

**Newport News Shipbuilding
Contractor Environmental, Health and Safety
Resource Manual**

Confined and Enclosed Spaces

CONFINED AND ENCLOSED SPACES

1. Hazard

Confined spaces present an extreme potential hazard to personnel brought on by limited ventilation resulting in oxygen deficiency, increased levels of flammable/combustible gases and increased levels of toxic materials.

Confined spaces are found in shipbuilding, repair and overhaul and in facilities operations. Contractors shall obtain from their Contractor Coordinator or Field Engineer specific information about confined spaces in the areas where contractor employees will be working.

Contractors whose employees work in confined enclosed spaces at NNS shall ensure their employees are aware of and can recognize the hazards associated with those spaces. These contractors shall also make sure their employees know entry and work procedures as well as emergency and rescue procedures for the specific confined spaces and enclosed spaces with dangerous atmospheres where they may work either in facilities or on ships.

Contractors shall work in accordance with their programs, and to any additional requirements contained within this manual.

2. Regulations

Where there is potential personnel exposure to hazardous conditions within confined or enclosed spaces, OSHA requires the contractor to establish and follow written confined space entry procedures. Where there is potential personnel exposure to hazards within confined/enclosed spaces in shipboard work, OSHA requires the contractor to comply with all provisions of:

- 29 CFR 1915, Subpart B - "Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment."

Where there is a potential personnel exposure to confined spaces in non-shipboard work, NNS requires the contractor to work in accordance with the requirements and provisions contained within:

- 29 CFR 1910.146, "Permit-Required Confined Spaces for General Industry."
- 29 CFR 1926, "Occupational Safety and Health Regulations for Construction."

Contractors shall incorporate additional requirements for specific locations and work as identified in this manual. These requirements are in addition to any local, state, or federal requirements.

3. References

The requirements listed here are taken from the following references and will be updated as necessary when these references are changed:

- (a) Volume II, Chapter 22, Confined and Enclosed Space Entry of the NNS Health and Safety Manual, which is the primary NNS reference,
- (b) Volume II, Chapter 35, Sewage, of the NNS Health and Safety Manual,
- (c) Volume II, Chapter 18, Requirements for the Procurement, Application, and Removal of Paint Coatings of the NNS Health and Safety Manual,
- (d) NFPA 306 “Standard for the Control of Gas Hazards on Vessels”

4. General Requirements

- (a) During the NNS pre-approval process each contractor whose employees may work within confined or enclosed spaces must provide to the NNS EH&S Department a copy of their written Confined and Enclosed Spaces Safety Program. This document must describe the contractor’s program for complying with each element of the applicable OSHA standard(s). The contractor shall provide a copy of any changes to the program on an annual basis.
- (b) Contractors responsible for opening shipboard confined spaces must be authorized in writing by NNS to open the space and shall do the following:
 - (1) Where applicable, have a valid NNS work permit or work package authorizing the opening of the space.
 - (2) Affix an appropriate NNS confined space danger sign at each entrance.
 - (3) Install fall guards or other positive means to prevent accidental fall/stepping into holes when manway or butterworth covers are removed or other accesses are generated. When fall guards cannot be attached, such as in a roadway, an appropriate barrier shall be erected and maintained to prevent entry into the area of the opening.
 - (4) Obtain a cold work permit and notify NNS hot work coordinator and Marine Chemist Office prior to opening any tank or system containing flammable or combustible substances. Post area with “Danger” “NO HOT WORK” signs

while spaces are open or until they have been cleaned and certified as incapable of being a fire hazard "Safe for Hot work."

- (c) Contractors shall ensure that their employees obey NNS confined space signs and tags.

All contractors shall ensure each space that could contain or develop an atmospheric hazard to workers is tested and inspected prior to and at a frequency thereafter to ensure that work does not continue should a hazard develop during the course of their work.

- (d) Contractors shall ensure that pipelines that could carry hazardous materials into spaces are disconnected, blanked off, or otherwise blocked by positive method to prevent hazardous materials from being discharged or re-entering the space before the space is designated "Safe for Workers" or "Atmosphere Safe for Workers."
- (e) Contractors shall ensure that prior to starting work all their employees, including temporary leased employees, are properly trained in the hazards and other requirements of working in enclosed or confined spaces. This training must be job specific and may require additional training if the employee begins a different job.
- (f) In all shipboard spaces requiring a competent person inspection, if the contractor does not have trained and designated shipyard competent persons to perform inspections, a NFPA Certified Marine Chemist shall then carry out inspections.
- (g) Contractors shall ensure that no employee enters, continues to work within or remains in a shipboard confined space unless the following criteria are met:
- (1) Where applicable, the contractor has a valid work permit. No contractor personnel may enter a confined space without a valid work permit issued from NNS work control center.
 - (2) The contractor has verified that suitable isolation is in place to prevent employee exposure to hazardous materials or energy.
 - (3) Fall guards are in place. Contractors must immediately take steps to isolate unguarded openings and report problems to their Contractor Coordinator.
 - (4) Each employee is provided with primary light and secondary back up light sources. Secondary light is to be used to exit space should primary lighting fail.
 - (5) Effective mechanical exhaust ventilation must be operating at levels sufficient to ensure safe for workers. At no time must this be less than 300CFM when employees are entering and working in a space.

