Subject: Chapter 26 Confined Space Entry

Responsible Office: Code QH/Occupational Safety, Health, and Medical Service Division

DOCUMENT CHANGE LOG

<table>
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<tr>
<th>Status [Baseline /Revision /Cancelled]</th>
<th>Document Revision</th>
<th>Date of Change</th>
<th>Description</th>
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<td>Revision 1</td>
<td>1</td>
<td>4/6/2004</td>
<td>Chapter was re-formatted. Changes were made to Permit forms and procedures. Entry supervisor duties clarified.</td>
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<tr>
<td>Revision 3</td>
<td>3</td>
<td>6/26/2017</td>
<td>Preface and Change History added. Construction requirements revised to conform to new 29 CFR 1926.</td>
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<td>4</td>
<td>5/23/2018</td>
<td>Peer Review comments addressed</td>
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</table>

COMPLIANCE IS MANDATORY
TABLE OF CONTENTS

PREFACE

P.1 PURPOSE
P.2 APPLICABILITY
P.3 AUTHORITY
P.4 APPLICABLE DOCUMENTS AND FORMS
P.5 MEASUREMENT/VERIFICATION
P.6 CANCELLATION

CHAPTER 26 CONFINED SPACE ENTRY

26.1 Responsibilities
26.2 Entry Team
26.3 Entry Procedures
26.4 Rescue
26.5 Training and Certification

APPENDIX A. DEFINITIONS

APPENDIX B. ACRONYMS

APPENDIX C. REGULATIONS AND STANDARDS

APPENDIX D. PERMIT-REQUIRED CONFINED-SPACE DECISION FLOW CHART

APPENDIX E. CONFINED SPACE EVALUATION FORM

APPENDIX F. CONFINED SPACE PERMIT ENTRY FORM

APPENDIX G. ALTERNATE-PERMIT CONFINED SPACE CHECKLIST

APPENDIX H. NON-PERMIT CONFINED SPACE CHECKLIST

APPENDIX I. CONFINED-SPACE SIGN: PERMIT REQUIRED

APPENDIX J. CONFINED SPACE SIGN: DO NOT ENTER

APPENDIX K. CONFINED-SPACE SIGN: NON-PERMIT CONFINED SPACE
Preface

P.1 PURPOSE

a. This chapter provides requirements for the management and control of entries into confined spaces.

P.2 APPLICABILITY

a. This directive applies to all Ames employees, Ames contractors and grantees as specified in their contracts or grants; and to other organizations (i.e., commercial partners, other Federal agencies, international parties, and Ames tenants) as specified and described in written operating agreements.

b. In this chapter, all mandatory actions (i.e., requirements) are denoted by statements containing the term "shall." The terms: "may" or "can" denote discretionary privilege or permission, "should" denotes a good practice and is recommended, but not required, "will" denotes expected outcome, and "are/is" denotes descriptive material.

c. In this chapter, all document citations are assumed to be the latest version unless otherwise noted.

P.3 AUTHORITY

a. NPR 1800.1, NASA Occupational Health Program Procedures

b. NPR 8715.1A, NASA Occupational Safety and Health Programs

P.4 APPLICABLE DOCUMENTS AND FORMS

a. See Appendix C

P.5 MEASUREMENT/VERIFICATION

a. Verification and measurement for compliance to this directive will be tracked through Agency triennial audit and Ames Safety Accountability Program (formerly Ames Annual Voluntary Protection Program (VPP) self-inspections).

P.5 CANCELLATION

a. APR 8715.1 Chapter 26 Confined Space Entry Expiration date 9/10/2017

Eugene Tu
Director
DISTRIBUTION STATEMENT:

APR 8715.1 Ames Health and Safety Manual Chapters shall be made available via procurement website to anyone bidding a job here at Ames. The exceptions are Chapter 7 – Ames Radiation Safety Guide, Chapter 10 – Pressure Systems Safety, Chapter 12 – Explosives Safety and Chapter 23 – Control of Narcotics and Other Controlled Drugs including Alcohol, which shall not to be made public but can be viewed onsite.
CHAPTER 26  CONFINED SPACE ENTRY

26.1  Responsibility

26.1.1  General

Every employee in the chain of responsibility shall ensure a safe work environment at Ames Research Center that follows safety standards, regulations, codes and guidelines starting with the Center Director, management, supervisors, contractors and employees.

a. Every employee at ARC shall follow all safety precautions and specifications that apply to their tasks being performed or be subject to dismissal proceedings.
b. Non-entry methods. Supervisors and employers shall first evaluate non-entry methods for conducting necessary work, before scheduling entry operations into confined spaces.
c. Construction work in confined spaces shall comply with 29 CFR 1926 Subpart AA and this chapter. All other confined space work shall comply with 29 CFR 1910 and this chapter.

26.1.2  Supervisors and Managers

Supervisors and managers shall be responsible for employees and contracted work as follows:

26.1.2.1  Employee Protections

a. Ensure that risk assessments of potential confined spaces within their area(s) of responsibility have been made and are on file with the Safety, Health & Medical Services Division (Code QH). When confined spaces exist in your areas, ensure that entry into these spaces is controlled in accordance with this chapter and any supporting documents.
b. Ensure that employees who may enter permit-required confined spaces are aware of the existence, location and dangers posed by the permit spaces.
c. Ensure that confined spaces are re-evaluated when there are changes in the use or configuration that might increase the hazards to entrants.
d. Know the hazards that may be faced during entry, including information on the mode, signs, symptoms, and consequences of the exposure as well as all potential hazards in the space.
e. Ensure the proper equipment required for safe entry into confined spaces is available.
f. If confined spaces exist in area of supervision, attend initial and annual refresher training for confined spaces operations.
g. Ensure employees entering confined spaces are trained in all aspects of the Ames Research Center Confined Space Program.
h. Ensure the terminated Permit and associated monitoring forms are returned to Code QH at M/S N237-14 at completion of entry. This includes any contractor confined space entry forms as well.
i. Ensure all entrants have been medically authorized per NPR 1800.1C, NASA Occupational Health Program Procedures.
26.1.2.2 Contracted Work

When contractors are hired to perform work that involves permit-required confined-space entry, the COR, NASA Project Manager, contractor responsible for subs and the NASA area supervisor shall:

a. Inform the contractor that the workplace contains permit spaces and that permit required confined space entry is allowed only through compliance with this chapter, Confined Space Entry.

b. Apprise the contractor of any precautions or procedures that NASA has implemented for the protection of employees in or near permit required confined spaces where contractor personnel will be working.

c. Apprise the contractor of the elements, including the hazards identified and NASA's experience with the space that makes the space in question a permit required confined space.

d. Debrief the contractor at the conclusion of the entry operations regarding the program followed and any hazards confronted or created in permit required confined spaces during entry.

e. Coordinate entry operations when employees of more than one employer is working simultaneously as authorized Entrants in a permit required confined space, so that employees of one employer do not endanger the employees of any other employer.

f. Deviations from any of the Confined Space Entry chapter sections shall be documented to the contracting officer or project manager.

g. Collaborate with Safety, Health & Medical Services, Code QH for coordination between this program and specially tailored programs that provide improved procedures for unique operations.

(1) Resident on-site contractors (resident contractors): Resident on-site contractors shall participate in the Confined Space Working Group. Collaboration arrangements shall be documented and renewed annually. Collaboration participants comprise the Confined Space Working Group of paragraph 26.1.6, as required by NPR 8715.3C, NASA General Safety Program Requirements.

(2) Construction contractors and maintenance contractors:

(a) The Ames library of confined space evaluations shall be utilized to determine known hazards of existing spaces. Contact the COR and Safety, Health & Medical Services Division, 604-5602, for specific data prior to completing entry permit.

