

# CONFINED-SPACE ENTRY PROGRAM

## Lawrence Berkeley National Laboratory

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# CONFINED-SPACE ENTRY PROGRAM

## 1. POLICY

Any permit-required space at Berkeley Laboratory may be entered only after a written Confined Space Entry Work Permit has been approved. All entries into confined spaces must be conducted in a safe manner consistent with applicable regulations and recognized good work practices.

## 2. SCOPE

### 2.1 GENERAL

This policy sets forth the requirements necessary for working in confined spaces at Lawrence Berkeley National Laboratory to prevent exposure of personnel to dangerous air contamination, oxygen deficiency, and physical hazards associated with confined spaces. Confined spaces include, but are not limited to, tanks, ducts, pipelines, sumps, sewers, trenches, vaults, and similar spaces not intended for continuous human occupancy and meeting the criteria described in 29 CFR 1910.146.

### 2.2 LABORATORY EMPLOYEES

This policy applies to all Laboratory employees and any worker under the technical supervision of a Laboratory employee.

### 2.3 SUB-CONTRACTORS

Sub-contractors may elect in their Safety Plan to comply with PUB 3000; in which case, this policy, except for paragraph 3.2 below, is applicable. If the sub-contractor chooses to use their own Safety Plan for confined space procedures, it must be reviewed by the LBNL's Environmental Health and Safety (EHS) Division and approved by the Facilities Project Manager, before work may commence. The safety plan must contain procedures which meet Federal and/or CAL OSHA requirements for entering permit-required confined spaces and include the completion of a permit form acceptable to the Laboratory.

## 3. CLASSIFICATION

### 3.1 PERMIT-REQUIRED CONFINED SPACES (PRCS)

Permit-required confined spaces are confined spaces where actual hazards have been identified, or where the probability of a hazard is significant. Evaluation using the Confined Space Entry Permit (Appendix A) is required. Both the on-site supervisor (or designee) and a Laboratory industrial hygienist must sign the permit. Some cases may

require signature approval by EHS Radiation Protection if radiological hazards are present and by the Electrical Shop Supervisor if 12KV lines are present.

### 3.2 PROCEDURAL CONFINED SPACE (This option is not available to subcontractors)

For confined spaces where a permit is required, but hazards have been evaluated as low risk, the on-site supervisor may approve a procedural confined space permit. The following conditions must be met:

- The work is performed by Laboratory employees or contract employees who have completed EHS 275 Confined Space Entry Hazards Training.
- The entry permit must be completed and signed by a Laboratory employee who has completed EHS 277, Permit Writer Training and has current EHS 275 Training.
- All conditions for a permit-required confined space are met.

### 3.3 NON-PERMIT REQUIRED CONFINED SPACES (NPRCS)

Confined spaces that do not contain hazards, nor have a potential to contain hazards, do not require an approved Confined Space Entry Permit. However, a permit must be completed by the on-site supervisor, and, if hazards are found not to exist, clearly marked as a "Non-permit Space" and posted at the work site. "Non-permit Space" must be approved by the Industrial Hygienist.

## 4. CONFINED-SPACE ENTRY WORK PERMIT SYSTEM

A Confined Space Entry Work Permit (see Appendix A) **must** be completed for all confined-spaces before entry. This permit documents in writing the location(s) and type of work to be done, certifies that all existing hazards have been evaluated by the responsible qualified person(s), and ensures that necessary protective measures have been taken to protect the safety of each involved LBNL employee. Non-permit confined spaces must be identified as such by documenting that chemical and physical hazards (e.g., oxygen levels, etc.) do not exist and by writing "Non-Permit Space" in bold print across the work permit.

Permits will expire when the entrance is closed or at the end of the 8-hour work shift, whichever is sooner. In certain instances (e.g., if the confined space will remain isolated and the type of work will not change), the permit may be extended by EH&S.

(Sections 4.1 through 4.5 describe sections of the Confined Space Entry Work Permit found on page 14; Appendix A).

