

Guidelines for Safely Entering and Cleaning Vessel Sewage Tanks

Sewage systems on vessels are known as Marine Sanitation Devices (MSDs) or Collection, Holding and Transfer Tanks (CHTs). Cleaning these systems is required for operations such as routine surveys and inspections, surface preservation, equipment modification, repairs and maintenance. Entering and cleaning sewage tanks, piping and components present specific hazards to workers that put them at risk for injuries and illnesses if they are not properly protected (29 CFR 1915.13).

Workers are often exposed to dangerous atmospheres during tank opening and venting; manual pumping and stripping; breaking or dismantling components and piping; and pressure washing, mucking, and scaling (29 CFR 1915.11(b); 1915.12). A dangerous atmosphere may expose workers to the risk of death, incapacitation, injury, chronic or acute illness, or impaired ability to escape unaided from a confined or enclosed space (29 CFR 1915.11(b)). When working on CHTs/MSDs, special attention should be given to good hygiene practices, proper use of personal protective equipment and safe confined space entry procedures (29 CFR 1915.88; 1915 Subparts B & I).

The information in this document can help prevent exposing workers to the known and unknown dangers of handling treated or untreated sewage and gray water tanks during tank opening, entry, cleaning and related operations. Related components/operations include: piping, aeration, vacuuming, settling, and treatment tanks and apparatus; sewage-contaminated water tanks or waste oil tanks, bilges, or sumps; and valves, pumps, grinders, macerators and other contaminated equipment.

Sewage and Gray Water

- **Sewage or “black water”** includes any wastes contaminated by human excrement and other effluent (liquid waste), such as from urinals and toilets.
- **“Gray water”** includes wastewaters uncontaminated by human excrement such as liquids from drains, sinks, sculleries, drinking fountains, showers, washing water, food wastes, laundry waste, etc.

Common Hazards in Tanks

- **Atmospheric hazards** include oxygen-deficiency and flammable or toxic gases such as methane and hydrogen sulfide. Methane gas is colorless, odorless and tasteless, but is highly flammable and is considered an asphyxiant. Hydrogen sulfide (H₂S) is also colorless and flammable, but it is highly odorous and extremely toxic to humans. At approximately 100–150 ppm of H₂S, the olfactory nerve is paralyzed after a few breaths. Within a very short time, the sense of smell disappears, giving a false sense that the harmful gas has gone away. These gases are detectable only by properly calibrated instruments (29 CFR 1915.12).
- **Biological hazards** include pathogens (e.g., bacteria, viruses, protozoa, parasitic worms, fungi) and other infectious microorganisms that can cause illnesses such as hepatitis, typhoid fever, dysentery and cholera. Inhaling or ingesting contaminated mists may result in serious illnesses.
- **Physical hazards** include slips, trips, and falls due to slippery and sloping surfaces; limited access and egress; corroded ladder rungs; and obstructions by piping and other structures. There is also the risk of receiving punctures and cuts from sharp edges (29 CFR 1915.81).
- **Mechanical hazards** include energized equipment; rotating machinery; and waste stream leaks. Before any servicing is performed where the energization or startup, or the release of hazardous energy may occur, all energy sources must be identified and isolated, and the machinery, equipment, or system rendered inoperative (29 CFR 1915.89(c)(1)).

- **Chemical hazards** include sewage treatment agents containing ammonium compounds, formaldehyde, chlorine products, sodium hydroxide, odor-control and sewage-biodegrading enzymes, sanitizers, biocides, cleaning or bleaching agents, pharmaceutical drugs, hormones and heavy metals.

Note: Other hazards may include inadequate ventilation, poor visibility, and heat stress.

Personal Protective Equipment (PPE) & Other Recommended Safe Practices



A worker with protective gear.

Note: Respirator shown here is not equipped with organic vapor HEPA cartridge as recommended.

- Although Level A or B protective gear is not required, to avoid liquid contact with exposed skin, it is recommended that full-body, impervious suits are worn in addition to using rubber boots, gloves, hard hats and eye protection (29 CFR 1915 Subpart I).
- Respirator selection is based on an evaluation of respiratory hazards in the workplace and other relevant workplace and user factors (29 CFR 1915.154; 1910.134(d)); however, during entry and cleaning inside a large sewage tank, it

is recommended that workers wear full-face, supplied-air respirators with an escape pack.