(b) All entry operations shall comply with 29 CFR 1926 Subpart AA, 29 CFR 1910.146 and 29 CFR 1910.268, as applicable, and this chapter.

26.1.3 Safety, Health & Medical Services (SH&MS) Division shall:

a. Develop and maintain a written confined space safety program for ARC.

b. Provide information and consultation to project management and employees involved in confined space operations.

c. Perform an annual review of the confined space program.
d. Review cancelled permits, alternate entry forms, and non-permit checklists periodically for compliance to improve program. Communicate any deficiencies to the relevant (involved) parties.

e. Provide training to civil service staff and on-site contractors.

f. Provide contract and specifications review as requested by Ames management.

g. Maintain a file of permits received and the locations of all confined spaces identified at ARC.

h. Function as the regulatory liaison with regulatory agencies as needed for confined space entries.

i. Document reviews of cancelled Confined Space Permits that are submitted to the Division at completion of each entry or task.

j. Retain confined space records of each canceled entry permit for at least 1 year; to facilitate the review of the permit-required confined space program required by paragraph (d)(14) of the OSHA Standard.

k. Retain copies of space evaluations and disseminate to future entrants upon request.

l. Provide respirator fit tests for resident staff and annual medical exams to civil servant staff.

26.1.4 The Contracting Officer (CO) shall:

a. Ensure all on-site (resident) contractors are aware and follow the confined space entry policies that govern work at NASA-Ames.

b. Ensure all contracted and subcontracted work, at every tier, involving confined space entry is conducted in accordance with the minimum standards of this chapter.

c. Ensure written programs are authorized by the Safety, Health & Medical Services Division; where contractor conducts entries in accordance with a specially tailored contractor program that provides improved procedures for its unique operations. These collaborative arrangements shall be reauthorized annually, by active participation in the Confined Space Working Group.

d. Obtain a copy of the contractor’s annual program assessment per requirements of 29 CFR 1910.146(d)(14) and 1926.1204(n). Forward a copy to SH&MS Division, M/S N237-14.

e. Inform off-site contractors involved in confined space entry of the following:

(1) Confined space entry is allowed only through compliance with the contractor's approved confined space entry program or this Chapter. If a contractor’s program is used it must be submitted and approved by the Safety H&MS Division.

(2) The hazards associated with the confined space and any past experience with the space.

(3) Coordinate the work with both the on-site and offsite contractors when both will be working in or near confined spaces.

26.1.4.1 Multiple Contractors
If more than one contractor will be entering a confined space the Contracting Officer Representative (COR) responsible for the project will coordinate entry operations and ensure that each contractor is aware of the operations of the other(s) and that each contractor signs the entry permit.

26.1.4.2 Documentation

Obtain a copy of the confined space program and documentation of training, prior to the start of work. The CO or COR shall ensure that every entry is performed with job specific written procedures and that a permit or operating procedure is posted at the job site, per NPR 8715.3C. Coordinate technical review of above documentation with the Safety, Health & Medical Services Division.

26.1.5 Contractors shall:

a. Ensure that employees and sub-contractors at every tier comply with all procedures in this chapter, particularly Sections 26.2, 3, 4 and 5.

b. Obtain all available information regarding permit space hazards and entry operations from the Contracting Officer or Representative (COR), area supervisor and the safety office (Code QH). Contact the safety office, 604-5602, for existing evaluations.

c. Coordinate entry operations with the CO or COR and area supervisor when both NASA personnel and contractor personnel will be working in or near permit spaces.

d. Notify the Ames Fire Department via Ames Emergency Dispatch Center at 4-5416, prior to each entry into a permit-required confined space. (Phone notification is required to determine availability of rescue).

1) Construction contractors shall additionally establish 2-way communication with the rescue service. For example, the Ames Fire Department could be provided the Entry Supervisor’s cell phone number.

e. Inform the CO or COR, project manager and the area supervisor of:

(1) the permit space program that the contractor will follow and any

(2) hazards confronted or created in the permit spaces. (This information must be conveyed every time a confined space is entered).

f. Obtain all equipment, medical authorizations and training necessary to conduct a safe entry, including calibrated monitoring equipment. (NOTE: NASA may provide certain items of equipment, if so specified in the contract. The contractor shall provide all other required equipment.)

g. Provide a copy of the confined space program you will be following if other than this procedure as well as documentation of training to the CO or COR and project manager prior to the start of work.

h. Conduct and document a program assessment per requirements of 29 CFR 1910.146(d)(14) or 1926.1204(n) annually and submit to government.
26.1.5.1 Construction Contractors shall additionally:

a. Identify, evaluate and post all confined spaces at the work site in which employees may work, per 29 CFR 1926.1203.

b. Provide continuous monitoring of atmospheric and engulfment hazards, per 29 CFR 1926.

c. Obtain agreement with the Ames Fire Department or other emergency responders to provide notification, in the event that the rescue service becomes unavailable.

26.1.6 Confined Space Working Group

A working group, as required by NPR 8715.3C, NASA General Safety Program Requirements, shall be established and consist of a civil servant and contractor representative from the Safety, Health & Medical Services Division and representatives from each resident on-site contractor with confined space operations.

26.2 Entry Team

26.2.1 Entry Supervisor

26.2.1.1 The entry supervisor is the responsible person overseeing the safe entry into and work within the permit required confined space. The entry supervisor must complete the annual training requirement prior to performing the duties assigned in this section.

Note: The supervisor of employees who enter a confined space may not be acting as the "Entry Supervisor." The employees' supervisor may delegate these responsibilities to other qualified individuals but is also fully responsible for ensuring that the assigned person meets all the requirements of this chapter. For example, a Branch Chief is not required to act as the "Entry Supervisor" but may assign the daily responsibilities required of an "Entry Supervisor" to a lead person. In this case, the lead person would ensure that the requirements for specific confined space entries are met, with periodic program review from the Branch Chief. The Branch Chief is ultimately responsible for ensuring that the requirements of this chapter are met, even though his/her employees may be acting as "Entry Supervisors."

26.2.1.2 Entry Supervisors shall not simultaneously be an entrant. If the entry supervisor must become an entrant they must formally re-assign the duties of the entry supervisor to either a new supervisor or to the attendant. This must be formally documented on the Entry Permit.

26.2.1.3 The Entry Supervisor is responsible for the following:

b. Review the confined space and project hazards for the confined space to be entered each time the space is entered. Consult the Safety Division if you need assistance at 604-5602.

c. Make the Confined Space Entry Permit available to employees and post the form near the entry point for the confined space during the entire entry.

d. Verify the entry personnel and attendants are qualified, required forms are complete, necessary pre-entry tests have been done, required PPE is worn by Entrants, and necessary equipment is in place including non-entry rescue, and communications when required.

e. Ensure that conditions are monitored, that they do not degrade from initial evaluation, and that conditions remain consistent with the entry permit.

f. Ensure hazards listed on the confined space entry forms are controlled or eliminated.

g. Provide appropriate barriers to isolate the area and protect the entrants from external hazards.

h. Establish emergency rescue services and 2-way communication with responders in case rescue service becomes unavailable during an entry.

i. Return the permit to the Code QH at M/S N237-14 at completion of entry.

j. Document any inconsistencies with the confined space evaluations on the permit.

k. When a confined space entry is cancelled or aborted the event must be documented on the permit or checklist.

l. If there are either planned or unplanned deviations from authorized procedure, the deviation must be approved by the project manager or CO.

m. Complete initial and annual training requirements.

