

Chapter 6.10

Entering confined spaces and controlled areas

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.

A technician was working in a chamber that was not a confined space and encountered an oxygen-deficient atmosphere after climbing a ladder to a higher level. The technician lost consciousness and fell from the ladder.

1. Applicability of this chapter

You are required to follow this chapter if you:

- a. Do or oversee any work that involves entering confined spaces or controlled areas at JSC.
- b. Have a confined space or controlled area in your work areas as a facility manager or line manager.
- c. Do any of the above work at WSTF; you are required to follow WSTF procedures and requirements for entering confined spaces or controlled areas and use WSTF forms that meet the intent of this chapter.

2. What this chapter covers

This chapter contains JSC requirements for safely entering confined spaces that meet and exceed those in 29 CFR 1910.146, "Permit-Required Confined Spaces." Paragraphs 28 – 31 cover controlled areas.

Defining and classifying confined spaces

3. What is a confined space?

A confined space is one 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, pits, and trenches deeper than four feet. Hazards of confined spaces include possible

Part 6, Safety and health practices for certain hazardous tasks

asphyxiation; explosions; poisoning from toxic vapors; engulfment; 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 OSHA permit-required confined spaces. Paragraphs 5 and 6 below define these spaces. The Safety and Test Operations Division, the Clinical Services Branch, and certain line organizations have classified confined spaces using these definitions. The Clinical Services Branch 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 shall evaluate their work areas to identify and classify confined spaces.
- b. You shall 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 shall 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 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.

6. OSHA permit-required confined spaces

An OSHA permit-required confined space is one 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:
 1. Flammable gas, vapor, or mist in excess of 10% of its lower explosive limit (LEL).
 2. Airborne combustible dust at a concentration that meets or exceeds its LEL.
 3. Atmospheric oxygen concentrations below 19.5% or above 23.5%.

Chapter 6.10, Entering confined spaces and controlled areas

4. Atmospheric concentration of any substance for which there is a published PEL and which could result in employee exposure in excess of its dose or PEL.
5. 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 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 to 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, you shall follow these rules:

- a. For an OSHA permit-required space, you shall:
 1. 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.
 2. Lock or bolt the space by a mechanical means.
 3. Post or stencil this sign on all entrances if you can't lock or bolt the space (contact Clinical Services Branch at x34317 for signs and stencils):

**DANGER CONFINED SPACE, NO ENTRY WITHOUT
PROCEDURE AND PERMIT**

- b. JSC-permit required spaces shall be labeled with the following sign:

**DANGER CONFINED SPACE, NO ENTRY WITHOUT
PROCEDURE AND PERMIT**

Requirements for entering confined spaces

8. Requirements for entering any confined space

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, control them with PPE or other measures. You shall follow these requirements for entering any confined space:

- a. Have the following before you enter any confined space:
 1. An approved and posted written procedure as described in paragraph 13 of this chapter.

Part 6, Safety and health practices for certain hazardous tasks

2. An approved and posted entry permit as described in paragraph 14 of this chapter.
3. 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 confined space, you shall 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.
- e. 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 shall 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 defined in paragraph 5. In addition to the procedure and permit, you shall 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:
 1. Oxygen levels are between 20.5% and 21.5 %.
 2. Explosive atmospheres are 0% of the LEL.. (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 that you have communications with those in the space and a method to call for

Chapter 6.10, Entering confined spaces and controlled areas

emergency services. See subparagraph 21.c of this chapter for more details.

- j. Contact the Occupational Health Department at x36726 if you have any questions.

10. Requirements for entering an OSHA permit-required confined space

In addition to having an approved procedure and permit, you shall:

- a. Follow your current, approved procedure and all conditions on your permit.
- b. Notify the Emergency Operations Center at x34658 and the Occupational Health Department at x36726 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 that:

- 1. Oxygen levels are between 20.5% and 21.5%.
- 2. Explosive atmospheres are 0% of the LEL.
- 3. Toxic vapor levels meet the 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:
 - 1. 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.
 - 2. Required PPE, including hard hats. See paragraph 22 of this chapter for more details.
 - 3. 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.