#### 4.1 CONFINED-SPACE TEAM

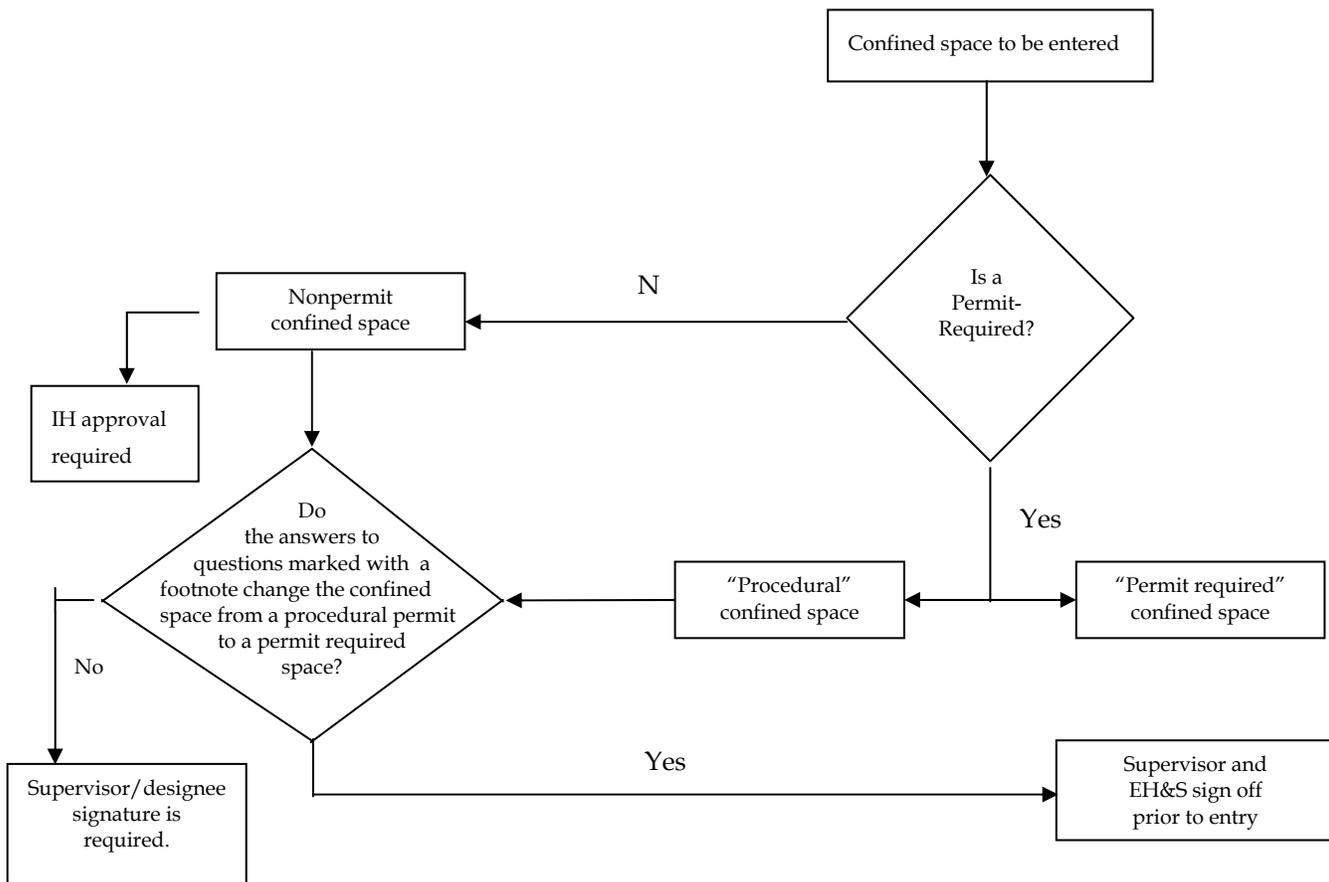
List the person(s) entering the space (entrant) and the designated standby (attendant) person(s). If applicable, the rotation by the designated attendant(s) with personnel working in the confined space must be specified.

#### 4.2 REQUIREMENTS COMPLETED PRIOR TO ENTRY

This section of the permit is a checklist of items to be considered prior to entry. The checklist is designed to determine the hazard level of the permit-required confined space [i.e., procedural (low-hazard) or permit-required (high hazard)]. For example, if a requirement indicated by a footnote is marked “yes,” then the confined space is permit-required (even if it was previously classified as a procedural confined space), and **both** the supervisor and an industrial hygienist must sign off on the permit prior to entry.

