

SAFETY
and
HEALTH
INJURY
PREVENTION
SHEETS



Working with the Shipyard Industry

Process

Housekeeping Safety



Establishing an Injury and Illness Prevention Program

The key to a safe and healthful work environment is a comprehensive injury and illness prevention program.

Injury and illness prevention programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers. Thousands of employers across the United States already manage safety using injury and illness prevention programs, and OSHA believes that all employers can and should do the same. Thirty-four states have requirements or voluntary guidelines for workplace injury and illness prevention programs. Most successful injury and illness prevention programs are based on a common set of key elements. These include management leadership, worker participation, hazard identification, hazard prevention and control, education and training, and program evaluation and improvement. Visit OSHA's injury and illness prevention program web page at: www.osha.gov/dsg/topics/safetyhealth for more information.

How Can OSHA Help?

OSHA has compliance assistance specialists throughout the nation who can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. Contact your local OSHA office for more information.

OSHA's On-Site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site Consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management systems. To locate the OSHA On-site Consultation Program nearest you, visit OSHA's website at www.osha.gov/dcsp/smallbusiness/index.html, or call 1-800-321-OSHA (6742).

OSHA's Cooperative Programs: OSHA offers cooperative programs under which businesses, labor groups and other organizations can work cooperatively with OSHA. To find out more about these programs, visit www.osha.gov/dcsp/compliance_assistance/index_programs.html.

Worker Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary they can understand) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- Get copies of test results that find and measure hazards.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation.

For more information, see www.osha.gov/workers.html.

Contact OSHA

For questions or to get information or advice, to report an emergency, to report a fatality or catastrophe, to order publications, to file a confidential complaint, or to request OSHA's free on-site consultation service, contact your nearest OSHA office, visit www.osha.gov, or call OSHA at 1-800-321-OSHA (6742); TTY 1-877-889-5627.

Twenty seven states operate their own OSHA-approved plans. State Plans have and enforce their own occupational safety and health standards that are required to be at least as effective as OSHA's, but may have different or additional requirements. For a complete list of State Plans and their contact information, see www.osha.gov/dcsp/osp/index.html.





Disclaimer

This guidance document is not a standard or regulation, and it creates no new legal obligations. The information provided is designed to highlight safety and health hazards associated with poor housekeeping aboard vessels and during shipyard employment only. Suggested preventative measures as well as descriptions of mandatory safety and health standards are also included. The recommendations are advisory in nature, informational in content, and are intended to assist employers in providing a safe and healthful workplace. The *Occupational Safety and Health Act* requires employers to comply with safety and health standards and regulations promulgated by either federal OSHA or through an OSHA-approved State program. In addition, the Act's General Duty Clause, Section 5(a)(1), requires employers to provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm.

Standards Applicable to Housekeeping Safety

The standards applicable to the hazards associated with housekeeping are:

- 29 CFR 1915 Subpart C – Surface Preparation and Preservation
- 29 CFR 1915 Subpart E – Scaffolds, Ladders and Other Working Surfaces
- 29 CFR 1915 Subpart F – General Working Conditions
- 29 CFR 1915 Subpart P – Fire Protection in Shipyard Employment
- 29 CFR 1915 Subpart Z – Toxic and Hazardous Substances

Other requirements contained in 29 CFR Part 1910 may apply (e.g., Subparts G – Occupational Health and Environmental Control, and H – Hazardous Materials).

Resource Materials

OSHA's Shipyard **"Tool Bag" Directive, CPL 02-00-157**, dated April 1, 2014, provides guidance on the applicability of standards. See Appendix A for the application of 29 CFR Part 1910 standards where 29 CFR Part 1915 provisions do not address a recognized hazard in Shipyard Employment.

See the Shipyard e-Tool for additional compliance guidance at www.osha.gov/SLTC/etools/shipyard/index.html.

