</td>
<td>Chapter 8.6</td>
</tr>
<tr>
<td>Using radioactive materials or radiation-producing equipment (ionizing and nonionizing)</td>
<td>HOP</td>
<td>no</td>
<td>no</td>
<td>Chapter 7.3</td>
</tr>
<tr>
<td>Operating boiler plants</td>
<td>none</td>
<td>no</td>
<td>noise only</td>
<td>n/a</td>
</tr>
<tr>
<td>Operating aerial baskets and truck platforms</td>
<td>HOP</td>
<td>no</td>
<td>no</td>
<td>Chapter 8.7</td>
</tr>
<tr>
<td>Working with insulation</td>
<td>none</td>
<td>no</td>
<td>yes</td>
<td>n/a</td>
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<tr>
<td>Operating Class 3B and 4 lasers or solar simulators</td>
<td>HOP</td>
<td>no</td>
<td>yes</td>
<td>Chapter 6.2 (laser only)</td>
</tr>
<tr>
<td>Handling cryogenics</td>
<td>HOP</td>
<td>no</td>
<td>no</td>
<td>Chapter 6.5</td>
</tr>
<tr>
<td>Pressure suit technicians</td>
<td>none</td>
<td>yes</td>
<td>yes</td>
<td>n/a</td>
</tr>
<tr>
<td>Welding (fusion) on flight ground-support equipment</td>
<td>HWP</td>
<td>no</td>
<td>no</td>
<td>Chapter 8.4 and JSC 18323</td>
</tr>
<tr>
<td>Hand or automated wire wrapping</td>
<td>none</td>
<td>no</td>
<td>no</td>
<td>MIL-STD-130b</td>
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<tr>
<td>Hand soldering for flight and ground-support equipment</td>
<td>none</td>
<td>no</td>
<td>yes</td>
<td>NASA STD-8739.3</td>
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<td>OSHA Class I, II, or III asbestos work</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>Chapter 5.7 and Part 12</td>
</tr>
<tr>
<td>Using Self Contained Breathing Apparatus</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>n/z</td>
</tr>
</tbody>
</table>

### 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
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 Clinical Services Branch if none is required by state or federal laws. You shall:

a. Have specific training in federal, NASA, and JSC rules for preparing, packaging, marking, and transporting the material you will handle. Training shall include instruction in how to find both the specific hazards of the material(s) and the standard emergency and first-aid procedures to follow if a spill or exposure to the material occurs. This shall also include a review of the Material Safety Data Sheet(s) before handling or transporting any material.

b. Pass a written test to show you have the necessary knowledge and skills.

c. Get a certification card and carry it. The card shall 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.

<table>
<thead>
<tr>
<th>For these personnel or operations . . .</th>
<th>Follow requirements in . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot work</td>
<td>Chapter 8.4 and paragraph 8 below</td>
</tr>
<tr>
<td>Working in acoustic and vibration chambers</td>
<td>Chapter 6.9</td>
</tr>
<tr>
<td>Working in acceleration facilities</td>
<td>Chapter 6.9</td>
</tr>
<tr>
<td>Working in impact testing facilities</td>
<td>Chapter 6.9</td>
</tr>
<tr>
<td>Working in oxygen-enriched or oxygen-deficient atmospheres</td>
<td>n/a</td>
</tr>
<tr>
<td>Demolition</td>
<td>29 CFR 1926.850</td>
</tr>
<tr>
<td>Using pneumatic and power-actuated devices that incorporate projectiles</td>
<td>Chapter 8.6</td>
</tr>
<tr>
<td>Excavation</td>
<td>29 CFR 1926.650 and 1926.651</td>
</tr>
<tr>
<td>Proof pressure-testing components or systems</td>
<td>n/a</td>
</tr>
<tr>
<td>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</td>
<td>Chapter 5.1, Chapter 8.5, Chapter 9.1</td>
</tr>
</tbody>
</table>
## 8. Work shift limits for hazardous operations

These limits prevent dangerous situations due to fatigue. They apply to those who are 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 shall:
   1. Never work a shift of more than 12 hours in a 24-hour period.
   2. 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 shall:
   1. Never work a shift of more than 12 hours in a 24-hour period.
   2. Be off for at least 10 hours between shifts.

c. If you are involved in test team activities that directly support tests, you shall:
   1. Never work a shift of more than 12 hours for continuous testing. Normal and desired shifts are 8 hours.
   2. Have a qualified relief every 4 hours so you can take rest breaks, unless your position allows you to take comfort breaks and have water and food during the test.
   3. Be off for at least 10 hours between shifts.

d. If you are involved with hypobaric chamber activities, you shall:
   1. Be off for at least 24 hours before the test starts if you work 12-hour shifts during the pretest phase.
   2. 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.
   3. Never work more than five 12-hour shifts in a week without a day of rest right after the 60-hour workweek.
   4. Never work more 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 for monitoring lock observers for excessive fatigue.
e. Have waivers to the requirements in subparagraph a above approved by the Division Chief responsible for the facility.

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 shall 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, 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 shall 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 to 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 shall:

1. Take appropriate action if potential fire hazards are observed. This includes notifying responsible persons of the observed hazards.

2. 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.

3. 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.

