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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/SDS, which indicates 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.

5.8.1 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 5.8.19 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.

5.8.2 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.

5.8.3 Requirements for any hazardous operation

5.8.3.1 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 5.8.4, 5.8.5, 5.8.6, and 5.8.7 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.
- d. As a supervisor, use a JHA to evaluate each hazardous operation where the risk is high, to determine if using a “buddy system” applies. Concurrence from the Safety and Test Operations Division is required for a determination of “non-applicable.” When applicable; 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

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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.
- f. Hazardous activities outside of NASA operational control shall follow paragraph 1.14 of NPR 8715.3.

5.8.4 Requirements for Category I hazardous operations

5.8.4.1 Category I jobs involve operations that are likely to either cause death or serious injury or high-dollar property damage for JSC and require management certification. 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) 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.

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<i>For these personnel or operations . . .</i>	<i>Permit req'd . . .</i>	<i>Physio trng req'd?</i>	<i>Med. exam req'd?</i>	<i>Follow requirements in . . .</i>
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	Procedure, for heavy lifts	no	some, see Chapter 3.6	Chapter 8.5
Handling or using explosives or pyrotechnics (ordnance category)	Procedure	no	no	Chapter 9.5
Handling propellants	Procedure	no	yes	Chapter 9.5
Rescue personnel	none	yes	yes	n/a
SCAPE operators	none	no	yes	n/a
Scuba diving and operating neutral buoyancy tanks	Procedure	no	yes	Chapter 6.6
Handling pesticides, insecticides, or herbicides	Procedure	no	yes	Chapter 9.3
Test directors and subjects	none	yes*	yes	Chapter 6.9
Test conductors and engineers	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	yes**	Chapter 6.10

*Required for human occupied hyperbaric and hypobaric activities only.

** Required only for entry into OSHA-permitted confined spaces.

5.8.5 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, and require management certification. 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 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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<i>For these personnel or operations . . .</i>	<i>Permit req'd . . .</i>	<i>Physio trng req'd?</i>	<i>Med. exam req'd?</i>	<i>Follow requirements in . . .</i>
Operating altitude chambers	Procedur e	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	Proecdur e	no	no	Chapters 8.1 and 8.2
Servicing and maintaining equipment with hazardous energy & Performing Lockout/Tagout	none	no	no	Chapter 8.2
Operating hyperbaric chamber	Proecdur e	yes	yes	Chapter 6.9
Operating powder-actuated tool	Proecdur e	no	nois e only	Chapter 8.6
Using radioactive materials or radiation-producing equipment (ionizing and nonionizing)	Proecdur e	no	no	Chapter 7.3
Operating boiler plants	none	no	nois e only	n/a
Operating aerial baskets and truck platforms	Proecdur e	no	no	Chapter 8.7
Working with insulation	None	no	yes	n/a
Operating Class 3B and 4 lasers or solar simulators	Proecdur e	no	yes	Chapter 6.2 (laser only)
Handling cryogenics	Proecdur e	no	no	Chapter 6.5
Pressure suit technicians	None	yes	yes	n/a
Welding (fusion) on flight ground-support equipment	HWP	no	no	Chapter 8.4 and JSC 18323
Hand or automated wire wrapping	None	no	no	MIL-STD-1130b NASA STD-8739.4 & NASA STD-8739.5 for spaceflight
Hand soldering for flight and ground-support equipment	None	no	yes	NASA STD-8739.3

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<i>For these personnel or operations . . .</i>	<i>Permit req'd . . .</i>	<i>Physio trng req'd?</i>	<i>Med. exam req'd?</i>	<i>Follow requirements in . . .</i>
OSHA Class I, II, or III asbestos work	JF 644	no	yes	Chapter 5.7 and Part 12
Using Self Contained Breathing Apparatus	None	no	yes	n/a

5.8.6 Requirements for Category III hazardous operations

5.8.6.1 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 5.8.13 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 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 Sheets (MSDSs)/Safety Data Sheets (SDSs) 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.

5.8.7 Requirements for Category IV hazardous operations

Category IV operations require a hazardous operations permit unless you have a procedure as described in paragraph 5.8.13 of this chapter. Controlled areas require a hazard analysis and may require a procedure. 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.