26.2.2 Attendant shall:

a. Be stationed outside a permit-required confined space to monitor the conditions of the Entrants.

b. Attend annual training as required by their supervisor or employer and satisfy the minimum training requirements of paragraph 26.5.

c. Be aware of the hazards that may be faced during entry, including physical and behavioral changes in Entrant and know the consequences of exposure.

d. Maintain Entrant identification and effective communications with all Entrants.

e. Ensure Entrants are properly equipped and that pre-entry testing and measurements have been taken prior to entry.

f. Monitor entry activities inside and outside the permit space and ensure entry conditions remain consistent with the terms of the entry permit.

g. Attendants may not be assigned another duty that could possibly distract them. Attendant shall not leave their location until completion of entry unless relieved by another qualified attendant.
h. Ensure the removal of unauthorized individuals who enter or who attempt to enter the permit-required confined space during entry operations.

i. Order the Entrants to cease all activities and exit the confined space if any of the following conditions occur:

1. A prohibited condition exists
2. A behavior or other unusual condition occurs inside or outside the space
3. An unsafe condition occurs inside or outside the space
4. The attendant is unable to fulfill their duties

j. Order to cease activities and exit must be formally documented on the entry permit as a significant incident on the back of the permit.

k. Perform non-entry rescue and notify emergency rescue if necessary. NEVER Enter a confined space for rescue purposes unless properly trained and certified in Confined Space Rescue.

l. Document on the Entry Permit, all deviations and inconsistencies that occur during entry period.

26.2.3 Authorized Entrants

NASA Employees or its contractors shall know the potential hazards that may be encountered during entry and the proper use and limitations of equipment to control those hazards prior to entering a confined space. The entrant cannot be the Entry Supervisor since all of the assigned duties of the supervisor cannot be carried out as an entrant. In addition entrants must also:

a. Attend annual training and obtain medical evaluations as required by their supervisors or employer.

b. Alert the attendant (if present) whenever:

1. The entrant recognizes any warning signs or symptoms of exposure to a dangerous substance
2. The entrant detects a prohibited condition

c. Communicate with the attendant (when there is one needed), as necessary to enable the attendant to know the status of the need to evacuate the confined space.

d. Exit from the permit space as quickly as possible whenever:

1. An order to evacuate is given by the attendant or the entry supervisor.
2. The entrant recognizes any warning sign or symptom of exposure to a dangerous situation.
3. The entrant detects a prohibited condition.
4. An evacuation alarm is activated.
5. Atmospheric monitoring equipment indicates an unsafe atmosphere.

e. Ensure that proper PPE is worn and functional and that required equipment is on site and functional.

f. Communicate all deviations and inconsistencies from the approved procedure to the attendant.
26.3 Entry Procedures

26.3.1 Confined Space Evaluation and Classification

Every confined-space shall be evaluated by the employee supervisor, area supervisor, or an individual working on his/her behalf to determine if a space/area is a permit-required confined-space, non-permit-required confined-space, or neither. All confined spaces in the area should be properly labeled. If there are spaces in the area that are incorrectly labeled or have not yet been evaluated, the Safety Division should be contacted to perform an evaluation. This evaluation must take place prior to any Confined-Space Entry. The flow chart found in Appendix D shall be used to assist with the evaluation. The area or employee supervisor is responsible for ensuring that the evaluation has been performed.

26.3.1.1 Confined Space Evaluation Form

For every Confined Space there should be a confined space evaluation on file. If there is not an evaluation on file then the area supervisor or Code QH should be contacted to ensure the space is properly classified and all potential hazards are identified prior to any confined space entry. If an area supervisor or manager completes an evaluation of a space a copy of that form must be returned to the Safety Division and one copy must be retained with the employee supervisor. A copy of the confined space evaluation form can be found in Appendix E. In the absence of a completed Confined-Space Evaluation Form, a confined-space must be considered to be a Permit-Required Confined Space.

26.3.1.2 Danger Sign

Danger Signs shall be posted at all permit-required confined spaces and Warning Signs shall be posted at all non-permit required confined spaces by the area or employee supervisor. The purpose of the sign is to inform employees of the existence, location, and danger posed by the permit-required or non-permit required confined-space. See Appendices I, J and K for confined-space danger and warning sign(s) to be used at Ames.

26.3.2 Confined Space Entry

26.3.2.1 Non-Permit Entry Control

A Non-Permit Required Confined Space (NPRCS) is confined space that does not contain, or with respect to atmospheric hazards, have the potential to contain any hazards capable of causing death or serious physical harm. There are however, entry control procedures to ensure the safety of Entrants.

a. Pre-entry: Before entry into a non-permit space is authorized the designated Entrant shall, complete the Non-Permit Confined Space Checklist.

b. The effective time of the Non-Permit Confined Space Checklist shall not exceed the time required to complete the task identified. If a new crew arrives, new forms must be completed by the new entrant.

c. The completed form shall be signed and dated by the entrant and returned to M/S N237-14, Code QH at the completion of entry.
26.3.2.2 Permit Required Entry Control
26.3.2.2.1 Pre-Entry

a. Before entry into a PRCS is authorized, the Entry Supervisor shall:

(1) Complete the Confined Space Entry Permit and document that the space is safe to enter.
(2) Coordinate with the Ames Emergency Dispatch Center as required by permit, to ensure rescue availability.
(3) Develop a non-entry rescue plan and set up associated equipment.

All members of the crew involved with the Confined Space Entry shall sign the permit, verifying the information on the permit and acknowledge their understanding of the permit requirements.

All pre-entry preparation activities specified on the permit shall be completed before entry is authorized.

These preparations include but are not limited to:

(4) Isolate the permit space.
(5) Depressurize equipment under positive and negative pressure. Note: Jackets and vessels are to be depressurized. If work is to be performed that could compromise the integrity of the inner jacket wall, the jacket must be drained and free from extremely hot or cold, noxious, poisonous, or flammable materials.
(6) Lock out, tag out, and try out all sources of electrical, pneumatic, mechanical, chemical, thermal, or radiation hazards.
(7) Purge, render inert, flush, or ventilate the permit space as necessary, eliminate or control atmospheric hazards.
(8) Provide pedestrian, vehicle, or other barriers as necessary to isolate the area and protect entrants from external hazards.

Evaluate permit space conditions as follows:

(9) Test conditions in the permit space to determine if acceptable entry conditions exist before entry is authorized to begin, except that, if isolation of the spaces is not feasible because the space is larger or is part of a continuous system (such as a sewer), pre-entry testing shall be performed to the extent feasible before entry is authorized and, if entry is authorized, entry conditions shall be continuously monitored in the area where the authorized entrant is working.
(10) Plan to test or monitor the permit space as necessary (every 15 minutes is recommended) to determine if acceptable entry conditions are being maintained during the course of the entry operation.
(11) When testing for atmospheric hazards use a calibrated direct reading instrument and, unless testing simultaneously with multi-gas meter, test first for oxygen, second for flammable gases and vapors (LEL), and third for toxic gases and vapors.

The complete Permit shall be made available at the time of entry to all authorized entrants and attendants, by posting it at the entry portal or by any other equally effective means.
26.3.2.2 Entry

a. Continue test monitoring described above.

At least one attendant is required outside the permit space for the duration of the entry operation. The permit space shall be evacuated immediately under any of the following conditions:

(1) The entrant or attendant detects a prohibited condition.
(2) The entrant recognizes any warning signs or symptoms of exposure to a dangerous situation.
(3) The attendant detects the behavioral effects of hazard exposure to an authorized entrant.
(4) The attendant detects a situation outside the space that could endanger the authorized attendant or entrant.
(5) The attendant cannot effectively and safely perform all the required duties.

PRCS permits shall track who is inside the space.

Construction work PRCS permits shall list rescue equipment and the non-entry rescue plan, on the back side of the permit form.

26.3.2.2.3 Post Entry

a. When the job is completed, all entrants have exited the space, and the space is ready to return to its initial configuration, the Entry Supervisor shall note on the permit any problems encountered during the entry so that appropriate revision to the confined space entry program can be made.