- (6) Employee is protected (provided and wearing suitable personal protective equipment (PPE)) when a space or process within an affected area could expose the worker to hazards.
 - (7) Oxygen is at/or between 19.5% and 22.0% by volume within the space.
Exception: Emergency rescue.
 - (8) Concentrations of combustible gases are less than 10% by volume of the Lower Explosive Limit regardless of any administrative, engineering, or PPE including respiratory controls. Exception: Emergency rescue.
 - (9) Airborne concentrations of hazardous materials remain below IDLH (immediately dangerous to life and health) levels. Where no OSHA Permissible Exposure Limit (PEL) or Ceiling (C) values are provided, Contractor shall use other sources such as ACGIH, NIOSH, or Manufacturer data to protect their workers health and safety. Contractor shall use values to determine time, clothing, or respiratory protection restrictions. Exception: Emergency rescue.
 - (10) Contractor Coordinators must ensure contractors comply with the requirements of NNS procedure Y-1073 "Use and Handling of Argon, Nitrogen, and Other Inert Gases." Representatives of the contractor must verify that the additional requirements of NNS procedure Y-1073 are met prior to workers entering spaces posted with NNS "Danger" "Argon/Inert Gas" signs.
- (h) All personnel must evacuate a space when ordered or when alarms are sounded or when they perceive they are in danger.
 - (i) No personnel may remain in a space when unsafe staging is discovered.
Exception: Personnel responsible for correcting staging problems.
 - (j) Contractor representative shall immediately report any occurrence or situation that prevented entry or required the removal of personnel to NNS Marine Chemist Office (757) 380-7634. However, during third shift, weekend, or holidays call (757) 380-4031, NNS Communications Center, to contact Marine Chemist personnel on call during these periods.
 - (k) Personnel shall not open or enter any radiological controlled areas without cognizant NNS Nuclear Engineering-Radiological Control department's representative's specific authorization and approval.
 - (l) Contractors shall coordinate entry operations with their Contractor Coordinator or Field Engineer when both NNS and contractor personnel will be working in or near the same confined space.

- (m) Contractors shall exchange all available information on specific confined spaces with other employers whose employees may enter the same space, such as:
- (1) Hazards,
 - (2) Work affecting conditions within the space
 - (3) Safety rules, and
 - (4) Emergency procedures
- (n) Contractors responsible for closing confined spaces shall ensure:
- (1) The space is thoroughly searched and no personnel remain.
 - (2) Tools, excess materials, and debris are removed.
 - (3) Temporary services are removed.
 - (4) Fall guards and other barriers along with job related materials; tools, equipment, etc. are removed to an NNS approved location. Good housekeeping practices must be maintained.
 - (5) Notification is provided to NNS cognizant project management.
- (o) Each day a Contractor's representative shall provide copies of all applicable OSHA recordkeeping requirements such as test and inspection records, Entry Permits, or NFPA Certified Marine Chemist certificates to the NNS Marine Chemist Office. For work offsite, copies shall be provided to the NNS Marine Chemist (O27) designated representative on site.
- (p) All contractors shall use NNS hot and cold work permits as required by the type of work which they perform in accordance with the Fire Prevention and Control Manual.
- (q) Contractors shall ensure that spaces or adjacent spaces that have contained or contain liquids, gases, or solids that are flammable, combustible, toxic, corrosive, or irritant by nature are tested and visually inspected and determined safe for workers prior to any personnel entering. No worker shall enter or remain within a space that has airborne concentrations of hazardous materials that are IDLH (immediately dangerous to life and health). If a space cannot be ventilated to permissible levels, a Certified Marine Chemist or Certified Industrial Hygienist must re-inspect and provide additional control requirements in writing that must be followed by any personnel who enter into the space.

- (r) The following sections discuss requirements for some specific hazardous operations and locations within NNS.

