



SANFORD UNDERGROUND RESEARCH FACILITY

SOUTH DAKOTA SCIENCE AND TECHNOLOGY AUTHORITY

Confined Spaces Standard

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Revision History

Rev	Date	Section	Paragraph	Summary of Change	Authorized by
02	5/29/2024	NA	NA	Update Logo	CCR 946
03	10/16/24	1, 3, 4, 5, 6	1, 3, 4.1, 4.3.6, 4.4.1, 4.9.1, 5.1, 5.2, 5.3, 5.5, 6.1	Content changes per annual review	CCR 1013

1.0 Purpose

The purpose of this standard is to provide requirements for safely entering and performing work in a confined space.

South Dakota Science and Technology Authority (SDSTA) references the following to fulfill this standard:

- 29 CFR 1910.146, Occupational Safety and Health Standards (OSHA), Permit Required Confined Spaces.

2.0 Scope

This standard is applicable to all personnel, regardless of affiliation, at Sanford Underground Research Facility (SURF).

3.0 Definitions

Acceptable Entry Conditions – Conditions that must exist in a confined space to allow entry and to ensure that employees involved can safely enter and work within the space.

Attendant – A trained employee, contractor, or user who is stationed and remains outside of the confined space for the purpose of monitoring the Entrants and who performs all Attendant's duties. An Attendant shall be stationed outside any confined space requiring a permit for each job assignment.

Confined Space – A space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work.
- Has limited or restricted means for entry or exit.
- Is not designed for continuous employee occupancy.

“Restricted entry or exit,” means physical impediment of the body, e.g., use of the hand or a contortion of the body to enter, or exit from, the space. Enclosures that can be accessed by a ladder with no other access/egress points are considered confined spaces.

Confined Space Entry Permit – The written or printed document established by SDSTA (ESH-(4000-P)-73372 Confined Space Entry Permit), the contents of which are based on the hazard identification and evaluation for that confined space and is the instrument by which SDSTA authorizes its authorized Entrants to enter confined spaces.

Engulfment – The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance.

Entrant – A trained employee, contractor, or user who will enter a confined space.

Entry – The act by which a person passes through the opening into a confined space. The Entrant is considered to have entered as soon as any part of the Entrant's body breaks the plane of an opening into the space.

Entry Supervisor – A trained employee, contractor or user responsible for determining if acceptable entry conditions are present where entry into a confined space is planned, for authorizing entry and overseeing entry operations, and for terminating entry.

Hazardous Atmosphere – An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a confined 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 explosive limit.
- Airborne combustible dust at a concentration that meets or exceeds the lower explosive limit.
- Atmospheric oxygen concentration below 19.5% or above 23.5%.
- Atmospheric concentration of any substance which may exceed either the OSHA PEL or the American Conference of Governmental Industrial Hygienists (ACGIH) TLV for that substance.
- Any other atmospheric condition that is immediately dangerous to life or health.

NOTE: For air contaminants for which ACGIH or OSHA has not determined a dose or PEL, other sources of information, such as Safety Data Sheet, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

Immediately Dangerous to Life or Health (IDLH) - Any condition which poses an immediate or delayed threat to life or that would cause irreversible adverse effects or that would interfere with an individual's ability to escape unaided from the confined space.

Lower Explosive Limit (LEL) – The lowest concentration of gas or vapor (% by volume in air) that will burn or explode if an ignition source is present at ambient temperatures.

Non-Classified Confined Space – A confined space that has not yet been classified by a qualified person as either a Permit required or Non-Permit Required confined space.

Non-Permit Required Confined Space (NPRCS) – A confined space that does not contain or, have the potential to contain any hazard capable of causing death or serious physical harm. Introducing a hazard (e.g., welding, painting, chemical use, etc.) into a non-permit confined space may cause the space to become a permit-required confined space.

Oxygen Deficient Atmosphere – An atmosphere containing less than 19.5% oxygen by volume.

Oxygen Enriched Atmosphere – An atmosphere containing more than 23.5% oxygen by volume.