Introduction

Good housekeeping not only results in a cleaner workplace, but makes it safer as well. Good housekeeping reduces illnesses and injuries and promotes positive behaviors, habits, and attitudes. Employers are responsible for assessing each workplace before work begins to identify the potential hazards present, and determine ways to eliminate the hazards. An effective housekeeping program is an important element in workplace safety and health management systems.

Uncluttered working conditions are essential to the safety of all workers and should be maintained at all times in both work and office areas. Proper housekeeping management provides for an orderly arrangement of operations, tools, equipment, storage facilities, supplies, and waste material. Good housekeeping is evidenced by floors free from grease and oil spillage; properly identified passageways; unobstructed accesses and exits; neat and orderly machinery and equipment; well-nested hoses and cords; properly stored materials; removal of excess waste material or debris from the working area; walkways free from ice and snow; surfaces, including elevated locations, free from accumulated dust; and adequate lighting. Maintaining these conditions contributes significantly to lower incident rates.

While OSHA regulations require that each working surface be cleared of debris, including solid and liquid waste, at the end of each workshift or job, whichever occurs first, to fully realize the benefit of a clean workplace, it is recommended that good housekeeping be maintained throughout the course of the job and workday. For example, consider the following consequences that can result from poor housekeeping:

- A trip or fall over lines and leads in walkways and work areas
- A slip or fall on an oily or slippery facility floor, vessel deck or other working surface
- A trip or fall from a dock or vessel
- An allergic reaction to a spilled chemical
- An eye injury from falling grit left in the overhead of a work site
- A fire as a result of oily rags left in an area where hot work is performed, or due to the accumulation of combustible dust
- Illness due to the unsanitary conditions of restrooms
- Electrical shock as a result of poorly maintained equipment or energy sources, such as broken, cracked or damaged insulation and connections of wiring
- Lacerations and amputations when poor maintenance results in inadequate lighting
- Exposure to hazardous substances from poor storage and ineffective labeling of hazardous chemicals
- Slip hazards where snow, ice, or standing-water is left on walkways

In shipyard employment, trip hazards and slippery walking surfaces are two of the most hazardous housekeeping issues. In many of these instances, injury could have been prevented had the employer ensured cleanup prior to the start of work, or required more effective storage of materials, rerouting of hoses and cords, and inspection procedures. Every effort should be made to run air, gas, and electrical lines overhead or underneath walkways. However, such utilities may be placed on walkways, provided that they are covered by crossovers or other means that will prevent injury to workers and damage to hoses and cords. Frequent

inspections and assessment of walkways and working surfaces should be conducted to address hazards before they become a danger to workers. Spilled materials, such as oil, grease, and water, must be immediately cleaned from walkways and working surfaces to eliminate slip hazards.

Even with a dedicated effort to keeping work areas clean, ship construction and repair requires that work be performed in tight and congested areas. A key to protecting workers from such obstacles and preventing injury is early detection and immediate action. Employers can keep workers safe by training all workers to:

- Take time to stack materials, boxes and packages properly.
- Clean up messes. Never let safety be someone else's job.
- Remove, repair, and/or report housekeeping hazards.
- Never jeopardize someone else's health and safety by obstructing the access to exits, electrical panels, or fire extinguishers.
- Avoid stringing cords, hoses or lines across walkways. Use "S" and "J" hooks and cable trees to keep lines out of walkways. If lines must cross walkways, cover the lines.

In addition, provisions contained in [29 CFR 1915.81](#) outline OSHA's minimum housekeeping requirements to protect workers. Employers must:

1. Establish and maintain good housekeeping practices.
2. Eliminate slippery conditions, such as snow, ice, and grease, from walkways and working surfaces as necessary. Where removal is not possible, access to such areas must be restricted and an alternate route established, or slip-resistant footwear provided.
3. Store materials in a way that does not create hazards for workers.
4. Ensure easy and open access to all exits (including ladders, staircases, scaffolds, and gangways), fire-alarm boxes, fire extinguishing equipment and fire call stations.
5. Dispose of oils, paint thinners, solvents, rags, scraps, waste, or other flammable and combustible substances, or store them in covered fire-resistant containers, at the end of each workshift or when the job is complete, whichever occurs first.
6. Maintain walkways so that they provide adequate passage and are:
 - Free from debris, including solid and liquid waste;
 - Clear of tools, materials, equipment, and other objects; and
 - Free from trip hazards as a result of the improper storage or placement of hoses and electrical service cords. Hoses and cords must be placed above or underneath walkways or covered.
7. Cordon off any portion of a walkway that is being used as a working surface.
8. Make sure working surfaces are free from all tools, materials, and equipment not necessary to perform the job in progress. All debris, including liquid and solid waste, must be cleared at the end of the job or workshift, whichever occurs first.