5. Foundry AOD Pit

- (a) The contractor shall ensure that the following precautions are taken whenever it becomes necessary for workers to enter the AOD (Argon-Oxygen Decarbonization) Pit in the NNS Foundry:
- (1) Foundry personnel turn off and lock out as required by Procedure Y-078 the argon supply valve.
 - (2) All contractors must affix their company system lock and tag, personal service tags and locks to the group lock prior to entry.
 - (3) Adequate ventilation is provided for at least 20 minutes prior to entry and at all times while a worker is in the pit.
 - (4) The oxygen level is continuously monitored when personnel are in the pit.
 - (5) All workers entering the AOD Pit are trained in the potential hazards of confined spaces as required by the applicable OSHA regulation.
 - (6) Signs are posted in the vicinity of the ladder at the pit as required by the applicable OSHA regulation.
 - (7) Suction tubes are located within 2 feet of the bottom of the pit, providing at least one air change every 3 minutes.
 - (8) Workers will evacuate the pit immediately if the ventilation fails.
 - (9) Entry permits required by the applicable OSHA regulation are posted for each shift.
- (b) The contractor shall verify, prior to posting the entry permit, that:
- (1) The argon is locked out and tagged,
 - (2) Ventilation is operational,
 - (3) A sign is affixed at the ladder, and
 - (4) Oxygen concentration at worker level in the pit is no less than 19.5% and no more than 22%.
 - (a) Normal Oxygen levels should be 20.8% plus or minus 0.2 percent by volume.

- (b) Any deviation from normal oxygen levels should be investigated to find the cause and corrected.
- (c) Do not enter until normal oxygen levels are restored.

6. Sewage Systems and CHT Tanks

- (a) The contractor shall ensure that the following precautions are taken if it is necessary for workers to open or enter CHT tanks or sewage piping systems:

Note: Not applicable to routine water closet or toilet repairs.

- (1) All personnel must receive specific hazard communication training, including but not limited to: (a) The potential hazards of sewage and gases generated by these systems. (b) The importance of good personal hygiene, (c) measures taken to prevent exposure, (d) ability to know when one is exposed, and (e) steps to take if worker believes they are being exposed to any chemical or biological hazards.
 - (a) Contractors shall ensure that personnel are trained in the wearing and use of emergency breathing equipment.
- (2) The system must be properly isolated to prevent the reintroduction of hazards that could cause harm to workers or damage to property or release to the environment.
 - (a) Contractors shall continuously monitor atmosphere during the opening and cleaning of CHT/Sewage spaces, sewage piping systems.
 - (b) In the event an atmospheric alarm is activated, all personnel in the compartment or space shall immediately evacuate and notify NNS Communications Center by dialing 380-4031 or 380-2222 cell phone or *911 or 0-2222 NNS phone.
 - (c) If all personnel are not able to evacuate the space within 10 seconds, (contractor provided) emergency self-contained escape respirators will be issued for work in spaces.
- (3) When initially opening a sealed tank or other sewage system/components:
 - (a) Slow controlled opening of sewage systems is required. Do not remove all bolts; leave two bolts in place until seal is broken.
 - i. Only manual or air pneumatic driven equipment shall be used to open the sewage system.

- (b) As the seal is broken and the cover removed, a suction ventilation duct must be placed in the immediate vicinity of the opening to capture and ventilate any gases.
 - i. Suction ventilation shall be mechanical explosion proof type.
- (c) The ventilation duct must be lowered as far as possible into the tank without contacting the contents of the tank.
- (d) Exhaust must be clear of any intakes and pose no danger to other NNGN or contractor workers.
- (4) Cleaning methods for CHT/Sewage spaces and sewage piping systems must be in accordance with NNS Procedure Y-1119 "Disinfecting, Flushing, and Cleaning Sanitary Tanks."
- (5) Cleaning personnel must wear suitable PPE to prevent skin contact, and supplied air respiratory equipment.
 - (a) PPE and supplied air respirators may be discontinued once the space has been isolated, cleaned, disinfected and finally designated as "Atmosphere Safe for Workers" by a NFPA Certified Marine Chemist.
- (6) Lighting shall be approved for Class 1, Group D atmospheres or equivalent.
 - (a) Explosion proof ventilation and Class 1, Group D approved lighting may be discontinued once the space has been isolated, cleaned, disinfected and finally designated as "Safe for Hot work" by a NFPA Certified Marine Chemist.

7. Handling, Use and Storage of Gases

- (a) Contractors shall ensure that their employees never use gases in the Shipyard in such a manner that could create a hazardous atmosphere. Some examples are:
 - (1) Never place an oxygen or fuel gas cylinder in a confined or enclosed space.
 - (2) Keep oxygen or fuel gas cylinders outside in open, well-ventilated areas and where they will not be damaged.
 - (3) Secure gas cylinders in an upright position with chain, wire rope, or similar method (this does not include small one pound gas bottles).
 - (4) Never leave Oxy/Air-fuel gas torches and lines unattended in confined spaces.