Permissible Exposure Limit (PEL) – An exposure limit established by OSHA.

Permit-Required Confined Space (PRCS) – If the confined space has one or more of the following characteristics, the entry will require a permit to be valid for the duration of the job as long as the conditions specified on the permit do not change:

- Contains, or has a potential to contain, a hazardous atmosphere.
- Contains a material that has the potential for engulfing an Entrant.
- Has an internal configuration such that an Entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard.

Toxicity – All of the adverse biological effects resulting from an exposure to a harmful substance.

4.0 Responsibilities

4.1. SURF Laboratory Director

- 4.1.1. Ensure all direct reports are familiar with the contents of this standard.

4.2. Department Directors

- 4.2.1. Identify confined spaces located in areas under their control and report to the Environment, Safety, and Health (ESH) Department.
- 4.2.2. Ensure confined spaces located in areas under their control are properly labeled and report to the ESH Department.
- 4.2.3. Provide safety equipment required for confined space entry (gas monitors, tripods, ventilation systems, lighting, etc.).

4.3. Environment, Safety, and Health (ESH) Department

- 4.3.1. Provides a confined space training program.
- 4.3.2. Provides expertise to departments on all aspects of confined space entry.
- 4.3.3. Maintains lab-wide confined space documentation, including a master inventory.
- 4.3.4. Maintains monitoring equipment (including calibration) for confined space entry.
- 4.3.5. Reviews contractors confined space programs and permits.
- 4.3.6. Reviews and revises the standard for compliance with applicable regulations.

4.4. Supervisors

- 4.4.1. Identify confined spaces in their areas and work with the ESH Department in classifying.
- 4.4.2. Ensure only properly trained employees perform confined space related work activities.
- 4.4.3. Ensure Confined Space Entry Permits are in place prior to any PRCS entry.
- 4.4.4. Ensure the requirements within this standard are followed.

4.5. Project Manager

- 4.5.1. Identifies any confined spaces associated with the contracted work.
- 4.5.2. Ensures contractors meet the requirements of this standard.
- 4.5.3. Ensures contractors utilize Confined Space Entry Permits (either their own, or SDSTA's).
- 4.5.4. Apprises the contractor of any precautions or procedures that have been implemented for the protection of employees in or near the confined space where contractor personnel will be working.
- 4.5.5. Coordinates entry operations with the contractor when both SDSTA and contractor personnel will be working in or near the confined space.
- 4.5.6. Notifies the ESH Department prior to entry. Information shall include the location of the entry, the number of Entrants and the nature of the work.

4.6. Attendant

- 4.6.1. Understands the hazards that may be faced during confined space entry, including information on the mode, signs & symptoms (including any possible behavioral effects), and consequences of the exposure.
- 4.6.2. Remains outside the confined space during entry operations until relieved by another Attendant, or entry is terminated.
- 4.6.3. Maintains constant communication with Authorized Entrants (voice, radio, etc.) and maintains contact with Entrants as necessary to monitor their status.
- 4.6.4. Monitors activities inside and outside of the confined space to determine if it is safe for Entrants to remain in the space. This includes air monitoring.
- 4.6.5. Orders the authorized Entrants to evacuate the permit space immediately under any of the following conditions:
 - If the Attendant detects conditions that are not authorized by the permit.
 - If the Attendant detects signs and/or symptoms of hazard exposure to the Entrant.
 - If the Attendant detects a situation outside the confined space that could endanger the Entrants.
 - If the Attendant cannot effectively and safely perform all duties required.
- 4.6.6. Notifies the Duty Officer in the event of an emergency.
- 4.6.7. Enforces the following actions when unauthorized persons approach or enter a confined space:
 - Warns the unauthorized persons that they must stay away from the confined space.
 - Advises the unauthorized persons that they must exit immediately if they have entered a confined space.
 - Informs Entrants and Entry Supervisor if unauthorized persons have entered the confined space.
- 4.6.8. Performs non-entry retrievals if properly trained.
- 4.6.9. Performs no duties that might interfere with the Attendant's primary responsibility of monitoring the Entrants.