9. Keep working surfaces dry, when possible. If a wet process is used, drainage must be maintained and dry standing places made available, or workers provided with protective footgear when such means are not practicable.

Benefits of Good Housekeeping Practices

Good housekeeping implies that a workplace is kept in an organized, uncluttered, and hazard-free condition. While this is a relatively simple concept, the benefits that can be realized from good housekeeping practices are far reaching, and affect not only workers' safety but also their health and productivity. Improvements in worker health and productivity, in turn, lead to lower operating costs thereby providing benefits to both the workers and the employer.

Good housekeeping is not just about cleanliness; it lays the basic foundation for accident and fire prevention. It requires attention to details, such as the layout of the worksite or facility, identification and marking of physical hazards, ensuring the adequate number of storage facilities, and routine maintenance. Here are some of the many benefits that can be gained when implementing good workplace housekeeping:

Improved Worker Safety

- Fewer trip and slip incidents where walkways and working surfaces are free of clutter and spills.
- Decreased fire hazards as a result of the reduction or elimination of waste, dust, debris, and other flammable materials.
- Reduced number of workers being struck by objects through organized and careful storage of materials, tools, and equipment.
- Fewer worker injuries as a result of defective or malfunctioning parts through timely maintenance of machinery, equipment, or systems.

Improved Worker Health

- Reduced worker exposure to hazardous substances, such as dust and vapor buildup, by following a regular cleaning schedule.
- Improved working conditions and worker health through regular servicing, cleaning, and supplying sanitation facilities.

Increased Worker Productivity/Reduced Costs

- Safe work environments lead to healthier workers, higher worker morale, and increased productivity.
- Workplace cleanup and maintenance, including worker training, will ensure better control over tools and materials as well as the inventory of supplies.
- Tidy and clean work areas allow for more effective use of space.
- Improved preventive maintenance can reduce property damage.
- Increased worker participation in general housekeeping helps reduce the workload and cost of janitorial staff.

The U.S. Department of Labor reports that slips, trips, and falls (STFs) account for approximately 15 percent of all accidental workplace deaths and are second only to motor vehicle accidents as a cause of worker fatalities. Good housekeeping practices can substantially reduce the underlying causes of STFs in shipyard employment.

For example, good housekeeping practices can reduce the risk of tripping on equipment, tools, and other items that have been left on the floor or misplaced. One study published in the *International Journal of Industrial Ergonomics* found that incidents in a shipyard were reduced 70-90% once steps were taken to improve housekeeping practices conducted at the facility (Saari et al., 1989).

Good housekeeping can also improve the health and safety of shipyard workers by reducing exposure to hazardous chemicals and unsafe conditions, including fires or explosions. Good housekeeping practices help ensure that containers used for hazardous substances are not only returned to their appropriate storage areas, but are also properly closed and sealed so that dust, fumes, or vapors are not released. Combustible dusts, when knocked from elevated surfaces or otherwise made present in the air, can result in fires and explosions. Certain materials or substances can pose a fire hazard when spilled or combined unintentionally; it is important to avoid leaving such materials unattended or in close proximity to ignition sources. Clutter in the workplace can obstruct walkways, which could make it more difficult to exit during a fire or other emergency.

The improvement of workers' attitudes is another advantage to maintaining good housekeeping. Good housekeeping practices help ensure neat, organized, and safe workspaces, which can reduce stress and improve morale. An increase in productivity and lower operating costs may also result when workers spend less time tracking down a needed tool or other item.