The duration of the permit shall not exceed the time required to complete the task identified. The duration must not extend beyond one shift with the same crew. If a new crew arrives, new forms must be completed by the new Entry Supervisor.

The Entry Supervisor must indicate the time and date the Permit is terminated and return the complete permit to M/S N237-14 within ten days of completion. The Area Supervisor should also retain a copy of each canceled or completed entry permit for at least one year.

All problems encountered and entry issues noted shall be communicated to contractors and management involved with the entry.

26.3.2.3 Alternate Entry

Alternate entry procedures for PRCS are allowed in accordance with 29 CFR 1910.146(c) or 29 CFR 1926.1203(e), provided that all the requirements in this section and Appendix G are met.

If a confined space is to be entered through alternate entry procedures it must be documented that the only primary hazard posed by the space is an actual or potential atmospheric hazard.

In both 29 CFR 1910.146(c)(5) and (c)(7) and 29 CFR 1926.1203(e), OSHA allows use of an alternate entry procedure to enter a PRCS in place of an entry permit, provided that all of the following requirements are met:
26.3.2.3.1 Alternate Pre-Entry

a. There is documentation of air monitoring and inspection data that substantiate the conditions above.

Documentation to support the former conditions is recorded on the Confined Space Alternate Entry Form prior to entry into the space and made available to each employee who enters the permit space. A copy of this form can be found in Appendix G of this chapter, on the Code QH website and on the ARC forms web page.

If any initial entry of the permit space is necessary to obtain the required monitoring and inspection data, the entry shall be performed under the regular procedures for entering a permit-required space including the completion of a Confined Space Entry Permit and the presence of an attendant.

If conditions exist that make it unsafe to remove an entrance cover, the unsafe condition shall be eliminated before the cover is removed.

When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

When testing for atmospheric hazards it is CRITICAL that the order of testing be followed, unless continuously monitoring multi-gas meters are used.

(1) Oxygen

(2) Combustible gases or vapors

(3) Toxic gases and vapors

The authorized entrant or attendant if used is responsible to complete and record these atmospheric tests on the Confined Space Alternate Entry Form.

Establish continuous forced air ventilation sufficient to maintain the space safe for entry.

26.3.2.3.2 Alternate Entry

a. There shall be no hazardous atmosphere within the space whenever any employee is inside the space.

Continuous forced air ventilation shall be used as follows:

(1) An employee shall not enter the space until the forced air has eliminated any hazardous atmosphere;

(2) The forced air ventilation shall be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees have left the space;

(3) The atmosphere within the space shall be periodically tested as necessary to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere.
If a hazardous atmosphere is detected during entry:

(4) Each employee shall leave the space immediately

(5) The space shall be evaluated to determine how the hazardous atmosphere developed.

(6) Measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

26.3.2.3.3 Alternate Post Entry

a. At the completion of the entry make sure that a copy of the Confined Space Alternate Entry Form is sent to M/S N237-14, Code QH.

26.3.3 Safety Precautions

26.3.3.1 Confined Space Hazards

Confined space hazards fall into two (2) general categories; hazardous atmospheres and physical hazards. Identify each hazard present and appropriate remedy on the permit. Examples of hazards follow:

26.3.3.1.1 Atmospheric Hazards

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Description</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₂ Deficiency</td>
<td>Less than 19.5% by volume</td>
<td>May cause light-headedness, dizziness or unconsciousness</td>
</tr>
<tr>
<td>O₂ Increase</td>
<td>Greater than 23.5% by volume</td>
<td>Increase flammability and explosion possibilities</td>
</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>Poisonous gas</td>
<td>Has a bitter almond odor</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>Toxic gas</td>
<td>Has a rotten egg odor</td>
</tr>
<tr>
<td>Methane</td>
<td>Toxic, flammable, and explosive</td>
<td>Has no odor</td>
</tr>
<tr>
<td>Freon</td>
<td>May be toxic depending on type</td>
<td>Displaces breathing air</td>
</tr>
<tr>
<td>Vapors from Jet Fuels, gasoline, solvents, and other carbon based liquids</td>
<td>Usually toxic, flammable, and explosive</td>
<td>Get up wind from vapors</td>
</tr>
<tr>
<td>Dusts</td>
<td>May be explosive</td>
<td>May damage respiratory system</td>
</tr>
<tr>
<td>Hazard</td>
<td>Description</td>
<td>Comments</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Carbon Dioxide (CO₂) &amp; Nitrogen (N₂)</td>
<td>Can concentrate in low places</td>
<td>Displaces breathing air</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>Toxic gas</td>
<td>Replaces O₂ in the blood</td>
</tr>
<tr>
<td>Fumes, vapors, mists, and gases</td>
<td>Welding, cutting, flames, sparks, etc.</td>
<td>Work being done may change the classification of the space</td>
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26.3.3.1.2 Physical Hazards

<table>
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<tr>
<th>Hazard</th>
<th>Description</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical</td>
<td>Electrical transmission line, equipment or machines</td>
<td>Lockout or tagout (LOTO) procedures may be required</td>
</tr>
<tr>
<td>Thermal Energy</td>
<td>Heat, steam, or hot atmosphere</td>
<td>May not require ventilation, LOTO, etc.</td>
</tr>
<tr>
<td>Becoming lodged</td>
<td>Space becomes narrower, slopes downward</td>
<td>Area requires a survey before entering and the use of an extraction harness</td>
</tr>
<tr>
<td>Falling objects</td>
<td>Debris, or tools that can fall into space</td>
<td>Isolate openings, Hard hats required and other precautions need to be taken</td>
</tr>
<tr>
<td>Falls</td>
<td>Falls from ladders or other support equipment</td>
<td>Use proper support equipment</td>
</tr>
<tr>
<td>Noise</td>
<td>Noise may be excessive where equipment or machinery is located in a confined space</td>
<td></td>
</tr>
<tr>
<td>Hot Tap, welding, brazing, etc.</td>
<td>Open flames, sparks</td>
<td>May required additional permits</td>
</tr>
</tbody>
</table>

26.3.3.2 Test Conditions

26.3.3.2.1 Conditions must be tested in a confined space prior to entry to determine if acceptable entry conditions exist. If isolation of the space is not feasible because the space is larger or is part of a continuous system, such as a sewer, pre-entry testing shall be performed to the extent feasible before entry is authorized and, if entry is authorized, entry conditions shall be continuously monitored where Entrants are working.
If hazardous atmosphere could be created by the work being done such as welding, cutting, brazing, open flames, etc., atmospheric monitoring shall be continuous.

26.3.3.2.2 Test Sequence

When testing for atmospheric hazards it is CRITICAL that the order of testing be followed, unless continuously monitoring multi-gas meters are used.

a. Oxygen
b. Combustible gases or vapors
c. Toxic gases and vapors

26.3.3.3 Ventilation

Entrants will not enter a confined space that contains a hazardous atmosphere without appropriate respiratory protection. The hazardous atmosphere must be eliminated from a PRCS by forced ventilation in order for the space to be re-classified. The airflow shall be directed to ventilate the immediate area where the Entrants are to be in the space and shall start 30 minutes prior to entry and continue until all Entrants have left the space. The air supply shall be from a clean source and may not increase the hazards in the space. The atmosphere shall be tested periodically or as directed by the permit or checklist to ensure the ventilation is adequate. Should a hazardous atmosphere be detected all Entrants shall evacuate the space. The reason for the atmospheric change shall be determined and corrected before Entrants may re-enter the space.

26.3.3.4 Toxic Materials

If an injured Entrant is exposed to a substance for which a Safety Data Sheet (SDS) or similar written information is required to be kept at the work site, that SDS or written information shall be made available to the medical facility treating the exposed Entrant.