If the answer to any of the asterisked (\*) requirements is “yes,” site-specific details are required in the “Additional Information” section.

Figure 4-1 is a flow chart to help determine if a confined-space permit needs to be signed by the supervisor or the supervisor and EHS.



**Figure 4-1.** Confined-space decision flow chart.

The key points in this section are described below.

- If **12-kv electrical** lines are present in the confined space, the Electrical Shop Supervisor (or designee) must also approve the entry permit.
- **Lockout and tagout/blockout** must be done in accordance with LBNL’s lockout and tagout procedures. This may require the completion of Berkeley Lab’s Lock and Tag Out course, EHS 256.
- Lines, pipes, etc., must be **blanked/capped** to the extent feasible before the confined space is entered.
- If mechanical **ventilation** is required, site-specific details, such as the direction of airflow and the placement of the air intake, must be documented in the “Additional Information” section. The air supply must be from a clean source: exhaust from vehicles, cranes, earth compactors, and other potential sources of contaminants must be considered when locating the blower.

- The confined space must be emptied and purged of all **hazardous materials** to the extent possible prior to entry. If **hazardous materials** have been identified or will be used in the confined space, an industrial hygienist must be present to determine their concentrations and approve the permit. If these materials exceed, or have the possibility to exceed, occupational health limits (e.g., PEL or TLV; see the glossary section for details), rescue equipment (e.g., **hoist, lifelines, and harness**) is required, and the **standby** must be CPR trained (LBNL Fire Department could serve as standby).
- Periodic or continuous **air monitoring** may be required if the confined space cannot be isolated from potential contaminants. For example, flowing sewers often cannot be blanked off, and continuous air monitoring is recommended.
- When entrance covers are removed, openings must be guarded by **temporary barriers** that will protect the entrants from external hazards, such as vehicles, and protect pedestrians from falling into the opening.
- A **fire extinguisher** must be present if “hot work” is being performed.
- If **ionizing radiation** may be present, radiation levels must be monitored by personnel trained in radiation hazard assessment before entry.
- When **protective clothing** is specified, site-specific information (e.g., type of coveralls, gloves, etc.) must be specified in the “Additional Information” section.
- At least one **standby** person must be present at all times while the PRCS is occupied. The primary responsibility of the standby personnel is the safety of the occupants in the confined space. Standby personnel must be in constant **visual/radio** contact with the occupants and must immediately notify the LBNL Fire Department if there are any problems. The standby person should always summon emergency rescue workers, and may never enter a confined space to attempt a rescue. However, the standby can initiate a non-entry rescue, such as by operating a hoist or lift.
- If **respiratory protection** is required, site-specific details, such as the type of respirator and cartridges, must be specified in the “Additional Information” section.
- If “**hot work**” will be performed, a Fire Safety Permit, available from the Fire Department, must be completed and posted at the entrance to the space prior to the start of work. **All** confined spaces become permit-required confined spaces when hot work is performed in them. In addition, welding gas cylinders may never be brought into a confined space.
- Personnel entering the space must receive **confined-space training** (EHS 275) prior to entering a permit-required or procedural confined space. Attendants must also receive EHS275 prior to fulfilling the role as an attendant. In addition to this training in the hazards and classification of confined spaces, personnel must review the Confined Space Entry Work Permit, as well as any special procedures written for the space(s) prior to entry. In certain instances, employees may receive site-specific confined-space training from a EHS industrial hygienist until they can be scheduled

for the confined space training class.

- Additional **lighting** equipment may be needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency. In certain instances, explosion-proof lighting may be required.
- The **gas monitor** must be calibrated monthly and function checked prior to each daily use.

#### 4.3 MONITORING RESULTS

Atmospheric monitoring is required for **all** permit-required confined spaces (i.e., procedural and permit-required). This monitoring must be performed by personnel who have been trained in the use of gas-detecting instruments (Permit Writer Training, EHS 277). When testing for atmospheric hazards, test first for oxygen, then for flammable gases and vapors, and finally for toxic gases and vapors [29 CFR 1910.146 (d) 5 (iii)]. Many modern direct-reading instruments provide simultaneous reading of oxygen, flammable gases, and select toxic gases. All levels of a confined space must be tested: since gases and vapors can be lighter or heavier than air, they may tend to accumulate at one level. Atmospheric monitoring is required before mechanical ventilation is put into operation.