Reducing workplace injuries will also help lower costs. Workplace injuries result in substantial expenditures. Worker injuries lead to missed days at work, higher workers' compensation premiums, and increased spending on the hiring and training of new or temporary workers. See OSHA's [Safety Pays](#) website to assess information on the impact of occupational injuries and illnesses on business profitability.

References:

Saari, J., Nasanen, M., The effect of positive feedback on industrial housekeeping and accidents; a long term study at a shipyard, *International Journal of Industrial Ergonomics*, Volume 4, Issue 3, November 1989, pages 201-211.

Dufort, V., Infante-Rivard, C., Housekeeping and Safety: An Epidemiological Review, *Safety Science*, Volume 28, Issue 2, March 1998, pages 127-138.

Establishing a Housekeeping Program

As discussed in the previous sections, *Introduction and Benefits of Good Housekeeping Practices*, good housekeeping is a necessary component of maintaining a safe work environment in shipyard employment activities. Housekeeping practices are among the easiest and most visible safety measures to implement in the workplace. Operations that are neat and organized help reduce potential hazards. Employers are responsible for establishing and maintaining good housekeeping practices as required by [29 CFR 1915.81\(a\)\(1\)](#); they should have a written housekeeping plan or program that includes the following key elements:

- Worker training
- Routine maintenance and housekeeping schedule
- Assignment of worker responsibilities

Worker Training

In addition to training workers on the type, appropriate use, and care of PPE, workers should understand the potential hazards associated with poor housekeeping. A written housekeeping plan or program should include a training schedule for all workers at each facility including contractors. The schedule should include initial training and any refresher training that may be necessary due to a change in facility operations or change in worker assignment. Training records should be maintained at the facility and include the name of the worker, the date of training, and the material covered.

Important training topics for workers should include general housekeeping procedures, safe work practices, and hazard reporting. General housekeeping includes ensuring that all trash (e.g., recyclables and food items) is placed in proper receptacles during the work shift and at the end of the day. Safe work practices include such elements as ensuring that walkways and working surfaces are free of debris, including solid and liquid wastes, and other items such as tools that are not in use ([29 CFR 1915.81\(b\) and \(c\)](#)). Employers should ensure that workers understand that any potential hazards discovered should be reported to supervisors as soon as possible. Management and workers can implement corrective actions such as relocating items that are causing an obstruction, or making repairs to damaged equipment or machinery.

Routine Maintenance/Housekeeping Schedule

Developing and implementing a schedule for routine maintenance and housekeeping activities promote a safe working environment by incorporating safe practices into day-to-day activities. Safety meetings and worker training can also be used to engage workers and identifying areas that may need development or improvement for routine maintenance and housekeeping.

Areas to include in a routine housekeeping schedule include sanitation ([29 CFR 1915.88](#)), storage areas ([29 CFR 1915.81](#)), and maintenance of equipment and machinery ([29 CFR 1915.89 and Subparts G, J and L](#)). Routine cleaning and restocking of supplies in common areas (such as kitchens and bathrooms) reduce the risk of exposure to harmful contaminants (e.g., germs and hazardous or toxic substances) that could cause injury, illness and loss of work days.

Organized storage areas are also important to the safety of workers because they reduce physical hazards such as slips, trips, falls, or falling objects. Where it is not possible to eliminate slippery conditions on walkways and working surfaces, employers must restrict worker access to those areas or provide slip-resistant footwear ([29](#)

[CFR 1915.81\(a\)\(2\)](#)). Furthermore, there must be easy and open access to fire-alarm boxes, fire-call stations, fire-fighting equipment, and exits (including ladders, staircases, scaffolds, and gangways) ([29 CFR 1915.81\(a\)\(4\)](#)). Another concern is the improper storage of items such as flammable and combustible substances. Paint thinners, solvents, rags, scrap, and waste must be disposed of, or stored in a covered fire-resistant container, at the end of each workshift or when the job is complete, whichever comes first ([29 CFR 1915.81\(a\)\(5\)](#)).