26.3.3.5 Air Supply

An adequate continuous supply of air shall be provided while work is performed in utility vaults under any of the following conditions:

a. Where combustible or explosive gas vapors have been initially detected and subsequently reduced to safe levels by ventilation, or;
b. Where solvents and other hazardous materials are used in the work procedure, or;
c. When open flame torches are used in the work procedure, or,
d. Where the utility vault is located in the portion of a public right of way open to vehicular traffic and/or exposed to seepage of gas or gases, or;
e. Where toxic gas or oxygen deficiency is found.

26.3.3.6 Ladders
Ladders shall be used to enter and exit utility vaults exceeding 4 feet in depth.

26.3.3.7 Open Flame

When open flames are used in utility vaults, the following precautions shall be taken to protect against the accumulation of combustible gas:

a. A Confined Space Entry Permit or Alternate Entry Form is required.

b. A test for combustible gas shall be made immediately before using the open flame device and continuously while using the device.

c. A fuel tank (e.g., acetylene, etc.) may not be in the utility vault except during actual use.

d. A welding, cutting and brazing permit (hot work permit) shall be filled out and approved by the appropriate department prior to performing any work that creates a flame or spark. Precautions shall be taken to guard against a build-up of combustibles, toxic gases, fumes, mists, etc., when open flames or welding operations are being performed in vaults.

26.3.4 Alternate Entry and Telecommunications Field Work

This section applies to the guarding of utility vaults and street openings, and to atmospheric testing and ventilation in utility vaults and non-vented vaults where telecommunications fieldwork is performed on or with underground lines. Telecommunications utility companies or contractors they control may perform work in spaces that NASA has classified as permit required confined spaces. The space may be reclassified so long as it has been documented that all potential or actual hazards have been eliminated prior to entry and at a minimum the requirements of this section and 29 CFR 1910.268 are met.

26.3.4.1 Guarding Utility Vaults and Street Opening

When covers of utility vaults or street openings are removed, the opening shall be promptly guarded by a railing, temporary cover, or other suitable temporary barrier which is appropriate to prevent an accidental fall through the opening, and to protect employees working in the utility vault from foreign objects entering the opening.

26.3.4.2 Requirements Prior to entering Utility Vaults and Non-vented Vaults

Before an employee enters a utility vault, the following steps shall be taken:

a. The internal atmosphere shall be tested for oxygen deficiency, combustible gases, and toxic gases. When unsafe conditions are detected by testing, or other means, the work area shall be vented and otherwise made safe before entry.

All air monitoring results shall be documented on the Non-permit Confined Space Entry Checklist. The checklist is used to verify that the vault is safe to enter and prior atmospheric conditions have not changed.

26.3.4.3 Joint Power and Telecommunications Manholes
While work is being performed in a manhole occupied jointly by an electric utility and a
telecommunication utility, an employee with basic first-aid training shall be available in the immediate
vicinity to render emergency assistance as may be required. The employee whose presence is required
in the immediate vicinity for the purposes of rendering emergency assistance is not to be precluded
from occasionally entering a manhole to provide assistance other than in an emergency.

26.4 Rescue

26.4.1 First Aid & CPR Certification

At least one member of the confined space rescue team shall hold a current certification in First-Aid and
CPR. Other members shall have received initial basic first-aid and CPR training. (29 CFR
1910.146(k)(2)(iii) and 1926.1211(b)(3).

26.4.2 Retrieval Systems

To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorized
entrant enters a PRCS, unless the retrieval equipment would increase the overall risk of entry or would
not contribute to the rescue of the entrant. Retrieval systems shall meet the following requirements:

a. Each authorized entrant shall use a chest or full-body harness, with a retrieval line attached at the
center of the entrant's back near shoulder level, or above the entrant's head. Wristlets may be used in
lieu of the chest or full-body harness if the NASA Ames and/or NASA contractors can demonstrate that
the use of a chest or full-body harness is not feasible or creates a greater hazard and that the use of
wristlets is the safest and most effective alternative.

The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the
permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue
is necessary. A mechanical device shall be available to retrieve personnel from vertical permit spaces
more than five feet deep.

26.4.3 Non-entry Rescue

If in the course of a PRCS entry, an attendant becomes aware that an entrant needs assistance in
escaping from permit-required confined space hazards, the attendant shall:

a. Summon rescue and other emergency services.

b. Begin non-entry rescue procedures determined in the pre-entry safety briefing (e.g., use the
mechanical retrieval system to extract the entrant from the confined space).

c. Attendants may not enter a permit-required confined space to attempt a rescue unless they have
been trained and equipped for rescue operations, and if they have been relieved by another attendant.

26.4.4 Rescue that Requires Entry

Employees who enter PRCS to perform rescue services must meet the training requirements outlined in
section 26.5.2.

a. If rescue cannot be accomplished using the non-entry procedure, the attendant shall:
b. Summon rescue and other emergency services.

c. Implement rescue support actions determined in the pre-entry safety briefing.

d. Qualified rescuers will follow their standard operating procedure for rescue operations in confined spaces.

26.5 Training and Certification

26.5.1 General

Entrants, Attendants, Entry Supervisors, and rescue service members shall be qualified for the position they fill. Training records shall include each employee's name, the signature or initials of the trainer, and the dates of the training. Training records will be available for inspection by authorized confined space team members and their authorized representatives.

Training shall at minimum, include the following:

a. The operations of the Confined Space Program.

b. The specific duties of each person involved in confined space operations.

c. The hazards of confined-spaces including information on the mode, signs or symptoms, and consequences of exposure.

d. The proper use of equipment required during confined space operations including testing and monitoring equipment, ventilating equipment, communication equipment, personal protective equipment, lighting equipment, barriers and shields, ingress/egress equipment, rescue and emergency equipment used for non-entry rescue.

e. The methods and importance of communication between Entrant and Attendant.

f. The conditions under which the space should be evacuated.

g. The procedures for summoning rescuers.

h. The procedures to be used for a non-entry rescue.

i. Each member of the confined space entry team at Ames will receive annual refresher training after the initial training course has been taken.

26.5.2 Rescue Training

Employees who enter permit-required confined spaces to perform rescue services shall receive all the training normally given to authorized Entrants, Attendants, and Entry Supervisors.

In addition, their training shall also include the following:

a. The proper use of any PPE or rescue equipment necessary for making rescues from permit spaces.

b. The specific duties required for rescue personnel.
c. Practice making confined space rescues at least once a year, by means of simulated rescue operation in which they remove dummies, mannequins, or actual person from the actual or representative permit spaces.

d. Basic first aid and CPR.

e. At least one member of the rescue team shall have current certification in both first-aid and CPR training.

26.5.3 Employee Training

Training shall establish employee proficiency in the duties required of authorized Entrants, Attendants, Entry Supervisors, and rescue service members, and shall introduce new or revised procedures, as necessary.

Training shall be provided to each affected employee:

a. Before the employee is first assigned confined-space operations duty.

b. Before there is a change in assigned duties.

c. Whenever there is a change in permit-required confined-space operations that presents a hazard about which an employee has not previously been trained.

d. Whenever anyone has reason to believe either that there are deviations from the permit-required confined space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.

26.5.4 Safety, Health and Medical Services

This office will provide confined space training to Ames personnel and on-site contractors. Off-site contractors will make appropriate arrangements for training and documentation in accordance with 29 CFR 1910.146, 29 CFR 1926.1207 and the approved program plan.

26.5.5 Training Certification

Once trained, each employee who serves as an authorized Entrant, Attendant, Entry Supervisor, or rescue service member shall have his/her training documented. The documentation shall contain the employee's name, the signature and initials of the trainer, and the dates of training. The documentation will be available for inspection by employees and their authorized representatives. The safety office, Code QH, maintains a list of employees trained in-house.
APPENDIX A. DEFINITIONS

Acceptable entry conditions. The conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined-space entry can safely enter into and work within the space.