<i>For these personnel or operations . . .</i>	<i>Follow requirements in . . .</i>
Hot work	Chapter 8.4 and paragraph 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

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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
Using "heavy lift" material handling equipment	Chapter 8.5
Working in a Controlled Area	Chapter 6.10
Doing hazardous waste operations	29 CFR 1910.120 40 CFR Parts 260–279

5.8.8 Work shift limits for hazardous operations

5.8.8.1 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 follow the work shift limits in paragraph 2.14.3.3 of NPR 1800.1.
- b. 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.
- c. 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

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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.

- d. Have waivers to the requirements in subparagraph a above approved by the Division Chief responsible for the facility. Intermittent hazardous operations may exceed 12 hours on the job, but may not exceed 16 hours if there is rest time between operations.
- e. Have waivers for test support, test facility support, test team and hypobaric personnel and up to 16 hours on station 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.
- f. Have waivers that exceed 16 hours approved by the JSC Designated Safety and Health Official.

5.8.9 Requirements for “hot work”

5.8.9.1 “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 5.8.12.b of this chapter for more information on permits. See paragraph 5.8.11 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 or (281) 483-3333, and building occupants of a fire and start an evacuation.
 - (5) Extinguish small fires if it can be done safely.

5.8.10 Permit-required hot work areas

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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 5.8.12.1.b of this chapter for more information. The Safety and Test Operations Division and the Occupational Health Branch shall review permit-required hot work areas during each annual safety, health, and fire protection inspection.

5.8.11 Designated hot work areas

5.8.11.1 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) Occupational Health Branch representative
 - (3) Fire Protection engineer
 - (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.
 - (3) Chapters 5.1, "Fire Safety," and 8.4, "Welding, Cutting, and Brazing Safely," of this Handbook.
 - (4) NASA-STD-8719.11, "Safety Standard for Fire Protection."
 - (5) National Fire Protection Association Standard 1, "National Fire Prevention Code."
 - (6) 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 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 JHA for the planned activities

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- (7) An Emergency Evacuation Plan
- (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.

5.8.12 Permits for hazardous operations

5.8.12.1 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:

- 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 D. 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 Occupational Health Branch if you suspect any exposure or health issue with the hot work.

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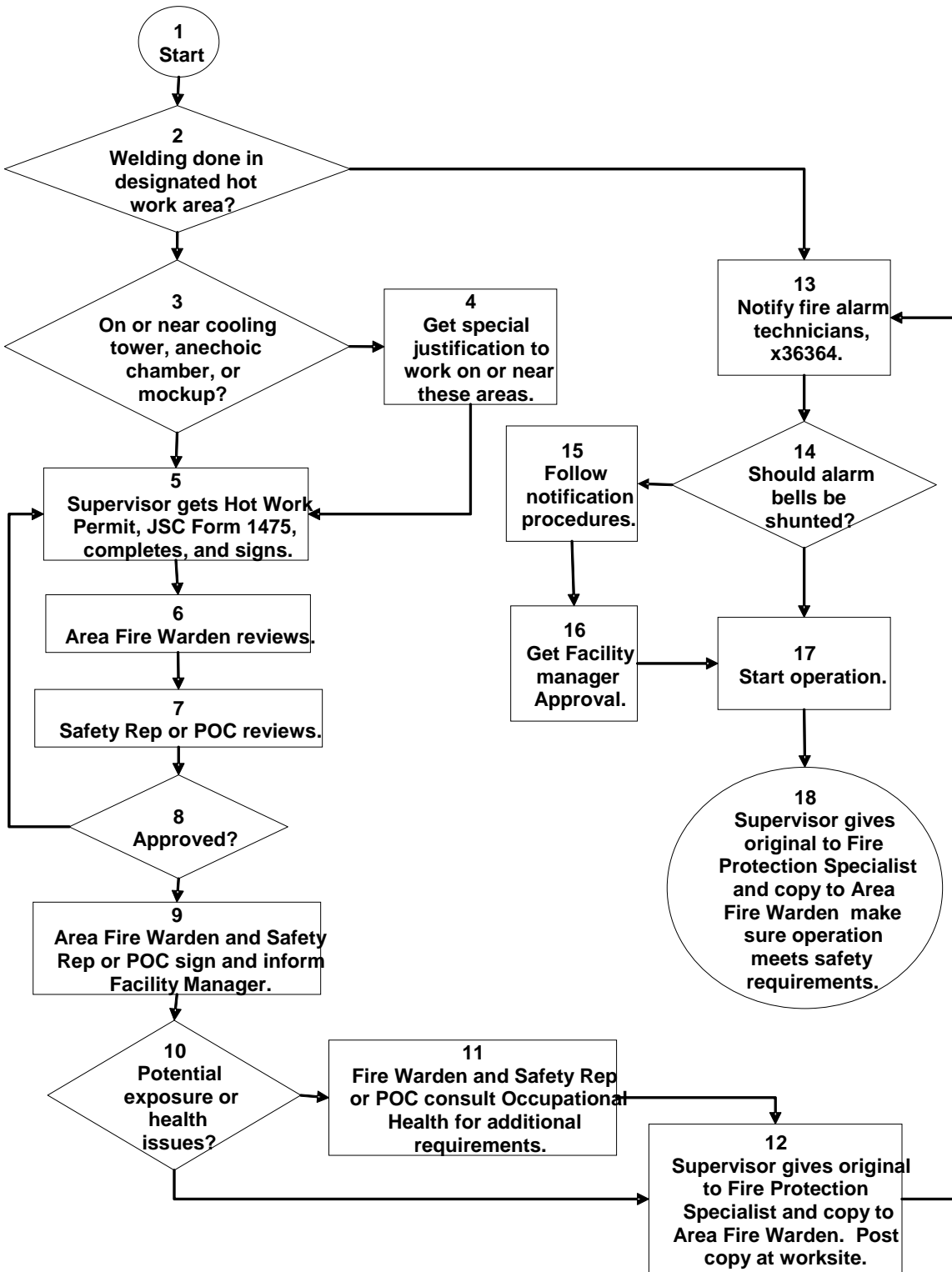