Also, properly maintained machinery, equipment, and systems prevent malfunctions and ensure continued safe use. It is important that the proper lockout and/or tags-plus procedures are followed when servicing machinery, equipment, or systems ([29 CFR 1915.89](#)). For more detailed guidance on safety procedures during servicing activities, see SHIPS Documents - [Control of Hazardous Energy Lockout/Tags-Plus](#) and [Shipboard Electrical](#).

Assignment of Worker Responsibilities

Housekeeping should be a team effort. Designated worker responsibilities will help engage all workers in good housekeeping practices. An established maintenance program should identify the responsibilities of each job or work area, and assign a frequency for conducting those tasks. For example, workers should be responsible for keeping their work areas tidy during their normal shift, as well as at the end of their shift, to ensure that the work area is clean, organized, and free of debris or obstructions. This is particularly important in areas where routine maintenance or cleaning may be conducted after regular working hours. It is also important that unused materials are returned to their proper storage location as soon as possible, but no later than the end of the work shift. Further, hazardous materials and waste products should be stored or appropriately discarded when they are no longer in use. Employers or their representatives should also inspect the facility at regular intervals and at the end of the work day to ensure that good housekeeping practices are effective.

Areas of Concern

Before employers can effectively establish a housekeeping program, they should first determine where potential hazards may exist for workers. Some areas of concern may include:

- dust and dirt removal
- sanitation facilities
- vermin control
- walkways and working surfaces
- lighting
- hazardous waste and emergency response
- material storage

Areas of Concern – Dust and Dirt Removal

Dusts are a common byproduct of shipyard activities and when given the proper conditions, can result in a fire, flash fire, or explosion. Dusts produced from sandblasting activities, if allowed to accumulate, can ignite and burn when airborne. Also, metal dusts that result from cutting and grinding work can be particularly energetic, burning at high temperatures and at a quick rate. When finely divided solid materials dispersed or suspended in air result in a fire, flash fire, or explosion, this is called a combustible incident. The U.S. Chemical Safety and Hazard Investigation Board (CSB) identified 281 combustible dust incidents between 1980 and 2005 that led to the deaths of 119 workers and injured 718 others. Such incidents occur depending on which of the following conditions (or elements) are present at the same time and location.

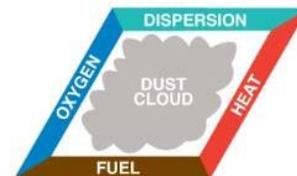
For a fire to occur, elements 1 through 3, described below, must exist simultaneously. The term **fire triangle** is commonly used to describe these three elements.

1. **Fuel**, consisting of small dust particles (finely divided). Some examples of dusts found in shipyards that are combustible are paint particles, iron, hemp, epoxy, aluminum, and zinc coatings.
2. **Oxygen** or another oxidizing agent is present in substantial quantity.
3. **Heat** or ignition source with enough energy to ignite the dust (above the minimum ignition energy). Potential ignition sources may include temporary electric equipment, welding and other hot work.



A fourth element, which is **dispersion**, must exist in addition to fuel, oxygen, and heat for a **flash fire** or **deflagration** (a type of flash fire with a strong pressure wave) to occur.

4. **Dispersion** of dust particles, suspending them in the air, can result from shipyard processes that include pneumatic air, welding gas and pressure scarfing.



Flash fires are much more dangerous to workers than an ordinary fire because it spreads too quickly to outrun. Workers can sustain burns and other injuries immediately or while attempting to escape. Depending on whether the flash fire spreads, damage can range from minimal to severe. Workers can sustain severe injuries even if property damage is minimal.

The fifth and final element needed for an explosion to occur is **confinement**.

5. **Confinement** of accumulated and suspended dust particles sufficient to create sudden and dramatic pressure effects. This may consist of any enclosure—equipment, ductwork, dust collectors, compartments, or spaces. Explosions are extremely fast and can result in flying shrapnel and collapsing structural members over a large area. Workers often sustain burns or traumatic injuries in explosion incidents.