- (5) Oxy/Air-fuel gas lines may not be left unattended in enclosed spaces for periods longer than lunch or short work breaks.
 - (6) Oxy/Air –fuel gas lines must be removed at the end of shifts from enclosed spaces.
 - (7) Uses of oxygen and fuel gas within enclosed and confined spaces must be in accordance with additional requirements contained within NNS Health and Safety Manual, Volume II, Chapter 5, Appendix E which is available through your contractor coordinator or Field Engineer.
 - (8) Alternative practices and requirements may be offered when elements of Appendix E cannot be met. However the, alternative practices or requirements must be jointly approved by the NNS departments O27 and O15.
- (b) Contractors shall train their employees to do the following steps if they notice propane gas (rotten egg smell) or other suspicious odors:
- (1) Stop all hot work in or near the confined/enclosed space (or in the open, stop hot work in the vicinity, especially downwind),
 - (2) Have all personnel leave the space immediately,
 - (3) Call the NNS Fire Department (O15) at *911 or 0-2222 on shipyard phones, or call 380-2222 from cellular phones.
 - (4) Check ventilation and secure any possible sources of suspect gas.
- (c) Inert gas supplies, including cylinders, shall not be brought aboard a vessel without prior notification and the approval of NNS Gas Master.
- (1) Contractors shall not use inert gases aboard vessels without prior approval of the NNS Gas Master.
 - (a) Contractor shall be responsible for maintaining the conditions set forth by the Gas Master. Contractor shall notify Gas Master when each job requiring inert gas is completed.
 - (b) Inert gas usage within confined spaces or within 6 feet of any opening to a confined space must be posted with NNS inert gas confined space signs.
 - (c) Gas Master is responsible for placing and removing signs at all entrances. All other confined space signs must be removed when inert gas confined space signs are attached.

- (d) Controlled spaces must have low point exhaust and supply ventilation operating at all times workers are present. Mechanical ventilation must be operating at all times.
- (e) Special PPE, engineering, and/or administrative controls may be required for personnel working and the contractor shipyard competent persons inspecting these spaces.
 - (1) At least one member per work group must have an oxygen indicator inside the space at all times.
 - (2) All entrants must remain within 25 feet of the oxygen indicator.
- (f) Temporary enclosures affected by inert gas are considered confined spaces and shall be treated as confined spaces.
- (g) When inert gases are being exhausted or released within enclosed areas, additional engineering and administrative controls are required.
- (h) Contractor Shipyard Competent Person (SCP) must inspect area periodically each day.
 - (1) Inspection and test recording must include verification that:
 - (a) Supply and exhaust ventilation is operating.
 - (b) The exhaust must be operating at a minimum of 300 CFM.
 - (c) Oxygen level and toxic measurements must be within permissible limits.
 - (d) No hazards present to prevent safe entry.
 - (i) If a confined space is opened in the area affected by inert gas usage, the Contractor must immediately notify the Gas Master.
 - (j) Contractor SCP must perform frequent checks of worksite. Inspection and test recordkeeping to include:
 - (1) Verification that Exhaust and Supply ventilation are operating.
 - (2) Exhaust ventilation is operating at least 300 CFM.
 - (3) Oxygen level and toxic measurements must be within permissible limits.

- (4) No hazards are present to prevent safe entry.
- (5) Special instructions have been provided to contractor personnel.
- (k) Contractors planning inerting in conjunction with the performance of hot work affecting equipment, systems or structures that contained or have ever contained combustible, flammable, toxic, irritant, corrosive or combustion supportive substances must obtain the approval of an NFPA Certified Marine Chemist.
- (l) Contractor shall provide notification prior to starting work to NNS Marine Chemist Office.
 - (1) 24-hour advance notification during normal work week and before 12:00 PM on the Friday before weekend or weekend holidays prior to inerting and subsequent hot work.
 - (2) NNS reserves the right to accompany the Contractor- selected Certified Marine Chemist during the course of their inspection.

Bulk supplies of refrigerants shall not be released aboard or loaded/charged without prior notification being provided to NNS Marine Chemist and approval of the NNS Fire Safety Administrator (FSA).
 - (1) NNS FSA must approve cold work permits and contractor must obtain a Chemist's Work Permit.
 - (2) Most refrigerants in presence of ultraviolet radiation or flame result in the generation of hazardous byproducts such as phosgene and acid gases.
 - (3) Exposure to excess levels of refrigerants can lead to cardiac arrest, cardiac arrhythmia, and or asphyxiation.
- (m) Contractor shall provide continuous monitoring to detect unsafe levels of refrigerants.
- (n) Contractor shall provide all administrative, engineering, and PPE necessary to protect employees against hazards of refrigerants.
- (o) Contractor shall provide low point ventilation affected areas until system integrity has been tested and verified to be leak free.