4.7. Entrant

- 4.7.1. Understands the hazards that may be encountered during entry, including information on the mode, signs and/or symptoms, and consequences of exposure.
- 4.7.2. Uses safety equipment properly. This may include air monitoring because of space configuration or work activity performed.
- 4.7.3. Communicates with Attendant as necessary to monitor Entrant status and enable the Attendant to evacuate the space as required.
- 4.7.4. Alerts Attendant when:
 - The Entrant recognizes any warning sign and/or symptom of exposure to a dangerous situation.
 - The Entrant detects a prohibited condition.
- 4.7.5. Exits from the confined space as quickly as possible when:
 - An order to evacuate is given by the Attendant or Entry Supervisor.
 - The Entrant recognizes any warning signs & symptoms of exposure to a dangerous situation.
 - The Entrant detects a prohibited condition.
 - An evacuation alarm is activated.

4.8. Entry Supervisor

- 4.8.1. Understands the hazards that may be encountered during entry, including information on the mode, signs & symptoms, and consequences of the exposure and prepares written procedures as may be required for entry. These procedures should be revised whenever conditions change the hazards associated with the entry.
 - 4.8.2. Verifies that the appropriate information has been entered onto the permit, that all tests specified on the permit have been conducted, and that all entry procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin.
 - 4.8.3. Notifies ESH Department prior to entry. Information shall include the location of the entry, the number of Entrants and the nature of the work.
 - 4.8.4. Notifies Emergency Response Team (ERT) to develop a rescue plan for PRCS.
 - 4.8.5. Determines that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained, including whenever responsibility for a confined space entry operation is transferred to another organization.
 - 4.8.6. Serves as the Attendant or Entrant, when necessary, provided that they have received the appropriate training and can adequately fulfill the duties and responsibilities of each position.
 - 4.8.7. Verifies training of Attendant and Entrants.
 - 4.8.8. Communicates entry procedures to Attendants and Entrants.
 - 4.8.9. Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations.
 - 4.8.10. Passes duties to another Entry Supervisor if the permit confined space entry continues over multiple shifts.
 - 4.8.11. Terminates the entry and cancels the permit when the entry operations covered by the entry permit have been completed or when a condition that is not allowed under the entry permit arises in or near the permit space. In the event conditions arise which are not authorized on the permit, the Entry Supervisor shall notify any affected stakeholders.
- 4.9. Emergency Response Team (ERT)
- 4.9.1. Assist the Entry Supervisor in the development of rescue plans as needed.

5.0 Instructions

PRCS at SURF may be entered only after an approved Confined Space Entry Permit has been issued, and all requirements of this program for safe entry are accomplished. In addition, no confined space will be entered until it has been categorized as either a PRCS or NPRCS. Confined space activities shall follow SDSTA's work planning and control process (ESH-(2000-S)-73320 Work Planning and Control Standard).

5.1. Confined Space Inventory and Signage

- Confined Space Inventory:
 - Each department will identify confined spaces in their workplaces and maintain an inventory of the spaces. See ESH-(4000-R)-208903 Confined Space Inventory Register for a list of spaces. This inventory must be updated when a new confined space is identified, or an existing confined space is reclassified.
- Signage:
 - All confined spaces permanently identified as PRCS must be labeled using a SDSTA approved sign that states "DANGER – PERMIT REQUIRED CONFINED SPACE". Please see the ESH Department for sign requirements.