Together, these five elements (fuel, heat, oxygen, dispersion, and confinement) make up the **Explosion Pentagon** (shown to right).



Poor housekeeping practices, where various types of dust are allowed to accumulate,

are a

major cause of combustible incidents. Whenever work processes produce dust, good housekeeping is extremely important in reducing the accumulation to a safe level. Below are tips for addressing combustible dust buildup:

Do:

- Ensure dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed to prevent fugitive dust in the work area (i.e., there is no leakage from the equipment).
- Use electrical grounding and bonding for dust systems. In some cases, inert atmospheres should be used. Dry powders can build up static electricity charges when subjected to the friction of transfer and mixing operations.
- Use a vacuum cleaner that is listed for use in Class II hazardous locations, or use a fixed-pipe system with a remotely located exhaust and dust collector to clean areas where dust may fall.
- Perform regular cleaning on horizontal surfaces, floors, decks, walls, and bulkheads, including equipment, ducts, pipes, hoods, ledges, beams, stair rails, and above suspended ceilings and other concealed surfaces. At a minimum, this should be performed at a frequency sufficient to prevent dust accumulations of 1/32 inch or greater.
- Ensure that dust control equipment, such as local exhaust ventilation and material transport systems for handling dust and dirt, contains either explosion relief vents or an explosion suppression system, or indicates an oxygen-deficient environment.

Do Not:

- Allow dust layers to accumulate to hazardous levels. The NFPA identifies dust accumulations of as little as 1/32 of an inch to be hazardous.
- Use compressed air or steam to blow down surfaces unless there is no other practical alternative. If compressed air or steam must be used, it is vital to first ensure that potential ignition sources in the vicinity are eliminated and apply the air or steam only under low pressure to avoid discharging clouds of dust to other areas.

For more information on combustible dust see www.osha.gov/dsg/combustible_dust

Areas of Concern – Sanitation Facilities

The absence of appropriate sanitation facilities can lead to adverse health effects in workers. A lack of suitable sanitation facilities can lead to communicable diseases, heat-related illnesses, health effects related to delay in using the restroom, and the effects of ingesting or absorbing hazardous substances not properly removed from the workplace. The unique working conditions associated with shipyard work often involve performing tasks in extreme weather conditions, as well as in locations where access to sewer toilets is not always possible. These conditions present a challenge for employers to ensure that they meet the sanitation needs of workers.

Sanitation Facilities

Sanitation facilities, including supplies, must be maintained in a clean, sanitary, and serviceable condition for workers' personal and health needs. Sanitation facilities include potable drinking water, toilet facilities, hand-washing and drying facilities, showers, changing rooms, eating and drinking areas, first-aid stations, and on-site medical service areas. Sanitation supplies include soap, waterless cleansing agents, single-use drinking cups, drinking water containers, toilet paper, and towels ([29 CFR 1915.80\(b\)\(24\)](#)). A schedule must be established for servicing, cleaning, and supplying each facility ([29 CFR 1915.88\(a\)\(2\)](#) and [\(d\)\(1\)\(iii\)](#)).

Toilet Facilities

A minimum number of toilets must be made available for workers at each worksite. These toilets must provide privacy, be separate for each gender, and kept in a clean, sanitary, and serviceable condition. If a toilet facility is designed to be occupied by only one worker at a time, separate toilets for each gender are not required as long as it can be locked from the inside and contains at least one toilet. Urinals may be substituted for toilet facilities designated for men; however, the number of toilets cannot be reduced to less than 2/3 of the minimum specified. Employers must also ensure that toilet facilities are readily accessible to workers, taking into account the size and location of worksites, and the physical characteristics of the shipyard. For example, workers who are located aboard a large vessel may not be able to get to facilities quickly enough if toilet facilities are only located on the dock. At worksites where it is not feasible to provide sewer toilets, or when there is a temporary and brief increase in the number of workers, portable toilets may be used. These facilities must be vented and equipped with lighting when necessary ([29 CFR 1915.88\(d\)](#)).