Figure 5.8-1, Hot work permit flow chart

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5.8.13 Hazardous Operations Procedure

5.8.13.1 Before engaging in any hazardous operations, you shall write a detailed procedure and have it approved by your organization's management and a corresponding hazard analysis that has been reviewed and concurred by required personnel as specified in paragraph 2.3.8 of Chapter 2.3 of this Handbook. 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 JHA 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.

5.8.14 Certification process

5.8.14.1 To be certified, you need to show that you have the necessary knowledge, skills, judgment, and physical ability to do the job safely. Certification shall follow these requirements:

- a. You shall be certified by your employer 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, state the minimum number of hours required, and refresher training needed. 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 from your employer to document you have the required safety knowledge and skills. The certifying officer shall sign the card. You may use JSC Form 353, Appendix D. Electronic systems that provide on-the-spot verification are also acceptable. See NPR 8715.3, "NASA General Safety Program Requirements," and Chapter 7, "Safety Training and Personnel Certification," for more information.
- b. Your employer shall keep a record of your certification on JSC Form 209, "Application and Record of Qualification for Personnel Certification," Appendix D, or a form or database that

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contains the same information.

- c. Certifying officers 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 for civil servants, or the contract Project Manager or designated representative for contractors to certify Category I operations.
 - (4) Be appointed by a directorate-level official or representative from the organization or contractor 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 5.8.4 or 5.8.5 of this chapter or by the Occupational Health Branch to be certified or recertified.

5.8.15 Exceptions to the requirements in paragraph 5.8.14 above

Certifications for operations other than the categories of hazardous operations mentioned in this chapter are exempt from the requirements of this chapter.

5.8.16 How you could lose your certification

5.8.16.1 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

5.8.17 Exclusions

Paragraph 7.7 of NPR 8715.3 list exclusions to NASA certification requirements. See part 5, subpart 6 of the JSC Personnel Manual for information on hazardous duty pay.

5.8.18 For more information on hazardous operations

- a. 29 CFR 1910.38, "Employee Emergency Plans and Fire Protection Plans"
- b. NPR 8715.3, Chapter 3.

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5.8.19 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.
 - (4) Keeping completed certificates and supporting records current. Protect employee training records under NPD 1382.17 (current version), "NASA Privacy Policy."
 - (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 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 requirements 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 *Occupational Health 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.

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- 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.