- (p) Contractors shall treat temporary enclosures that may be affected by flammable gas, poisonous, inert or other asphyxiating gases shall be treated as (permit required) confined spaces. When gases are exhausted or leaked into a temporary structure such as a drape, tent, or canopy in which the movements of gases, dust, dirt, etc, are restricted, these enclosures can quickly become dangerous environments.

8. Spray Painting

- (a) Contractors shall ensure all requirements listed below are followed for spray application of flammable and/or combustible paints in enclosed and confined spaces on board ships in the water, ways or dry docks.
 - (1) Prior to commencing painting operations, obtain a Cold Work permit and follow all instructions on the permit.
 - (2) Enclose spray-painting areas with bulkheads, plastic sheeting, etc., to contain and prevent the spread of flammable paint vapors to other areas of the ship.
 - (3) Prohibit smoking, open flames; arc and spark producing operations in spray painting areas.
 - (4) Contractor employees shall work the “buddy system” in confined spaces.
- (b) Contractors shall provide:
 - (1) Respirators and other personal protective equipment in accordance with applicable OSHA regulations.
 - (2) A fire extinguisher and portable eye wash bottle shall be near the paint pot.
- (c) Contractors shall ensure that ventilation meets the following requirements:
 - (1) Provide sufficient suction ventilation to keep solvent vapor concentrations below 10% of the lower explosive limit (LEL).
 - (2) Discharge of ventilation exhaust shall be overboard, clear of work areas or air intakes and away from ignition sources.
 - (3) Continue ventilation uninterrupted throughout the painting and curing/drying process.
 - (4) Bond metallic parts of air moving devices to the vessel and ensure that blowers have non-ferrous blades.

- (d) If ventilation fails or if flammable vapor concentration exceeds 10% LEL, stop the operation generating flammable vapors and evacuate the area until the vapor concentration falls below 10% LEL.
- (e) Contractors shall ensure that competent persons perform combustible gas tests and maintain documentation as follows:
- (1) Monitor flammable vapor concentrations in each space during the entire spraying operation.
 - (2) At minimum, record flammable vapor concentrations in each space being spray painted:
 - (a) Prior to commencing paint spraying,
 - (b) Immediately upon completion of spray painting, and
 - (c) Each time the flammable vapor concentration exceeds 10% of the LEL.
 - (3) Record, post and maintain flammable vapor concentration readings on a form that complies with 29 CFR 1915 Subpart B.
- (f) Contractors shall ensure power and lighting cables are free of cracked and worn insulation.
- (1) Temporary electrical connections in the spray areas shall be secured in a manner to prevent separation (e.g., wrapped with electrical tape or other suitable means). (Not allowed for highly flammable paints; see II.0.9 page 14.)
 - (2) Lines shall not be overloaded and shall be suspended with sufficient slack to prevent undue stress or chafing.
- (g) Contractors shall post the following signs:
- (1) Post the following sign at each entrance to the spray area:

Danger
No Hot Work
Flammable
Spray Painting
 - (2) Post the following sign on each outside boundary of the spray area, including overhangs, decks and bulkheads on all sides of the involved spaces:

**No Hot Work
On This Surface
Wet Paint On
Opposite Side**

- (3) Post “Caution - Wet Deck” signs as appropriate.
- (4) Monitor the drying/curing process and remove control signs when space or area has been returned to normal safe working levels.
- (h) When spray painting is completed, clean up the area and remove unused materials.
- (i) Perform flushing with flammable and combustible solvents in accordance with Chapter 6, Fire Prevention Control Manual.

9. Spray Painting with Highly Flammable Paints

- (a) In addition to the requirements for all spray painting listed above, contractors shall ensure that requirements listed below are followed for spray application of highly flammable paints (i.e. those with flash points less than 80° F) in enclosed and confined spaces.

Note: If flash point is 80° F or greater and within 10 degrees of temperature that could be expected within the work area, the additional precautions (preventing ignition sources) listed below must be followed.

- (b) Users of aerosol cans of spray paint which have flash points below 80° F do not have to meet these requirements when the paint is used for mark-up or similar applications. When used for area painting, however, use of these paints requires adherence to this procedure.
- (c) Prior to commencing painting operations, have a competent person certify in writing that compliance with all items listed below is adequate. This certification is required to obtain the Cold Work Permit.
- (d) Ensure that staging is erected in a manner which ensures that it is safe and non-sparking (e.g., prevents metal-to-metal impact).
- (e) Ensure that all electrical ventilation equipment exposed to flammable vapors is explosion proof and bonded to the vessel.
 - (1) Fans shall have nonferrous blades.
 - (2) All motors and other electrical equipment shall be properly maintained and grounded.