Alternate Entry Procedure. Entry into a Permit Required Confined Space without using rescue standby or filling out the formal permit provided that the only hazard posed by the permit space is an actual or potential hazardous atmosphere and continuous forced air ventilation is applied to maintain safe entry conditions. If any other hazards exist within then the alternate entry procedure cannot be used.

Attendant. An individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program.

Authorized entrant. An employee who is authorized by the employer to enter a permit space.

Blanking or blinding. The absolute closure of pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

Confined space. A space that:

Is large enough and so configured that an employee can bodily enter and perform assigned work; and

Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and

Is not designed for continuous employee occupancy.

Note: There are two types of confined-spaces: non-permit required confined-spaces (NPRCS) and permit-required confined-spaces (PRCS). See these definitions for more details. There are three possible ways to enter a PRCS depending on the conditions within the space. One method is entry by full permit, another is Alternate entry Procedure, and the third is non permit entry by reclassification of the PRCS. These methods will be discussed further in Section 26.7. (29 CFR 1910.146 (c) (5) (i), (c) (5) (ii), and (c) (7).

Construction contractor. An employer who conducts work that is subject to regulation by 29 CFR 1926 Subpart AA, Confined Spaces in Construction.

Double block and bleed. The closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.
Emergency. Any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment. The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entry. The action by which a person passes through an opening into a permit-required confined-space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry permit. The written or printed document that is provided by the employer to allow and control entry into a permit space.

Entry supervisor. The person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section. Note: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Hazardous atmosphere. An atmosphere that may expose employees to the risk of death, incapacitation, and impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL) or airborne combustible dust at a concentration that meets or exceeds its LFL. Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.

Atmosphere concentration of any substance for which a dose or a Permissible Exposure Limit (PEL) is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of 29 CFR and which could result in employee exposure in excess of its dose or PEL.

Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

Any other atmospheric condition that is immediately dangerous to life or health.
Note: For air contaminants for which OSHA has not determined a dose or PEL, other sources of information, such as Material Safety Data Sheets (MSDSs) that comply with the Hazard Communication Standard, §1910.1200 of 29 CFR, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

Hot work permit. The employer’s written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

Immediately dangerous to life or health (IDLH). Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual’s ability to escape unaided from a permit space. Note: Some materials (hydrogen fluoride gas and cadmium vapor, for example) may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12 to 72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

Inerting. The displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible. Note: This procedure produces an IDLH oxygen-deficient atmosphere.

Isolation. The process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Non-permit confined-space. A confined-space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazards capable of causing death or serious physical harm. The Non-Permit Confined Space Entry Checklist needs to be filled out prior to entry.

Oxygen deficient atmosphere. An atmosphere containing less than 19.5-percent oxygen by volume.

Oxygen enriched atmosphere. An atmosphere containing more than 23.5-percent oxygen by volume.

Permit-required confined-space (permit space). A confined-space that has one or more of the following characteristics:

- Contains or has potential to contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard (ex. Traffic, chemical hazard, process hazard, mechanical hazard, electrical hazard, and biological hazard).
Note: If the only hazard posed by the permit space is an actual or potential hazardous atmosphere and the employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain the space safe for entry then the Alternate Entry procedure can be used. (29 CFR 1910.146 (c) (5) & (c) (7)). If the permit required confined space does not have an actual or potential hazardous atmosphere and all serious safety hazards have been removed the permit space can be temporarily reclassified as a non-permit space for as long as the hazards do not exist. Non permit/reclassification checklists shall be filled out to document procedures followed to reclassify the space.

Permit-required confined-space program (permit space program). The employer's overall program for controlling, and where appropriate, for protecting employees from permit space hazards and for regulating employee entry into permit spaces. (29 CFR 1910.146 (d))

Permit system. The employer's written procedure for preparing, issuing and returning completed permits for each confined space entry and for returning the permit space to service following termination of entry.

Prohibited condition. Any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Reclassification of Spaces. A space classified by the employer as a permit required confined space may be reclassified as a non-permit confined space if the permit space does not pose an actual or potential atmospheric hazard and if all hazards within the space are eliminated prior to entry into the space. Also a non-permit confined space may be reclassified as a permit required confined space if any atmospheric or serious safety hazard is present in the space during the time of entry or if work in the space will create a hazardous condition.

Rescue service. The personnel designated to rescue employees from permit spaces.

Retrieval system. The equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

Safety Office. The Safety, Health and Medical Services Division (SH&MS), Code QH, M/S N237-14, Ames Research Center, phone 604-5602.

Testing. The process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

Note: Testing enables employers to both anticipate, evaluate and implement adequate control measures for the protection of authorized entrants and to determine if acceptable entry conditions are present immediately prior to and during entry.
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>APR</td>
<td>Ames Policy Requirement</td>
</tr>
<tr>
<td>ARC</td>
<td>Ames Research Center</td>
</tr>
<tr>
<td>Code QH</td>
<td>Safety Health and Medical Services Division</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon Monoxide</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>CO</td>
<td>Contracting Offices</td>
</tr>
<tr>
<td>COTR</td>
<td>Contracting Officer Technical Representative</td>
</tr>
<tr>
<td>CPR</td>
<td>Cardiopulmonary resuscitation</td>
</tr>
<tr>
<td>LEL</td>
<td>Lower Explosive Limit</td>
</tr>
<tr>
<td>LOTO</td>
<td>Lock Out Tag Out</td>
</tr>
<tr>
<td>NPRCS</td>
<td>Non-Permit Required Confined Space</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NPR</td>
<td>NASA Procedural Requirement</td>
</tr>
<tr>
<td>O₂</td>
<td>Oxygen</td>
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<tr>
<td>OSHA</td>
<td>Occupational Safety And Health Administration</td>
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<td>PRCS</td>
<td>Permit Required Confined Space</td>
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<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
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<tr>
<td>SDS</td>
<td>Safety Data Sheets</td>
</tr>
<tr>
<td>SH&amp;MS</td>
<td>Safety Health &amp; Medical Services Division</td>
</tr>
</tbody>
</table>
APPENDIX C: REGULATIONS AND STANDARDS

NASA Headquarters Requirements and Standards

NPR 1800.1C, NASA Occupational Health Program Requirements
NPR 8715.3C Chapter 3.17
NASA STD 8719.7
NPR 8831.2E Chapter 5.6
  • NPR 8800.15B Chapter 88.5.4
  • NPR 7900.3C Chapter 2.6
  • NPR 8621.1B Chapter 2.6

Federal OSHA General Industry (29 CFR 1910)

1910 Subpart H, Hazardous materials,
1910.124, General requirements for dipping and coating operations
1910 Subpart J, General environmental controls
1910.146, Permit-required confined spaces
Appendix A, Permit-required confined space decision flow chart
Appendix B, Procedures for atmospheric testing
Appendix C, Examples of permit-required confined space programs
Appendix D, Confined space pre-entry check list
Appendix E, Sewer system entry
Appendix F, Rescue team or rescue service evaluation criteria (Non-mandatory)

1910 Subpart Q, Welding, cutting, and brazing
1910.252, General requirements
1910 Subpart R, Special industries
1910.268, Telecommunications

Federal OSHA, Confined Spaces in Construction

29 CFR 1926.1200 to 1213, Subpart AA


§5157. Permit-Required Confined Spaces.
### APPENDIX D: PERMIT-REQUIRED CONFINED-SPACE DECISION FLOW CHART