Part 6, Safety and health practices for certain hazardous tasks

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 that you will enter. The atmosphere may suddenly become deadly from causes beyond your control. To work in a sewer, you shall follow the requirements in paragraph 10 of this chapter and:

- a. Keep in contact with the local weather bureau and fire and emergency services as much as possible. This will help you know whether you should delay your entry into the sewer or cause you to remove people from the sewer if:
 1. Sewer lines might suddenly flood from rain or firefighting activities.
 2. 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):
 1. Oxygen level within the range of 20.5% and 21.5%.
 2. Flammable gas or vapor concentrations above 0% of the LEL.
 3. 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 shall 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 to an OSHA permit-required confined space the zone that you will work in, you shall 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 that 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 the Operations Control Center ((281) 483-2038) before you enter and when you

Chapter 6.10, Entering confined spaces and controlled areas

leave the tunnel system.

- f. Wear hard hats, safety glasses, and industrial shoes (i.e., no soft-sole, open-toe, or canvas-covered shoes).
- g. Have a flashlight with you at all times.
- h. Read, sign, and follow “Tunnel Safety Awareness” at the Operations Control Center.
- i. Use the “buddy system.” Don’t enter the tunnel system alone.

13. Requirements for entering a trench

Trenches greater than 4 feet deep are confined spaces at JSC. You can find requirements for working in trenches in 29 CFR 1926.650, 1926.651, and 1926.652. Refer to Chapters 5.8 and 10.1 of this handbook for additional requirements for working in trenches and excavations. The following additional requirements apply:

- a. An approved procedure and a permit are required as described in paragraph 8 above.
- b. Signs and barriers are only required when the trench is unattended
- c. Work in trenches may require atmospheric testing when working at depths greater than 4 feet and will require protection from soil collapse when working at depths great than 5 feet.

Precautions for entering confined spaces

14. Procedure required to enter a confined space

Before you enter any confined space, you shall 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 shall:
 - 1. Be approved yearly by the Safety and Test Operations Division, the Occupational Health Department, 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 shall write a new one and have it approved.
 - 2. Be followed as written.
 - 3. Be posted at the entrance so that the entrants can confirm that safe entry conditions have been met.
- c. Include MSDSs for any chemicals that you will use in or near the confined space.

Part 6, Safety and health practices for certain hazardous tasks

15. 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 need to have a completed and endorsed entry permit form, JSC Form 1476, "Confined Space Entry Permit," (Appendix 6A) to enter any confined space. Entry permits shall:

- 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 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 shall get approval from the Safety and Test Operations Division and the Occupational Health Department.
- d. Include MSDSs for any chemical being used in or near the space.

16. Canceling a permit

As an entry supervisor, you shall follow these requirements to cancel a permit:

- a. Cancel if one of the following occurs:
 1. The work covered by the entry permit is done.
 2. A condition arises in or near the space that is not allowed under the permit.
- b. All entrants shall leave the space when the permit is canceled.
- c. Follow these steps after you cancel the permit:
 1. Note any problems you encountered during the operation on the permit so that JSC can improve its confined space program.
 2. Send a copy of each canceled permit within one week to the Occupational Health Department for a yearly review.
 3. Keep each canceled entry permit for at least 1 year.

17. Controlling atmospheric hazards in a confined space

You shall 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

Chapter 6.10, Entering confined spaces and controlled areas

required in continuously ventilated spaces and as approved in the confined space procedure.) You shall follow these requirements for forced-air ventilation:

1. Ventilate the space continuously until the job is done, whether the space is occupied or not.
 2. 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 Department, and your safety representative.
 3. Direct the ventilation to the immediate areas where employees are or will be working within the space.
 4. 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 as required by the procedure. Periodic or continuous testing may also be required while working inside the space. A qualified person shown on the approved entry procedure needs do the initial testing. This person shall be an authorized representative of the Occupational Health Department or an employer-designated confined space entry supervisor. The Safety and Test Operations Division and the Occupational Health Department 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:

1. Oxygen content.
 2. Flammable gases and vapors.
 3. Potential toxic air contaminants.
- c. Confirm that the following acceptable atmospheric conditions exist in the confined space before entry:
1. An oxygen level between 20.5% and 21.5%.
 2. No positive indication of a combustible, explosive, or toxic gas or vapor.