Safe levels for confined-space work are 19.5–23.5% oxygen, flammable vapors less than (<) 10%, and other toxins less than (<) the PEL, TLV, STEL, ceiling, or manufacturer's recommendations. Any deviation from "normal" atmospheric readings (20.9% oxygen, 0% LEL or any detectable amount of toxin) must be investigated further to determine the cause of contamination and to ensure that the confined space is truly isolated. For example, a 4% flammability reading in a telephone or electrical vault may indicate seepage from a leaking underground natural gas line that is not even located within the vault.

#### 4.4 ADDITIONAL INFORMATION

Include site-specific details required by the checklist here.

#### 4.5 APPROVALS

Approval signatures go in this section.

- For procedural confined spaces, either the LBNL supervisor or designee (EHS 277 required) or the LBNL EHS industrial hygienist may sign.
- For permit-required confined spaces, **both** the supervisor and the LBNL EHS industrial hygienist must sign.

The permit must be completed and approved before the confined space can be entered.

An Electrical Shop supervisor's (or designee) signature is required for **all** entries into confined spaces with 12-kv lines.

## 5. DOCUMENTATION AND RECORD KEEPING

The original copy of the completed Confined Space Entry Work Permit must be posted at the job site for the duration of the work. The yellow copy of the signed permit must be kept on file by the EHS Industrial Hygiene Group for at least one year.

The EHS Industrial Hygiene Group must maintain the Confined Space Survey file that inventories and evaluates all procedural and permit-required confined spaces at Berkeley Lab.

All training will be documented in the LBNL training database by the EHS Division.

## 6. LABELS

Confined spaces must be surveyed and posted with one of the signs listed below. An exception to this labeling requirement is spaces whose entrances are in roadways, sidewalks, etc., and subject to vehicular and foot traffic.



## **7. NON-PERMIT CONFINED SPACES**

Work requirements for non-permit confined spaces are as follows:

- Non-permit confined spaces must be identified as such by documenting that chemical and physical hazards (e.g., oxygen, etc.) do not exist and by writing “Non-Permit Space” in bold print across the work permit.
- Barricades and isolation (if appropriate).
- Ground fault circuit interrupters (GFCI) on power hand tools and other electrical equipment.
- Proposed activities must not introduce hazards to the area, thereby converting it into a high-hazard confined space.
- Prior approval by the Industrial Hygienist is required.

## **8. TRAINING**

Supervisors who authorize entry into confined spaces and employees who enter confined spaces or serve as attendants must have completed the Confined Space Training class, EHS 275. This training provides information on the hazards and classification of confined spaces, recommended safe work practices, and the correct use of a Confined Space Entry Work Permit. Retraining will be performed every three years (EHS 274).

LBNL employees who perform atmospheric monitoring for procedural confined spaces are required to have completed the Permit Writer Training class, EHS 277. This training provides information concerning instrument calibration, field checks and responsibilities of the Entry Supervisor. Retraining will be performed every three years (repeat EHS 277).

Depending on responsibilities and the type of confined-space entry, additional training may be required, such as:

- First aid and CPR certification (EHS 116, 123)
- Respirator training (EHS 310)
- Lockout/tagout (EHS 256)

## **9. RESPONSIBLE PARTIES**

### **9.1 ATTENDANT (STANDBY)**

- Read the Confined Space Entry Work Permit before starting work, and abide by its conditions.
- Stop work and request that workers exit the confined space if conditions under which the permit was written change, or if any danger is perceived.
- Remain outside the confined space until relieved by another attendant.
- Summon the Fire Department if it is determined that employees in the confined space may need assistance in escaping.
- Be knowledgeable of the hazards that may be encountered during the entry, including the signs, symptoms, and consequences of exposure to these hazards.
- Perform non-entry rescues, if possible.
- Maintain contact with the workers in the confined space.