- During cleaning operations performed outside a tank, where the atmosphere is not Immediately Dangerous to Life or Health (IDLH), wear supplied-air or air-purifying respirator with organic vapor HEPA (High-Efficiency Particulate Arresting cartridge) (29 CFR 1910.134(d)(3)(iv)(B)).
- Have extra flashlights and two-way radios readied for communication.
- Have a first-aid kit, an eyewash and flushing station, neutralizing solutions, cleaning equipment, and emergency medical services readily available (29 CFR 1915.87; 1915.88).

Note: For more information, see CPL 02-01-049, 29 CFR Part 1915, Subpart I, Enforcement Guidance for Personal Protective Equipment (PPE) in Shipyard Employment, November 4, 2010.

Immunization

- Ensure routine vaccinations such as for influenza and tetanus are current. Consult your physician about the need for Hepatitis A vaccination (NIOSH/CDC).

Training

Workers must be trained to recognize potential hazards, use proper work practices and procedures, recognize adverse health effects, understand the physical signs and reactions related to exposures, and are familiar with appropriate emergency evacuation procedures. They must also be trained to select and use the appropriate Personal Protective Equipment (PPE) (29 CFR 1915.12(d)(2) - (d)(3)); 1915.1200). Training may also be required in the following areas:

- Confined Space Entry Procedures;
- Atmospheric Testing;
- Calibration of Gas Detectors;
- Respirator Selection and Fit Testing;
- Ventilation and Engineering Controls;
- HAZMAT or HAZWOPER

Atmospheric Testing Requirements for Confined Space Entry & Hot Work

Tank entry must not be permitted if atmospheric conditions are found to be Immediately Dangerous to Life or Health (IDLH). IDLH means an atmosphere that poses an immediate threat to life or is likely to result in acute or immediate severe health effects (29 CFR 1915.11). Depending on the atmospheric condition, either a shipyard competent person or a NFPA-certified Marine Chemist is required to test sewage tanks prior to entry for cleaning (29 CFR 1915.7; 1915.13). Sewage tanks and all piping must be tested and visually inspected prior to doing any hot work (29 CFR 1915.14) to confirm that:



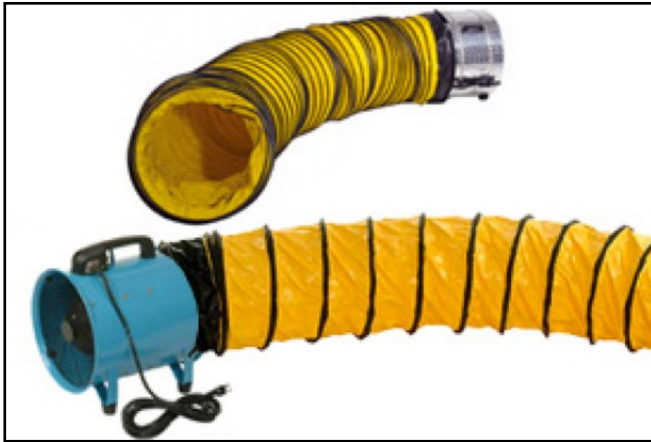
Test for oxygen, combustible gases and hydrogen sulfide prior to opening tank and entering.

- Oxygen levels in the tank and around the work area are maintained between 19.5 and 22.0% by volume;
- Combustible gases are maintained below 10% Lower Explosive Limit (LEL); and
- Hydrogen sulfide gas is maintained at 10 ppm (parts per million) or less.

Note: For more information, see CPL 02-01-051, 29 CFR Part 1915, Subpart B, Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment, May 20, 2011.