5.2. Confined Space Entry

- For entry into any confined space, it is recommended that rescue/retrieval methods be considered and placed within the work planning for the specific task, including notifying the ERT prior to entry.
- Non-Classified Confined Spaces:
 - If a confined space is discovered that has not yet been classified as either a PRCS or NPRCS, it must first be classified by the area supervisor in collaboration with the ESH Department before any work can proceed.
- Non-Permit Required Confined Spaces:
 - Entry requirement to NPRCS is at the discretion of the area supervisor. However, careful consideration must be given to any work conducted in NPRCS to determine if the work has the potential of introducing a hazard that would cause the space to become a PRCS (e.g., welding, painting, chemical use, etc.). If this is the case, then all the requirements for a PRCS must be followed. It is the responsibility of the area supervisor, work leads, and the worker to identify such occurrences.
- Permit Required Confined Spaces
 - Entries into PRCS are limited to only trained personnel and are controlled and authorized through the confined space entry permit.
 - ◆ A Confined Space Entry Permit must be completed with the guidance of ESH-(4000-WI)-204633 Confined Space Entry Permit Work Instruction before work commences and updated as necessary during work operations.
 - ◇ The permit must be visible to any individual that may visit the work site.
 - ◆ Each PRCS entry is to be performed with a Attendant, Entrant, and Entry Supervisor.
 - The entry employer is required to retain the permits for at least one year.

5.3. Confined Space Reclassification Process

- A space classified as a PRCS may be reclassified as a NPRCS. If all the following characteristics are removed from a PRCS, a supervisor, in collaboration with the ESH Department, can reclassify the confined space.
 - Contains, or has the potential to contain, a hazardous atmosphere.
 - Contains material that has the potential for engulfing an Entrant.
 - Has an internal configuration such that an Entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
 - Contains any other recognized serious safety or health hazard.
- However, if entry into the PRCS is required for the reclassification, permit-required confined space entry procedures must be followed.
- Reclassification status may be maintained for the duration of the entry as long as the hazards remain eliminated. If the reclassification is to be permanent, the confined space inventory must be updated to reflect the change, and all signage identifying the confined space as a PRCS removed.

5.4. Training For Confined Spaces

- SDSTA employees and users who may be involved with confined space entries shall receive training prior to initial entry into a confined space.

5.5. Contractors Working in Confined Spaces

- If a contractor is required to enter a confined space as part of their contract with the SDSTA, the contractor shall provide the SDSTA Project Manager with the following information to allow for adequate review prior to entry:
 - A written copy of their confined space entry program. This will be reviewed by the ESH Department to ensure it meets SDSTA requirements and if the program fails to meet the requirements, work will follow the SDSTA program.
 - Training records for potential Entrants, Attendants, and Entry Supervisors.
 - Evidence that all air monitoring equipment is properly calibrated within the calibration period specified by the contractor's program or manufacturer's instructions. This may be in the form of a calibration log, certification indicator on the instrument, or other means. (It is imperative that the equipment used by the contractor be capable of monitoring for the contaminants associated with the confined space to be entered.)
- It will be the contractor's responsibility to provide their own entry equipment, such as lifelines, harnesses, respirators, tripods, ventilators, etc., as specified by the entry permit.
- For entry into any confined space rescue/retrieval methods shall be considered and placed within the work planning for the specific task, including notifying the rescue team prior to entry. The SDSTA ERT may serve in this capacity if arranged by the project manager in advance.
- In addition to complying with the permit space requirements listed above, contractor performing permit space entry operations shall:
 - Obtain any available information regarding permit space hazards and entry operations from SDSTA.
 - Coordinate entry operations with SDSTA, when both SDSTA personnel and contractor personnel will be working in or near permit spaces.
 - Inform the SDSTA Project Manager prior to entering the space.
 - Inform the SDSTA Project Manager of any unanticipated hazards confronted during the confined space entry.
 - Provide the SDSTA Project Manager with a copy of the contractor's confined space permit or written certification once the work has been completed.
- If the contractor can demonstrate that continuous forced air ventilation alone is sufficient to maintain safe entry conditions, then the job specific confined space entry procedures can be modified by the SDSTA ESH Department.

6.0 Document

- 6.1.** ESH-(2000-S)-73320 Work Planning and Control Standard
- 6.2.** ESH-(4000-P)-73372 Confined Space Entry Permit
- 6.3.** ESH-(4000-WI)-204633 Confined Space Entry Permit Work Instruction
- 6.4.** ESH-(4000-R)-208903 Confined Space Inventory Register
- 6.5.** OSHA 1910.146 Permit Required Confined Spaces