### **9.2 EHS INDUSTRIAL HYGIENE GROUP**

- Authorize entry for procedural (low-hazard) confined spaces, and jointly approve entry with the supervisor (or designee) for permit-required confined spaces.
- Approve site-specific written entry procedures for procedural confined spaces.
- Provide technical guidance.
- Assist in monitoring and evaluating of confined-space hazards (e.g., oxygen deficiency, toxins).
- Conduct the Confined Space Entry Hazards class (EHS 275) and Refresher (EHS274).
- Conduct the Permit Writer training class (EHS 277).
- Administer the Confined Space Entry Program.
- Maintain copies of all Confined Space Entry Work Permits for at least one year.
- Maintain the inventory of permit-required confined spaces for Berkeley Lab.
- Perform the initial and periodic evaluation of the hazards associated with each confined space.
- Review Confined Space Programs submitted by subcontractors.

### **9.3 EH&S FIRE DEPARTMENT PERSONNEL**

- Assist in the development and implementation of rescue/recovery procedures for confined-space entry.
- Designate the rescue team.

- Conduct confined-space rescue drills at least once per year.

#### 9.4 PERSONNEL ENTERING CONFINED SPACES

- Read the Confined Space Entry Work Permit before starting work, and abide by its conditions.
- Stop work and exit the confined space if conditions under which the permit was written change or if any danger is perceived. Report this to the attendant and supervisor.
- Ensure that the Confined Space Entry Work Permit is posted at the worksite, and that other safety precautions, such as isolation of the space, lockout/tagout, barricades, etc., are performed, if required.
- Confer with the space/equipment owners and the person completing the permit to ensure that all hazards have been considered.
- Be knowledgeable of the hazards that may be encountered during the entry, including the signs, symptoms, and consequences of exposure to these hazards.
- Remove permits/barriers after the work has been completed.
- Maintain contact with the attendant.
- Ensure that a copy of the Confined Space Permit is forwarded to EH&S Confined Space Program Manager.

#### 9.5 PURCHASING

- Ensure that prospective subcontractors bidding on LBNL projects are informed when work in confined spaces will be required.

#### 9.6 SUPERVISORS

- Ensure that employees who may work or authorize entry into confined spaces have completed the Confined Space Entry Hazards (EH&S 275) and any additional safety classes that may be required.
- Ensure that employees who may perform atmospheric monitoring in confined spaces have completed the Permit Writer (EH&S 277) training.
- Authorize entry for procedural (low-hazard) confined spaces, and jointly approve entry with an industrial hygienist for permit-required confined spaces.
- Ensure equipment used for confined-space entries is kept in good operational condition and is calibrated according to manufacturers' recommendations.
- If necessary, write a site-specific procedure for entry into a procedural confined space, and obtain pre-approval from an EH&S industrial hygienist.

**Note:** This type of procedure is generally most applicable to temporary, unique,

research equipment.

- Ensure that operations comply with the terms and conditions on the permit.

## 10. GLOSSARY

**Attendant (standby).** An individual stationed outside one or more confined spaces to monitor authorized entrants, and who performs all attendants' duties assigned in the confined-space program.

**Confined space.** A space that (1) is large enough and so configured that an employee can enter bodily, (2) has limited or restricted means for entry or exit (e.g., tanks, vessels, vaults, pits), and (3) is not designed for continuous occupancy.

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

**Entry permit.** The written permit that must be completed and posted at the worksite before a confined space is entered (see Appendix A).

**Hazardous atmosphere.** An atmosphere that may expose employees to the risk of death, injury, or illness from one of the following:

- Flammable gas, vapor, or mist exceeding 10% of its lower explosive limit (LEL)
- Airborne combustible dust at a concentration that meets or exceeds its LEL

**Note:** This concentration may be approximated as a condition in which dust obscures vision at a distance of 5 ft or less.

- Atmospheric oxygen concentration below 19.5% or above 23.5%
- Atmospheric concentration that exceeds the PEL, TLV, STEL, ceiling, or the manufacturer's recommendations on the Material Safety Data Sheet (MSDS)

**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. Examples of these types of spaces are false ceiling plenums, trailer sub-floor areas, and shored trenches greater than 5 feet in depth.

**Note:** These spaces become permit-required confined spaces if hazards are brought in or exposed by the work. Examples include gasoline-powered earth compactors (carbon monoxide); solvent-based coatings, epoxies, and paints; open sewer lines in the bottom of trenches; contaminated soil; welding; etc.