4. Notify the Emergency Operations Center (x33333) and building occupants of a fire and start an evacuation.

5. 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 subparagraph 12.b of this chapter for more information. The Safety and Test Operations Division and the Clinical Services Branch shall 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 that is approved for hot work operations that will be done regularly. To set up a designated hot work area, you shall:

a. Form a team to review the area. The review includes an on-site survey of the area and a meeting to discuss any discrepancies or concerns. The team shall consist of the following individuals as a minimum:
   1. Safety and Test Operations Division representative.
   2. Clinical Services Branch representative.
   4. Facility Manager.
   5. Contractor Safety Representative for contractor operations.
   6. Line manager(s) over the proposed area.

b. Meet the following requirements:
   1. The area shall be a specific area designed or approved for hot work, such as a maintenance shop or a detached outside location.
   2. The structure shall be made of noncombustible or fire-resistive materials, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas.

c. Submit a plan to the team in subparagraph a above. The plan shall include, as a minimum:
   1. A description of the process and related activities planned.
   2. Location and floor plan, indicating the location of extinguishers, pull stations, phones,
emergency egress routes, nearest flammable and combustible materials, etc.

3. The type of fire alarm and suppression systems in the area.
4. A list of any associated hazards and controls.
5. A hazard analysis for the planned activities.
6. A Job Safety Analysis for the planned activities.
8. An air quality survey.
9. A list of responsible individuals and contacts.

d. Attach a signature page to the plan that shall 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 Chief, Safety and Test Operations Division, 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 need to 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 shall have one of the following permits as required and post it at the job site along with any procedures you will use:


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 shall contact the Clinical Services Branch if you suspect any
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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 Operation Permit,” Appendix 5A. The flowchart in figure 5.8-2 describes the steps necessary to complete and approve a hazardous operations permit.
Chapter 5.8, Hazardous operations: safe practices and certification

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Figure 5.8-1, Hot work permit flow chart
Figure 5.8-2. Hazardous operations permit flowchart.

Verify this is the correct version before you use it by checking the on-line version.
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 shall 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 shall:

a. Include the title and telephone extension of each person who would normally receive a copy of the permit with the procedure.

b. Include enough detail to identify residual hazards and cautions to personnel. This includes necessary tools, safe work practices, personal protective equipment, and worker qualifications. Use a job hazard analysis to identify hazards and controls.

c. Include equipment diagrams to clarify the equipment configurations.

d. Conspicuously mark the title page with a statement that the document contains hazardous procedures and strict adherence is necessary for safety and health.

e. Contact those you listed under subparagraph a above to let them know about your work before you start.

f. Post a copy of the procedure at the job site as you would post a permit.

g. Send any revisions to the procedure to the Safety and Test Operations Division for review and approval.

h. Review and update the procedures at least yearly.

Certification for hazardous operations

14. Certification process

To be certified, you need to 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 shall follow these requirements:

a. You shall be certified by your management after you:

1. Complete the necessary formal or on-the-job training. Your management shall at least outline the on-the-job training you need to have and state the minimum number of hours required. Training shall include applicable requirements from 29 CFR 1910, “Occupational Safety and Health Standards,” 29 CFR 1926, “Safety and Health Regulations for Construction,” and applicable NASA and JSC requirements.

2. Pass a written test.

3. Get a certification card when the certification examiner determines that you have the required safety knowledge and skills. The certification examiner and certifying officer shall both sign the card. You may use JSC Form 353, Appendix 5A.

Electronic systems that provide on-the-spot verification are also acceptable. See NPR JPR 353.1

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b. Your organization shall keep a record of your certification on JSC Form 209, “Application and Record of Qualification for Personnel Certification,” Appendix 5A, or a form or database that contains the same information.

c. Certification examiners shall:
   1. Know the requirements of the operation that they will certify.
   2. Be at least one organizational level higher than the employee to be certified.
   3. Be appointed by the Center Director or his or her designated representative to certify Category I operations.
   4. Be appointed by a 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:
   1. Any time they question your knowledge or skills.
   2. When you have to do any new hazardous operation.

e. You shall have a physical examination when required by paragraphs 4 or 5 of this chapter or by the Clinical Services 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.

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:
   b. NPR 8715.3, Chapter 3.

19. Responsibilities for hazardous operations

   a. As a supervisor, you are responsible for:
      1. Getting, completing, and distributing required permits.
      2. Monitoring hazardous operations to make sure that the requirements on the permit and in this chapter are followed for any hazardous operation.
      3. Providing detailed safety instructions for safe operations to employees who are authorized access to hazardous areas or who do hazardous operations.
      4. Identifying operations that could be hazardous. Analyze these operations to determine the risk to personnel, equipment, and facilities.

   b. As a line manager, you are responsible for:
      1. Making sure that hazardous operations that require certification are done only by employees with a valid certification.
      2. Managing a training and certification program for your organization. This includes providing all training and testing necessary to qualify your employees and certifying them after they show that they have the necessary knowledge and skills.
      3. Keeping 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.
      5. Recommending candidates for certification examiners.

   c. As a safety representative, competent person, or certified confined space supervisor, you are responsible for reviewing each permit to make sure that the requirements are
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followed and that personnel listed on permits have valid and current certifications if required.

d. As a contracting officer, you are responsible for making sure contracts contain hazardous operations requirement as necessary.

e. The Safety and Test Operations Division is responsible for:

1. Reviewing 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.

2. Monitoring JSC operations to make sure that only certified personnel are assigned to the tasks described in this chapter.

3. Surveying selected areas to determine the effectiveness of the certification program.

4. Keeping metrics on the waivers and mishaps related to the waivers.

f. The Clinical Services Branch is responsible for setting requirements for hazardous operations involving potential health hazards, sampling and monitoring environmental conditions, and providing professional medical support and surveillance as needed.

g. The Employee Development Branch is responsible for providing training courses for hazardous operations as requested by line management and the Safety and Test Operations Division. These courses shall qualify personnel for certification.