(f) Tools and equipment:

- (1) Use only non-sparking paint buckets, spray guns and tools.
- (2) Electrically bond spray guns, paint pots and other metallic parts to the ship.
 - (a) Place solvent drums in the paint area on non-ferrous surfaces and bond them to the vessel.
 - (b) Bond containers and drums to each other when flammable liquids are transferred from one container to another.

(g) Clothing

- (1) All footwear shall be non-sparking, such as rubbers, rubber boots or rubber soled shoes without nails.
- (2) Use coveralls or other outer clothing made of cotton or other static-free materials.
- (3) Use only rubber, rather than plastic gloves.

(h) Lighting

- (1) Use only explosion proof lights in the spray painting area and de-energize all other lights, including temporary lights and ships lighting.
- (2) Contractors shall ensure that temporary power and lighting cables are free of cracks and worn spots.
 - (a) There shall be no temporary connections within fifty feet of the work area.
 - (b) Lines shall not be overloaded.
 - (c) Lines shall be suspended with sufficient slack to prevent stress or chafing.
- (i) No matches, lighted cigarettes, cigarette lighters, cigars or pipes or ferrous articles shall be taken into the work area. Smoking, open flames, or hot work operations shall be prohibited in the spray painting area.
- (j) Exclude others from the danger zone.
- (k) Monitor the drying/curing process and remove control signs when space or area has been returned to normal safe working conditions.

10. Solvent Cleaning and Wipe Down

- (a) Solvent cleaning and wipe down includes any operations performed in confined and enclosed spaces which involve the use of paint strippers, degreasers, emulsifiers, solvents, etc., to clean residues, paints, or other coatings from pipes, bulkheads or other surfaces. Either the solvent is sprayed, brushed, or applied with a rag.
- (b) Contractors shall obtain a Cold Work Permit prior to wiping down enclosed areas (shipboard) with products that contain flammable or combustible liquids.
 - (1) In order to obtain this permit the following conditions shall be required:
 - (a) In addition to the ventilation normally installed for this type of operation. Low Point overboard exhaust ventilation will be required.
 - (b) Electrical lines pulled back from the affected area. No connections within 50 feet.
 - (c) “NO HOT WORK” signs posted and appropriate barriers erected.
- (c) Respirators may be required to protect employees from the toxic effects of vapors. Contractors shall have a respiratory protection program in accordance with 29 CFR 1910.134, which covers these issues.

11. Abrasive Blasting

The contractor shall ensure the following requirements are met:

- (a) The maximum available exhaust ventilation shall be used and suitable access provided to ensure proper air circulation in each work area.
 - (1) Consider the quality and quantity of make-up air available (air replacing the exhausted air).
 - (2) Provide sufficient access for lines, hoses, ventilation tubing and personnel.
 - (3) Additional ventilation may be required due to:
 - (a) Large numbers of blasters in the space.
 - (b) Heavy surface corrosion.
 - (c) Dusting or breakdown characteristics of the abrasive used.

- (b) A dust collector or bag house shall capture the exhausted dust.
- (c) Potential health hazards are controlled by the use of special protective clothing and approved air-supplied blasting respirators in accordance with 29 CFR 1910.94(a). The contractor shall have a written respiratory protection program which covers use of abrasive blasting respirators and meets the requirements of 29 CFR 1910.134.

12. Entering the Utility Tunnel

- (a) In addition to confined space training, entrants are required to view a video describing the hazards and safe entry into the tunnel. The Base 1 Dispatcher, Building 78 administers this video.
- (b) Entrants must have an oxygen meter (which is not provided by Base 1).
 - (1) Entrants must test the oxygen meter to ensure that it is operational.
 - (2) Only one member of a group needs an oxygen meter providing all members are working within 25 feet of this person.
 - (3) If the oxygen meter alarms, entrants shall:
 - (a) Warn other occupants and immediately exit the tunnel,
 - (b) Notify their supervisor or coordinator, and Base 1, and
 - (c) Not re-enter the tunnel until it is tested by the EH&S Department (O27).
- (c) Entrants must complete a Tunnel Access Work Permit issued by Base 1 Dispatcher, Building 78, for each entrant or group of entrants.
 - (1) The Base 1 Dispatcher will control and keep copies of the Permit.
 - (2) Entrants must have a copy of the permit in their possession while in the tunnel.
 - (3) Permits are valid for one shift only and shall be returned to Base 1 upon completion of the job.
 - (a) Personnel may enter and exit the tunnel as required for the same job, on the same permit.
 - (b) When the job for which the Permit was issued is completed, the Permit must be returned to Base 1.