1. Does the workplace contain confined spaces as defined below? Confined space means:
   - Is large enough and so configured that an employee can bodily enter and perform assigned work; and
   - Has limited or restricted means for entry (for example, tanks, vessels, sumps, storage bins, hoppers, vaults and pits are spaces that may have limited means of entry); and
   - Is not meant for continuous employee occupancy
   **No!** → 2. Consult other applicable OSHA Standards

3. Does the workplace contain permit-required confined spaces as defined below? Permit-required confined-space (permit space) means a confined space that one or more of the following characteristics:
   - Contains or has potential to contain a hazardous atmosphere;
   - Contains a material that has the potential for engulfing an entrant;
   - Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a roof which slopes downward and tapers to a smaller cross-section; or
   - Contains any other recognized serious safety or health hazard
   **No!** → 4. Consult other applicable OSHA Standards

5. Inform employees as required by Section 26.4 and 26.5
6. Will permit spaces be entered? **YES!**

8. Will Contractors Enter? **YES!**
   9. Task will be done by contractor employees. Inform contractor as required by section 26.1.6 Contractor obtains information required by Section 26.1.3 from host.
   10. Both Contractors and Host will enter Space **NO** → go to 14

11. Coordinate entry operations as required by Section 26.1.3
    **Go to 14**

12. Will Host employees enter to perform entry tasks **NO!**

14. Does Space have known or potential hazards **NO!**

15. Not a Permit-required confined space. Follow Non Permit confined space checklist or alternate entry form for confined spaces Consult OSHA standards

16. Can the Hazards be eliminated **YES!**

17. Employer may choose to re-classify space as non permit required confined space 29.3.2(a) or 29.3.2

18. Can the space be maintained in a condition safe to enter by continuous forced air ventilation? **YES!**

19. Space may be entered under section 26.2.5.2(c)

20. Prepare for entry via permit procedures

21. Certify acceptable entry conditions. (Test results recorded, space isolated, if needed rescue plan reviewed and means to summon available

    - Entrants properly equipped, etc.) **NO!** → 22. Permit not valid until conditions meet permit specifications

23. Permit issued by authorizing signature Acceptable entry conditions maintained throughout entry. **NO!**

24. Emergency exists (prohibited condition) Entrants evacuated. Entry aborts (call rescue if needed)

   - Permit now void. Re-evaluate programs to correct/prevent prohibited conditions. Occurrence of emergency (usually is proof of deficient planned entry).

   - No entry until a new plan and permit is amended

   **Got to 18**

25. Entry tasks completed. Forms returned and cancelled.

   - Audit permit program and permit based on evaluation of entry by entrants, attendants, testers, and preparers, etc.
## APPENDIX E. CONFINED SPACE EVALUATION FORM

RETURN COMPLETED FORM TO CODE QH, M/S N237-14, UPON CONCLUSION OF WORK

<table>
<thead>
<tr>
<th>Confined Space Evaluation Form</th>
<th>NASA Ames Research Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification #</td>
<td>Date:</td>
</tr>
<tr>
<td>Location:</td>
<td>Dimensions:</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>Type Of Evaluation (Check one): Initial ☐ Re-evaluation ☐</td>
<td></td>
</tr>
<tr>
<td>Does this space meet the definition of a confined space? Yes ☐ No ☐</td>
<td></td>
</tr>
<tr>
<td>If no, evaluation is complete and space is not a confined space. Sign, date, &amp; file the evaluation form.</td>
<td></td>
</tr>
<tr>
<td>If yes, determine if the space is a Non-Permit Confined Space or a Permit-Required Confined Space.</td>
<td></td>
</tr>
</tbody>
</table>

### Hazard Identification:

- **Yes** ☐ **No** ☐
  - Atmosphere (e.g. oxygen deficiency or asphyxiation; toxic air contaminants, combustible gases, vapors, or particulate; heat formation; biological decomposition; exhaust from internal combustion engines, etc.)
  - Chemical contact (e.g. acids, chlorides, coal tar products, sensitizers, skin irritants, solvents, paints, cleaners, adhesives, etc.)
  - Electrical (e.g. live wires, transformers, capacitors, relays, switch gear, exposed terminals, etc.)
  - Biological (e.g. sewage, storm drains, water, water-borne or bodily fluids, livestock, etc.)
  - Environmental (hot stress; cold stress; slippery surfaces; lighting; potential for insects; flooding due to groundwater, rain or leak, etc.)
  - Hazardous Material (e.g. pressurized fluids in chemical piping or hydraulic systems, residual process chemicals, etc.)
  - Ignition Sources (e.g. open flames, heat sources, frictional sparks, non-hazard classified electrical equipment, welding/cutting, hot riveting, hot forging, static discharge, grinding, chopping, etc.)
  - Mechanical (e.g. grinders, blenders, stirrers, conveyors, unguarded belts, unguarded fans, etc.)
  - Noise (e.g. sound high noise level area, fans and blowers, noise from operations in space, or nearby equipment, etc.)
  - Physical Hazards (e.g. falls, engulfing materials such as liquids or flowing particles, entrapment due to confined space configuration, access, etc.)
  - Process Hazards (e.g. contaminant producing activities in or around the space such as sandblasting, painting, or other unique process activities).
  - Radiant (e.g. lasers, welding flash, RF and microwave sources, etc.)
  - Traffic (e.g. pedestrian, public walk way, forklifts, etc.)

- **Yes** ☐ **No** ☐ **Other** ☐
  - Describe:

### Oxygen Content:

- %LEL: %
- %LEL: ppm
- CO: ppm
- H₂S: ppm

The space has been determined to be (check one):
- Not a confined space
- Non-permit confined space
- Permit-Required confined space

If a confined space is the appropriate sign posted?

If no, contact the Confined Space POC. Sign provided? Yes ☐ No ☐

This space has been inspected and evaluated for the purpose of determining the permitting status as a confined space. Work in this space must be further evaluated prior to entry, as the status may change based on new conditions or the work performed.

Evaluators:

- Date:

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APR 8715.1

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**APPENDIX F.  CONFINED SPACE PERMIT ENTRY FORM**

RETURN COMPLETED FORM TO CODE QH, M/S N237-14, UPON CONCLUSION OF WORK

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**ENTRY PERMIT FOR PERMIT REQUIRED CONFINED SPACES**

_This Entry is a Hazardous Operation_

<table>
<thead>
<tr>
<th>Confined Space Number:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of Confined Space:</td>
<td></td>
</tr>
<tr>
<td>Purpose of entry:</td>
<td>Communication:</td>
</tr>
<tr>
<td>Date:</td>
<td>Time issued:</td>
</tr>
<tr>
<td></td>
<td>Time Expired:</td>
</tr>
<tr>
<td></td>
<td>Evaluation Pulled:</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>Name of Entrants</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

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**Confined Space Hazards:**

(Describe and state how the hazard was eliminated. If hazard does not exist enter N/A.)

- Atmospheric hazards: (i.e. O2 deficiency, O2 enrichment, toxicity, flammability) N/A
- Mechanical Hazards: (i.e. Agitators, blenders, fan blades)
- Chemical Hazards: (i.e. Acids, alkalis, solvents)
- Electrical Hazards: (i.e. lines and cables, high voltage, transformers, exposed terminals)
- Engagement Hazards: (i.e. Water, plastics and chemicals, inwardly converging walls, sloping floors)
- Ignition Hazards: (i.e. open flames, heat sources, welding)
- Process Hazards: (i.e. pressurized fluids, chemicals, hydraulic fluid, traffic hazards)
- Noise Hazards: (i.e. ambient noise levels, loud equipment)
- Environmental Hazards: (i.e. heat, cold, insects, vermin, slippery surfaces)
- Describe other serious hazards and mitigations on back.
- Describe procedure deviations that occurred on back.