**Permissible Exposure Limit (PEL) and Threshold Limit Value (TLV).** Employee airborne-exposure limits established for particular chemicals by the Federal Occupational Safety and Health Administration (Fed/OSHA) and the American Conference of Governmental Industrial Hygienists (ACGIH), respectively. DOE

requires that employee exposures must not exceed PELs or TLVs. Time-weighted average (TWA), short-term exposure limit (STEL), and ceiling (C) standards are summarized as follows:

<u>Organizations and Standards</u>	<u>Work Exposure Duration</u>
Fed/OSHA PEL-TWA and ACGIH TLV-TWA	8-hour shift and 40-hour week
Fed/OSHA PEL-STEL and ACGIH TLV-STEL	15 minutes
Fed/OSHA PEL-C and ACGIH TLV-C	Any point in time

**Permit-required confined spaces (PRCS).** Confined spaces where actual hazards have been identified or the probability for a serious accident or hazard being present is high. Written authorization on the permit by both the supervisor and an EH&S industrial hygienist is required. Types of hazards may include

- Hazardous atmosphere
- Physical hazards, such as radiation, acids, combustible dusts, engulfment, crushing, falling etc.
- Oxygen deficiency

Examples of these types of confined spaces include sewers, degreasers, waste treatment tanks, and sumps.

**Note:** A space classified as a permit-required confined space may be reclassified as a non-permit confined space if the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space [29 CFR 1910.146 c (7) i].

**Procedural confined spaces.** A type of permit-required confined space that meets the definition of a confined space but in which hazards are unlikely to be present. Written authorization on the permit may be by the supervisor (who has completed EH&S 275 & 277) **or** an EH&S industrial hygienist. Examples of these types of spaces include electrical vaults, communication (phone) vaults, water valve vaults, etc.

**Note:** A procedural confined space becomes a permit-required confined space if hazards are brought in by the work. Examples include welding, epoxies, paints, solvent cleaning, etc.

## 11. REFERENCES AND STANDARDS

29 CFR 1910.146, *Permit Required Confined Spaces* (Department of Labor)

Title 8, Article 108, *Confined Spaces* (California Code of Regulations)

ANSI Z117.1-1989, *Safety Requirements for Confined Spaces*

## 12. APPENDIX A. CONFINED SPACE ENTRY WORK PERMIT

 <p style="font-size: 1.2em; font-weight: bold;"><i>Confined Space Entry Work Permit</i></p>	<p><b>Notify Fire Department Prior to Entering all Confined Spaces, Tel: X6015</b></p> <p><b>EMERGENCY NUMBERS</b>          LBNL Phones (486 prefix) X7911          Campus Bldgs. 9-911</p>																																																											
<p><b>Job Information</b></p> <p>Permit Start Date / Time: _____ Permit Expiration Date / Time: _____</p> <p>Site Location/Description: _____</p> <p>Task: _____</p> <p>Type of confined space    <input type="checkbox"/> Procedural            <input type="checkbox"/> Permit required</p> <p style="font-size: 0.8em;"><i>(Note: Permit required confined spaces require both the supervisor or designee &amp; EH&amp;S signatures)</i></p>																																																												
<p><b>List Confined Space Team</b></p> <p>Attendant (s): _____</p> <p>Entrant (s): _____</p>																																																												
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; font-size: 0.9em;"><i>Requirements completed prior to entry</i></th> <th style="font-size: 0.8em;">N/A</th> <th style="font-size: 0.8em;">Yes</th> <th style="font-size: 0.8em;">N/A</th> <th style="font-size: 0.8em;">Yes</th> </tr> </thead> <tbody> <tr> <td>12kv electrical lines present</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Fire extinguisher</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Lockout/de-energize/tagout completed</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Ionizing radiation<sup>1</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Line(s) blanked/broken/capped</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Protective clothing*</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Ventilation*</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Standby in visual/radio contact</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Hazardous materials*<sup>1</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Special communications required*</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Lifelines* (e.g., hoist, lifeline, harness)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Respiratory protection*<sup>1</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Standby CPR trained</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Hot work permit*<sup>1</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Air monitoring (periodic)*<sup>1</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Confined Space Training</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Secure area (signs/barriers)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Lighting (explosion proof)<sup>1</sup></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table> <p style="font-size: 0.8em; 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<p style="font-size: 0.8em;"><i>Original to remain at job site until the work is completed / yellow copy forward to EH&amp;S Industrial Hygienist, MS: 48-102          XBG-714 (Rev. 8/7/00)</i></p>																																																												