If initial testing shows conditions are unacceptable, you shall continue ventilation and retest the atmosphere unless the procedure says otherwise. If the readings continue to be unacceptable, call the Occupational Health Department at x36726 for further air quality testing.

- d. Follow these rules while working in the confined space:
1. Test the atmosphere in the space periodically to make sure that acceptable conditions are being maintained during entry operations. The time period between tests shall be specified on the confined space procedure and entry permit.
 2. Test the atmosphere continuously if you can't isolate the space because it is large or

Part 6, Safety and health practices for certain hazardous tasks

is part of a continuous system, or the work being done in the space makes continuous testing necessary.

3. 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 shall reevaluate the continuously ventilated space and test the atmosphere.
 4. Variations from atmospheric conditions as indicated above are acceptable.
 5. Record all readings on the permit.
- e. Make sure all instruments used to test the atmosphere in a confined space are:
1. Calibrated under the manufacturer's guidelines.
 2. Working properly before using them.
 3. 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 vapors, if feasible, to prevent a hazardous atmosphere from forming inside the space while work is being done. Isolate pipelines by:
1. Completely depressurizing and disconnecting possible contaminant supply lines and placing a blank flange on the pipe leading into the confined space.
 2. Using two blocking valves with a vent valve open between them.
 3. Using other blank, block, and bleed valve configurations that have been previously approved by the Safety and Test Operations Division.

18. Controlling other hazards in a confined space

You need to isolate energy sources to the area you in which you will be working to prevent mishaps such as electrical shock, fire, or injury from moving parts. To do this, you shall:

- a. Follow lockout/tagout and isolation requirements in Chapter 8.2, "Lockout/tagout practices," of this handbook to:
 1. De-energize electrical or pneumatic equipment within the space.
 2. 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:
 1. Using only properly insulated or grounded portable electrical equipment. Double-insulated electrical hand tools are acceptable. Inspect all electrical before entry.

Chapter 6.10, Entering confined spaces and controlled areas

2. 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.
 3. Using pneumatic power tools instead of electrical tools when possible. Pneumatic tools shall have conductive air supply hoses. Never use nitrogen or other inert gases to power the tools. Use breathable air to power pneumatic tools.
 4. Using cordless, rechargeable portable power tools, with an intrinsically safe rating, when possible. If they are used, they shall have an explosion-proof or intrinsically safe rating for spaces that could contain or develop an explosive atmosphere.
 5. 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.
 6. Grounding or double-insulating heavy-duty electric cords and all metal housings.
- d. Control ignition sources by:
1. Using explosion-proof or intrinsically safe (non-sparking) lighting, ventilation equipment, and tools in potentially flammable atmospheres.
 2. 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 the Occupational Health Department.
 3. Never using polyethylene and other materials that generate static electricity where explosive atmospheres could exist. Tents erected over or around the space shall be of a conductive material and properly grounded.

People and equipment required for entering confined spaces

19. Duties of entry supervisors

As an *entry supervisor*, you shall, 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.

Part 6, Safety and health practices for certain hazardous tasks

1. Notify the JSC Emergency Operations Center ((281) 483-4658) and the Occupational Health Department (x36726) immediately before anyone enters an OSHA permit-required confined space.
2. 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 (x49609).
- 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:
 1. All required blocks are filled in.
 2. All tests specified by the procedure have been conducted.
 3. All requirements and equipment specified by the procedure are in place.
 4. The approved procedure and permit are 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.
- f. Make sure that 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, 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 need to 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 the Occupational Health Department a copy of the canceled permit.

20. Duties of entry attendants

At least one attendant needs to be in the immediate vicinity outside an OSHA permit-required confined space and other spaces, if the procedure requires, while people are working in the

Chapter 6.10, Entering confined spaces and controlled areas

space. As an *entry attendant* you shall:

- 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 need to leave visual contact and verbal contact with the attendants, use mechanical or electronic communications.
- f. Monitor activities inside and outside the space to determine whether it is safe for entrants to stay in the space. Order those inside to leave the space immediately if you:
 1. Detect a prohibited condition.
 2. Notice behavioral effects of hazard exposure in someone in the space.
 3. See a situation outside the space that could endanger those inside.
 4. Can't effectively and safely perform all of 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:
 1. Warn the unauthorized persons that they need to stay away from the permit space.
 2. Advise the unauthorized persons that they need to exit immediately if they have entered the permit space.
 3. Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.
 4. 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.