Control Measures Prior to Tank Opening or Pipe Breaking

- Assess and review CHT or MSD systems, components and piping.
- Perform jobsite safety and health analyses and be aware of all associated risks and hazards. Inform all workers involved of the risks and hazards determined by the jobsite safety and health analyses (29 CFR 1915.3(a)).
- Post warning signs and labels (29 CFR 1915.16).
- Secure all toilets, urinals, drains, pumps, and sewage treatment systems.
- Isolate, close, secure, divert, de-energize, lockout and apply tags-plus applications to all valves, piping and associated equipment (29 CFR 1915.89).



Ventilation blower and ducting.

- Strategically place drip pans at pumps, joints, disconnected piping, tank manholes, clean-outs, drops, etc.
- Follow confined space entry testing and permitting procedures. If feasible, use sample ports to test for atmospheric contaminants inside the tank.
- It is recommended that a NFPA-certified Marine Chemist or shipyard competent person be present when breaching the sewage system, tank, or piping.
- Cautiously and deliberately remove bolts and nuts off manholes and piping, while staying alert to any immediate change of conditions, and be prepared to take necessary action.
- Use appropriate tools and operating procedures.
- Install and use adequate exhaust ventilation devices, ducting, lighting, and tank-cleaning equipment. Immediately following the piping being broken or the tank opened, apply or insert ducting to begin exhaust ventilation. Pipe all exhausts downwind, overboard, or away from people (29 CFR 1915 Subparts B & D).
- Cover and isolate all work areas with disposable plastic sheeting to prevent possible contamination.

- Flush tanks and piping systems; pump and drain all residual products.
- Check for residual pressure or vacuum effects in tanks and piping.
- While remaining outside the tank, continue to test the atmosphere inside the tank remotely for safe conditions.
- Before beginning tank cleaning operations, while wearing the appropriate PPE, clothing and respiratory protection, cautiously enter the tank for an internal inspection.
- Chlorinate or sanitize the tanks and piping systems when necessary.

Tank Cleaning Procedures

- Perform initial cleaning and any additional pumping or stripping through the opened manhole access.
- Pressure wash, pump-out and remove all loose materials.
- Manually scrape muck or scale and bag all hardened/calcified deposits.
- Perform a second pressure wash and remove any remaining debris before sanitizing all surfaces with bleach or sanitizer.
- Perform final rinses, squeegee, removal, wipe and dry operations.



A cleaned and sanitized sewage tank.

Sewage Disposal

- Dispose of sewage and contaminated liquids, sludge, solids, and all tank-cleaning wastes at local or state-approved treatment facilities.

Post-Work Cleanup

- Remove contaminated clothing and bag for proper disposal or decontamination.
- Shower or wash face, arms, hands and legs with soap, using a substantial amount of water.
- Disinfect equipment (e.g., using iodine compounds, bromine, chlorine, ozone, or their equivalent) and wash contaminated spaces, decks and bulkheads with detergent, sanitizer, or bleach (29 CFR 1915.152(d)).

- Dispose of or re-wash rubber boots, gloves, eye goggles, face shields and respirators with a disinfectant solution (29 CFR 1915.152(e)(v)).
- Wash contaminated clothing separately.
- Do not enter other spaces while still wearing contaminated clothing.

Confined Space Rescue

When confined space entries are performed, have a trained rescue team with the proper rescue equipment available at the job site, or notify your designated outside rescue team in advance that employees are working in a CHT or MSD so they can prepare to respond in the event of an emergency (1915.12(e)).

Regulations / References / Literature

- OSHA's Permissible Exposure Limits (PELs), 29 CFR 1915.1000 and 29 CFR 1915 Subpart B, D
- State Plans – www.osha.gov/dccsp/osp/index.html
- www.osha.gov/SLTC/etools/shipyard/index.html
- ACGIH's Threshold Limit Values (TLVs)
- NIOSH/CDC's Recommended Exposure Limits (RELs)
- www.epa.gov (Environmental Protection Agency)
- NAVSEA Standard Items 009-88; Navy NSTM 593 "Pollution Control"
- USCG, 33 CFR Part 159 MSD (Marine Sanitation Devices)
- Marine Chemist Association
- <http://www.nfpa.org/assets/files/pdf/mcdir.pdf>
- www.aiha.org (American Industrial Hygiene Association)

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.



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