- (c) If the job carried over into the next shift, a new permit is required for that next shift. Where a shift is longer than 8 hours, the permit is only valid for 8 hours from the time issued.
 - (d) All Permits must be closed out prior to the end of the shift and the person who requested the Permit must contact Base 1 to verify that all personnel are safely out of the Tunnel.
- (4) An exception to the permit is allowed when someone must enter the tunnel to respond to an emergency. In that case, personnel entering the Tunnel shall:
- (a) Have an oxygen meter with them,
 - (b) Exit the tunnel immediately after performing the emergency operation,
 - (c) Complete the Permit after exiting the Tunnel to document the entry.
- (d) Entrants must close the tunnel hatches after entering or exiting for the tunnel ventilation to work effectively.

13. Cleaning and Other Cold Work

- (a) Contractors shall follow this procedure when performing manual cleaning and other cold work in spaces containing or having last contained bulk quantities of dangerous materials such as combustible, flammable or toxic, solids, liquids or gases.
- (b) Contractors shall obtain a cold work permit be obtained from the NNS X18 or O43 Welders Department for cleaning and other cold work.
- (c) Contractors shall:
 - (1) Remove as thoroughly as practicable all liquid residues of dangerous materials before employees start cleaning operations or cold work in the space.
 - (2) Provide continuous forced ventilation.
 - (a) Ventilation volume and flow rate shall be sufficient to ensure that vapors of dangerous materials remain within safe limits as determined by the contractor's Competent Person.
 - (b) Where provisions of adequate ventilation are not possible, respiratory protection shall be provided as required by the contractor's respiratory protection program.

- (3) Provide a trained OSHA Competent Person when combustible liquids, such as diesel oil, are used to spray-clean confined and enclosed spaces. Flammable liquids (flash points below 100° F) shall not be used as spraying agents to aid in cleaning except small quantities such as in aerosol cans. The competent person shall continuously monitor the combustible gas concentration.
 - (a) If the vapor concentration equals or exceeds 10% of the lower explosive limit (LEL), the Competent Person shall order the space evacuated until the vapor concentration is reduced to below 10% of the LEL by the forced ventilation.
 - (b) Contractors shall record these combustible gas readings on a Competent Person's Log of Tests and Inspection and shall maintain this record three months.
 - (c) Repeated instances of the vapor concentration exceeding 10% of the LEL may indicate the spray cleaning exceeds the capacity of the ventilation, and either the ventilation needs to be increased or the spray cleaning activity reduced.
 - (d) The contractor shall evacuate personnel from a space where the vapor concentration equals or exceeds 10% of the LEL.
 - (e) The competent person shall test ventilation discharge areas to determine if vapors discharged from spaces being cleaned are accumulating in other areas that would impact other employees.
 - (f) If vapors are accumulating, the contractor shall stop cleaning until the vapors have dissipated.
- (4) Clean up spills or other releases of dangerous liquids as work progresses. If spill is beyond your control, call 911 or 380-2222.
- (5) Use only explosion-proof lamps and electrical equipment in the workspace.
- (6) Use only pumps that are compatible with the substance being pump and are safe for use in Class I, Group D atmospheres to move or transfer combustible/flammable liquids during the cleaning operations.
- (7) Electrically bond air-moving equipment.
- (8) Use only non-sparking fans and air ducts.
- (9) Post signs prohibiting sources of ignition within or near the workspace being cleaned, at the entrance to the workspace, and in adjacent spaces.

14. Maintaining Safe Conditions

- (a) Contractors shall ensure pipelines that could carry hazardous materials into spaces tagged “Safe for Workers” or “Safe for Hot Work” are disconnected, blanked off, or otherwise blocked by a positive method to prevent hazardous materials from being discharged into the space.
- (b) When a change occurs which could alter conditions within a tested confined or enclosed space occurs, contractors shall stop work in the affected space or area. Work may not be resumed until the affected space or area is visually inspected and retested by the contractor’s competent person.
- (c) Contractors shall follow common industry Safe Hot work practices such as fire watch, site survey, equipment checks, drop tests, proper grounding, use of GFCI, and etc. shall be followed.
- (d) Contractors shall ensure that No hot work is allowed within confined or enclosed spaces without adequate ventilation and in confined spaces exhaust mechanical ventilation equipment is provided.
- (e) All required control measures shall be observed and practiced at all times or the job shall be stopped and employees removed from the hazardous location until required controls can be reestablished. Control measures can vary according to the job requirements. Some examples of controls are shielding, ventilation, respirators, Fire Watches, welder lenses, local exhaust ventilation, lighting, noncombustible clothing, unfrozen water lines, charged fire extinguisher, where applicable guards on equipment, line plugs, etc.