Part 6, Safety and health practices for certain hazardous tasks

21. Duties of authorized entrants

If you are an *authorized entrant*, you shall:

- a. Know the hazards that 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:
 1. Recognize any warning sign or symptom of a dangerous situation.
 2. Detect a prohibited condition.
- e. Exit from the permit space as quickly as possible if you:
 1. Get an order to evacuate from the attendant or the entry supervisor.
 2. Recognize any warning sign or symptom of a dangerous situation.
 3. Detect a prohibited condition.
 4. Hear an evacuation alarm.

22. Equipment for entering a confined space

You shall 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.

23. Protective clothing and equipment for entering a confined space

If you enter a confined space, you shall 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. Industrial shoes (no soft-sole, open-toe, or canvas-covered shoes).
- e. Respiratory protection for hazardous atmospheres. You shall also follow these requirements:
 1. If you wear a respirator in a confined space, you shall follow Chapter 7.2, “Respiratory protection,” of this handbook.
 2. Use only NIOSH-approved respirators.
 3. 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.
 4. Use only certified breathing air (Compressed Gas Association, Grade D).
 5. See Chapter 5.6, “Personal protective equipment,” of this handbook for more requirements on PPE.

24. Rescue and emergency equipment

You shall 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. You shall have:

- 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 shall have the following retrieval equipment:
 1. A chest or full-body harness with a retrieval line that meets ANSI A10.14, “Construction and Demolition Operations – Requirements for Safety Belts, Harnesses.” You shall 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.
 2. Wristlet harnesses instead of a chest or full-body harness if 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 need to show that wristlet harnesses are the safest and most effective alternative. The Safety and Test Operations Division and the Clinical

Part 6, Safety and health practices for certain hazardous tasks

Services Branch shall 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. Use a full-body harness instead.

3. 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.

25. What to do in an emergency

Remember, your emergency numbers are: x33333 at JSC, Sonny Carter Training Facility, and Ellington Field, 911 at any off-site location, and x5911 at WSTF.

In an emergency, you as an *attendant* or *entry supervisor* shall:

- 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 are approved by the Safety and Test Operations Division and the Occupational Health Department 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:
 1. Telling them about the hazards that they may face during confined space rescues.
 2. Having them visit all confined spaces to which they may be called so that they can develop rescue plans for each space and practice rescue operations.

Other requirements for entering confined spaces

26. Training for working in confined spaces

Training needs to provide supervisors, attendants, and entrants with the knowledge and skills needed to work safely in confined spaces. Training shall follow these requirements:

- a. If you are involved with any work in a confined space, you shall have training:
 1. Before you are first assigned duties in confined spaces and before your assigned duties change.
 2. Whenever work in a confined space presents new hazards you have no training for.
 3. Whenever you think that there are deviations from entry procedures or that your knowledge or use of the procedures may be inadequate.
 4. 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 that you understand JSC's program.
 5. By getting a training completion card that states that you have been trained and demonstrated proficiency in JSC's confined space requirements. The card is good for 2 years. Then you shall be retrained.
- b. As an *entry supervisor*, you shall 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 shall 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 shall at least have training in JSC's confined space entry program and in your duties listed in paragraph 20 of this chapter.

27. Off-site contracts that involve entering confined spaces

For off-site contractors involved in entering confined spaces:

- a. If you arrange to have employees of an off-site contractor perform work in a confined space, you shall:
 1. Inform the contractor that the workplace has confined spaces and that the contractor needs to follow JSC's confined space entry program when working in confined spaces.
 2. Tell the contractor why a space in question is a confined space, including the hazards identified and JSC's experience with the space.
 3. Tell the contractor of any precautions or procedures that JSC has implemented under

Part 6, Safety and health practices for certain hazardous tasks

its program to protect employees in or near the spaces that contractor personnel will be working in.