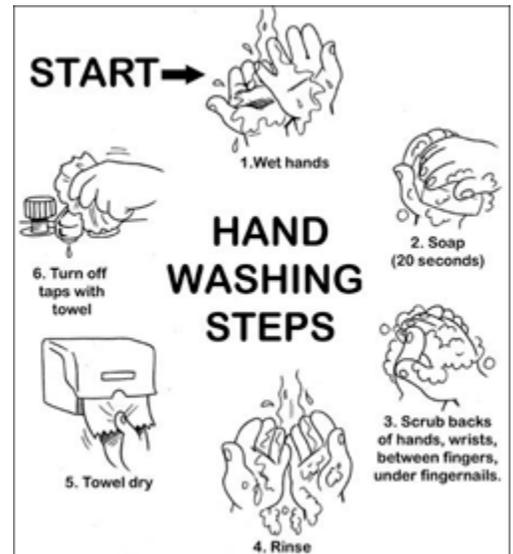
OSHA's Sanitation standard for shipyard employment at [29 CFR 1915.88\(d\)\(2\)](#) specifies the minimum number of toilets employers must provide per number of workers as outlined below:

Number of Workers	Number of Required Toilets
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
Over 150	1 additional toilet for each additional 40 workers

Handwashing Facilities

Handwashing stations must be at or adjacent to each toilet facility, and contain hot and cold or lukewarm running water and soap, and clean, single-use hand towels with a sanitary means for disposal. Continuous cloth roll towel systems that provide clean individual sections or hand-drying air blowers are also acceptable alternatives to disposable, single-use hand towels ([29 CFR 1915.88\(e\)\(2\)\(ii\)](#)), and waterless skin-cleansing agents capable of disinfecting the skin or neutralizing the contaminants workers are exposed to are acceptable alternatives to soap and water ([29 CFR 1915.88\(e\)\(2\)\(i\)](#)).

Workers engaged in the application of paints or coatings, or in other operations involving hazardous or toxic substances, must be informed about the importance of washing their hands and faces at the end of the workshift and prior to eating, drinking, or smoking ([29 CFR 1915.88\(e\)\(3\)](#)).



Eating, Drinking, Break Areas, and Waste Disposal

Facilities must have designated areas for the consumption and storing of food, beverages, and tobacco products, where employees are not exposed to hazardous or toxic substances ([29 CFR 1915.88\(h\)](#)). Waste receptacles must be provided both in these areas and work areas, in an appropriate quantity based on size and location to encourage their use ([29 CFR 1915.88\(h\)\(iii\)](#)). Employers must maintain a clean workplace in a manner to prevent vermin infestation ([29 CFR 1915.88\(j\)\(1\)](#)).

Waste receptacles must be constructed of materials that are corrosion-resistant, leak proof, and easily cleaned or disposable, including a solid, tight-fitting cover, unless the receptacle can be kept clean, sanitary, and serviceable without a cover ([29 CFR 1915.88\(i\)\(1\)\(i\) – \(i\)\(1\)\(ii\)](#)). Waste receptacles must be emptied as often as necessary to prevent overflow, and emptied every day for receptacles containing food ([29 CFR 1915.88\(i\)\(1\)\(iv\)](#)).

Potable and Non-Potable Water

Potable water must be supplied in an adequate amount to meet the health and personal needs of each worker ([29 CFR 1915.88\(b\)](#)). Potable water made available to workers for drinking must be provided from a fountain, a covered container with single-use drinking cups stored in a sanitary receptacle, or single-use bottles. Shared drinking cups, dippers, and water bottles are prohibited ([29 CFR 1915.88\(b\)\(3\)](#)). Non-potable water may not be used for human consumption or health and personal needs, and must be clearly marked as such -- "NOT SAFE FOR HEALTH OR PERSONAL USE" ([29 CFR 1915.88\(c\)\(2\)](#)). However, non-potable water is permitted for purposes such as firefighting and cleaning outdoor premises as long as it does not contain chemicals, fecal matter, coliform (intestinal bacteria), or other substances at levels that may create a hazard to workers ([29 CFR 1915.88\(c\)\(1\)](#)).