15. Baghouses

- (a) Contractors who remove or disturb the bags in a baghouse shall ensure that the workers are provided and use airline respirators or full-face negative pressure respirators, coveralls and exhaust ventilation. NOTE: When bags are removed by reaching into the dust collector and the person does not actually enter the dust collector, a half-face respirator with HEPA filters is adequate respiratory protection. The ventilation supplied to the space shall provide a minimum of 1000CFM per person inside the baghouse. If the dust in the baghouse contains more than 0.05 weight percent lead, the operation shall be performed in an established lead work area.

16. Vent Plenums

Requirements for Entry and Work in Ventilation Plenums, Trunks and Ducts.

- (a) Ventilation plenums, trunks, and ducts are confined spaces. Personnel entering and working in these spaces shall comply with all requirements of this section. Contractors with the assistance of Contractor Coordinators shall follow these steps for opening and working (including inspections) in a ventilation plenum or trunk.
 - (1) Contractors shall place a red & white confined space sign on all openings and contact the O27 Marine Chemist Section.
 - (2) Contractors shall contact the O27 Marine Chemist Section to evaluate the space and provide direction on the type of confined space sign (“Caution” yellow/black or “Danger” red/white).
 - (3) O27 will determine whether some form of fall protection is required. Generally the following three situations do not require fall protection, but final determination will be made by O27.
 - (a) Plenums with steel louvers (in good condition) installed in the opening.
 - (b) Plenums with moisture separators/mist extractors installed where it is not possible to access the opening or other fall hazards.
 - (c) Plenums that are too small to enter.
 - (4) O27 will require ventilation plenums to be posted with a durable sign stating “SAFETY HARNESS REQUIRED BEYOND THIS POINT.”
 - (5) Contractors shall contact the O27 Marine Chemist Section before making any of the following changes in condition so that atmospheric and fall protection requirements can be reassessed.
 - (a) Removing or installing screens (all types).
 - (b) Removing or installing moisture separators or other equipment in the plenum or ventilation trunk.
 - (c) Installing or removing abrasive blast protective covers or other cover.
 - (d) Constructing or removing outer hull staging for the purpose of fall protection in plenums and trunks.

- (e) Constructing or removing staging within the plenum or trunk.
 - (f) Installing or removing an approved walking/working surface cover over a plenum opening.
 - (g) Any other change that could affect air movement or create a new fall hazard from an elevated surface.
- (6) O27 will determine what confined space and fall protection signage is required based on the changed condition.

NOTE: Approved walking/working surface covers are the preferred method of preventing falls. In some cases, staging or other means may also be acceptable. Fall arrest equipment will be used when there is no other feasible method to eliminate the fall hazard and still accomplish the work. Only X36 or an approved staging contractor shall construct staging or walking/working surface covers. X11 may also install Procedure Y-1035 or O27 approved guards or covers.

- (7) Walking/working surface covers must be capable of holding twice the weight of the person(s) and their materials in accordance with Health and Safety Manual, Vol. II, Chapter 12.
- (b) Follow these steps for opening and working (including inspections) in ventilation ducts.
- (1) Contractors will place a “Danger” red & white confined space sign on all openings and contact the O27 Marine Chemist Section to evaluate the atmospheric hazards of space for the intended work and determine the appropriate safe work controls.
 - (2) O27 will evaluate the physical hazards of the space including fall hazards and make a determination whether fall protection is required. Generally, the following three situations will not require a form of fall protection, but final determination will be made by O27.
 - (a) Horizontal duct sections with no slopes, drops (i.e., vertical sections) or other fall hazards in the area.
 - (b) Horizontal duct sections with slopes, drops or other fall hazards either guarded or inaccessible.
 - (c) Horizontal duct sections with openings that cannot be bodily entered due to their small size.

NOTE: Ducts with no atmospheric or physical hazards may be posted with “Caution” yellow and black confined space signs if authorized by the Marine Chemist Section.

- (3) Generally, duct sections with slopes, drops or other fall hazards in the area will require appropriate safe work controls to protect against falls. Controls may include the following:
 - (a) Installation of safety guard rails.
 - (b) Use of a fall restraint system
 - (c) Installation of approved walking/working surface covers over the hazard.
 - (d) Restrictions requiring personnel to stay a pre-determined distance away from a potential fall hazard.

NOTE: Ducts with any atmospheric or physical hazards must be posted with a “Danger” red & white confined space sign. Additional information regarding safe work controls will be written on the back of each accompanying personnel entry tag.

- (4) Contractors shall contact the O27 Marine Chemist Section before making any of the following changes in condition so that atmospheric and fall protection requirements can be reassessed:
 - (a) Constructing or removing staging within the duct.
 - (b) Installing or removing an approved walking/working surface cover over a duct opening.
 - (c) Any other change that could affect air movement or create a new fall hazard.