4. Make sure that contractor employees who will enter confined spaces receive the training in paragraph 25 of this chapter.
 5. Coordinate entry operations with the contractor.
 6. 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 shall follow JSC's confined space requirements in this chapter and:
1. Obtain any available information on permit space hazards and entry operations from the contracting organization.
 2. Make sure that all employees who will work in confined spaces are trained as described in paragraph 25 of this chapter. They shall also provide documentation of prior class work in confined space entry, receive the JSC confined space overview, and demonstrate an understanding of JSC's program.
 3. Coordinate entry operations with the contracting organization.
 4. Inform the contracting organization of any hazards that you find or create in any confined space, either at a debriefing or while you are working.

28. 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"

Requirements for controlled areas

29. Definition of a controlled area

A controlled area is one that

- a. An employee can completely enter and work in the area, but is not, by definition, a confined space.
- b. Periodically contains, or can, after a single point failure, contain a hazardous atmosphere

Chapter 6.10, Entering confined spaces and controlled areas

where employees are present that may expose them to the risk of death, or acute illness, injury, incapacitation, and impairment of ability to self rescue from any of the following conditions:

1. Flammable gas, vapor, or mist in excess of 10% of its lower explosive limit (LEL).
 2. Airborne combustible dust at a concentration that meets or exceeds its LEL.
 3. Atmospheric oxygen concentrations below 19.5% or above 23.5%. Note: Atmospheric oxygen concentrations may vary significantly due to stratification or inadequate mixing; e.g., be acceptable at one location but not another.
 4. Atmospheric concentration of any substance for which there is a published exposure limit and which could result in employee exposure in excess of that limit.
- c. Contains any other condition that is immediately dangerous to life or health.

Examples of controlled areas include:

- Vacuum chambers (during non-test conditions).
- Hyperbaric and hypobaric chambers.
- WSTF Altitude Test Stands.
- Enclosed outdoor areas for loading liquid nitrogen.
- Laboratories with compressed or plumbed gas lines or LN2 dewars.
- Temporary work areas where construction, welding or other work processes can create the conditions described above.

30. Identifying a controlled area at JSC

To identify controlled areas, you shall:

- a. Evaluate your work areas to identify any controlled areas. Consult safety or health representatives to help in the determination. Consider the area based on its use when personnel are present. For example, evaluate the interior of a vacuum test chamber during periods for maintenance, test article mounting, instrumentation set-ups, etc. Do not evaluate a vacuum chamber while it is at vacuum under test conditions.
- b. Designate an area as “controlled” if occupational safety or health representatives determine it should be a controlled area after close calls, mishap, hazard analysis, or other inspection indicate hazards require additional mitigation or monitoring.

NOTE: Depending on the configuration of the area, a controlled area may be upgraded to a JSC or OSHA permitted confined space.

31. What to do if you have controlled areas in your work area

If you, as a facility manager or line manager, have a controlled area in your work area, you shall:

- a. Ensure the controlled area is covered by a Hazard Analysis per chapter 2.4 of this

Part 6, Safety and health practices for certain hazardous tasks

document. The Hazard Analysis shall also include:

1. Control of both hardware configuration and procedures that may generate the hazardous condition. Consider an entry checklist, procedure, warning signs, or training.
 2. Any critical timing associated with the controls. Note that there are trades to be made. If the valve were closed and locked the critical time may be extended to a shift or longer.
- b. Notify the Clinical Services Branch of the controlled area.
 - c. Include the hazard analysis in the facility baseline documentation if required by chapter 10.4.
 - d. Periodically assess the effectiveness of controls by field inspection.

32. Responsibilities

The following organizations have responsibilities for controlled areas:

- a. The Clinical Services Branch shall:
 1. Maintain a list of controlled areas under these requirements.
 2. Assess the effectiveness of controlled area controls yearly.
- b. The Safety and Test Operations Division shall:
 1. Assess the hazard analyses and controls during audits of the facility.
 2. Assess workplace conditions for compliance with these requirements during periodic facility inspections.