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**Personal protective and safety equipment**

- Helmet
- Coveralls
- Boots
- Face Shield
- Explosion Proof Light
- SCBA
- Gloves (Specify: )
- Safety harness
- Goggles
- Respirator (Specify: )
- Fire Extinguisher
- Crane/hoist w/ Whip
- Other (Specify: )

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**Atmospheric Monitoring**

<table>
<thead>
<tr>
<th>Acceptable Range</th>
<th>Pre-entry</th>
<th>Test 1</th>
<th>Test 2</th>
<th>Test 3</th>
<th>Test 4</th>
<th>Test 5</th>
<th>Test 6</th>
<th>Test 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>19.5% to 23.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability</td>
<td>&lt;10% LEL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>12ppm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOZ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toxicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test results indicate:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument Make Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration Date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conditions Measured (O2, CO, LEL, etc)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Rescue and emergency**

- Notify NASA Dispatcher, ext. 4-5410, that a Confined Space Entry is expected.
- Pr-entry Safety Brief: initial employees briefed on emergency procedures.
- Ensure mandatory notification methods of emergency alert to others, Health Unit and Employee Health Center.
- All employees wear harness and continuously attached to service. Unless retrieval equipment will increase overall risk of entry or benefit during a rescue.

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**Permit Authorization**

- Identity that all actions and conditions necessary for safe entry have been performed.
- Entry Supervisor Name: [ ] Entry Supervisor Signature: [ ]
- Date: [ ]
- Were any problems encountered during entry operation? [ ] Yes [ ] No
- If Yes please describe on the back.
- Submit by Email

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APPENDIX G. Alternate-Permit Confined Space Checklist

<table>
<thead>
<tr>
<th>Confined Space Alternate Entry Form</th>
<th>NASA Ames Research Center</th>
</tr>
</thead>
</table>

Identification# | Date: | Location: | Purpose of Entry: |

A permit space may be entered using alternate entry procedures if the only actual or potential hazard in the space is atmospheric and this hazard has been eliminated.

The alternate entry procedures are valid as long as the atmospheric hazard if any is controlled by forced air ventilation. If additional hazards arise within the space, or forced air ventilation is inadequate to control the atmospheric hazard, employees in the space must exit immediately and the space must be re-evaluated prior to entry.

**Measures Taken to Eliminate Hazards Prior to Entry:**

<table>
<thead>
<tr>
<th>Describe</th>
<th>YES</th>
<th>NO</th>
<th>Describe:</th>
<th>YES</th>
<th>NO</th>
<th>Describe:</th>
<th>YES</th>
<th>NO</th>
<th>Describe:</th>
<th>YES</th>
<th>NO</th>
<th>Describe:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Contents of space</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Chemical Hazards</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Electrical Hazards</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Slips, trips, falls</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Atmospheric Hazards Eliminated</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td>YES</td>
<td>NO</td>
<td>Describe:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Test atmosphere and document below)

| 6. Hazardous Materials | YES | NO | Describe: | YES | NO | Describe: | YES | NO | Describe: |
| 7. Physical Hazards | YES | NO | Describe: | YES | NO | Describe: | YES | NO | Describe: |
| 8. Process Hazards | YES | NO | Describe: | YES | NO | Describe: | YES | NO | Describe: |
| 9. Other Hazards | YES | NO | Describe: | YES | NO | Describe: | YES | NO | Describe: |

**Atmospheric Testing**

<table>
<thead>
<tr>
<th>Instrument: (Model Serial Number)</th>
<th>Calibration Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Entry Test:</td>
<td>Date:</td>
</tr>
<tr>
<td>Substance</td>
<td>Permissible Exposure Level</td>
</tr>
<tr>
<td>%Oxygen</td>
<td>19.5% to 23.5%</td>
</tr>
<tr>
<td>%LEL</td>
<td>10% or less</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>25 ppm or less</td>
</tr>
<tr>
<td>Hydrogen Sulfide (H₂S)</td>
<td>10 ppm or less</td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
</tbody>
</table>

Name of Entrant/Signature | Date: | Date of Entrants Training: |

I certify that all hazards have been eliminated in the space and the atmospheric hazard if present can be effectively eliminated through continuous forced air ventilation and hereby authorize that alternate confined space procedures may be used. (Persons endorsing this form must have received confined space training).
# NON-PERMIT CONFINED SPACE CHECKLIST

**Non-permit confined space:** A confined space that **does not contain** or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm. Also a previously permit-required space after all the hazards have been eliminated.

<table>
<thead>
<tr>
<th>Space Number:</th>
<th>Space Location:</th>
<th>Date:</th>
</tr>
</thead>
</table>

**Entrant’s Name/Organization or Contract Name/Date of Training**

1. / /  
2. / /  
3. / /  
4. / /  

- Will operations introduce contaminants into the space that change the atmospheric quality and characterization of the space?  
  - [ ] Yes  
  - [ ] No
- Do conditions exist outside the space that could adversely affect the entry?  
  - [ ] Yes  
  - [ ] No
- Do any potential hazards exist within the confined space? Circle all that apply. (If downgraded, explain how they were eliminated.)
  1. Atmosphere:  
  2. Chemical contact:  
  3. Electrical:  
  4. Biological:  
  5. Process Hazards:  
  6. Environmental:  
  7. Hazardous materials:  
  8. Ignition Sources:  
  9. Physical Hazards:  
  10. Other:  

**Note:** If Yes on any item above, the conditions must be eliminated prior to entry or re-evaluate for Permit-Required Confined Space Entry.

- Notify NASA Ames dispatch at 604-5416.  
  - Initials:  
- Secure the work site and install guarding.  
  - Initials:  
- Post the area with appropriate signs and set up traffic control.  
  - Initials:  
- Continuous Monitoring Recommended.  
  - [ ] Yes  
  - [ ] No  
  - Initials:  
- Purge/Continuous Ventilation.  
  - [ ] Yes  
  - [ ] No  
  - Initials:  
- Re-test after ventilation.  
  - [ ] Yes  
  - [ ] No  
  - Initials:  

<table>
<thead>
<tr>
<th>Acceptable Range</th>
<th>Test 1</th>
<th>Test 2</th>
<th>Test 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen 23.5 to 19.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammability &lt;10%LEL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO &lt;12 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₂S 5ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other &lt;1/2 PEL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Time**

<table>
<thead>
<tr>
<th>Instrument Make, Model No.</th>
<th>Serial Number</th>
<th>Calibration Date</th>
<th>Conditions Measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
<td>/</td>
<td>/</td>
<td></td>
</tr>
</tbody>
</table>

**Entry Supervisor Signature**

/ Org. / Date:  

**Reviewed By** (Following completion)
APPENDIX I:  CONFINED-SPACE SIGN: PERMIT REQUIRED

```
DANGER

Permit Required Confined Space
Do Not Enter
Without an "Entry Permit for Permit Required
Confined Spaces"

Special training, procedures, equipment and notifications
are needed prior to each entry.

For more information contact your supervisor or the
Ames Safety Office at 4-5602.

Confined Space I.D.  N207-01-0008
```
APPENDIX J: CONFINED-SPACE SIGN: DO NOT ENTER

DANGER

Confined Space
Do Not Enter
Without Conducting a Confined Space Evaluation

This area has been evaluated and found to be a
"Confined Space" as defined by OSHA.
Due to changing conditions in this area you must complete a
"Confined Space Evaluation Form" to determine if this area is a
"Non-Permit Required Confined Space" or a "Permit Required
Confined Space" prior to each entry.

For more information contact your supervisor or the
Ames Safety Office at 4-5602.

Confined Space I.D. N206-01-0007
CAUTION

Non-Permit Confined Space

Do Not Enter without a "Non-Permit Confined Space Checklist".

For more information, contact your supervisor or the Ames Safety Office at ext. 4-5602.