Areas of Concern – Vermin Control

Vermin are pests or nuisance animals, such as insects, birds, and rodents that may create safety and health hazards for workers. Workers at outdoor worksites, as well as in enclosed spaces, have the potential for exposure to vermin. For example, those working near water are at risk of disease from mosquito populations if they are not adequately controlled. Birds and rodents can also transmit disease directly, as well as through their urine or feces. For information on vermin-related diseases, see <http://www.hhs.gov> and <http://www.cdc.gov>.

While it is not possible to prevent all vermin, especially birds and insects, from entering outdoor worksites, employers must implement and maintain an effective vermin-control program when vermin are detected ([29 CFR 1915.88\(j\)\(2\)](#)). Each control program will differ depending on the facility's needs and the type of vermin affecting the site. However, all programs should include strategies for training workers, sanitation practices, maintenance schedules, pre-approved control methods, and records management.

Training

Employers should train workers on the facility's vermin-control procedures that include sanitation procedures (such as designated eating and food storage areas), detection of vermin, and reporting procedures. Depending on the level of responsibility assigned, the procedures should outline step-by-step strategies for addressing various vermin infestations.

Sanitation

An effective measure for preventing the infestation of vermin is to maintain the facility property and surrounding areas in a clean manner ([29 CFR 1915.88\(j\)\(1\)](#)). In doing so, employers must provide waste receptacles in appropriate quantity and of proper construction ([29 CFR 1915.88\(i\)](#)), and establish a regular schedule for emptying trash. Receptacles designated for containing food must be emptied at least every day unless they are unused ([29 CFR 1915.88\(i\)\(1\)\(iv\)](#)).

Housekeeping

In addition to maintaining worksites in a sanitary condition, it is equally important to keep areas free from excessive clutter or materials. In situations where materials sit for long periods of time, the potential to harbor vermin increases. Excessive clutter not only prevents the early detection of such pests, but in outside areas clutter increases the likelihood of water collecting and becoming stagnant, leading to mosquito infestation.

The elimination of material storage for long durations may be difficult during the construction or repair of vessels, where material and equipment are often ordered in advance. In such cases, the following are recommended for storage:

- Place items on racks, at least 12 inches above the ground.
- Conduct site inspections on a regular basis.
- Stage items in a way that avoids the accumulation of water (e.g., tent or tarp).
- Frequently move equipment and materials as the job progresses (e.g., warehouse, shop, and vessel).

Housekeeping recommendations include:

- Remove scraps before they accumulate. Move these items to a dumpster, trash receptacle, or similar container following the completion of work (for longer jobs, the removal may need to take place after each shift or workday).
- Ensure that electrical boxes or other cabinets containing wiring are properly shut. Doors left ajar may allow water to intrude and vermin to enter these areas.

Vermin Control Methods

Employers should regularly monitor outdoor workspaces and other areas frequented by workers. This can either be performed by a worker designated by the employer or by a hired contractor. The employer and designated inspector should determine the specific areas that will be inspected ahead of time, as well as the frequency that will ensure the prevention of vermin infestation. A site log or other means of recordkeeping is recommended.

Where vermin infestation is detected, employers should select a control method by considering the type of vermin; size of the population; acceptable extermination control measures (pesticides or trapping); appropriate storage, transportation, and application of extermination methods; and disposal of the vermin. If measures such as glue-boards, traps, or pesticides are implemented, placement or application should be posted using a diagram or map. Where an employer makes structural, sanitary, or work procedure modifications to control vermin, these changes should be recorded as well. Further, all vermin sightings, including those reported by workers, should be recorded and thoroughly investigated to determine the severity of the situation.

Areas of Concern – Walkways and Working Surfaces

Approximately 20 percent of non-fatal work injuries in shipyards each year result from slips, trips and falls. However, these incidents can be prevented with the proper safety precautions in place. Under [29 CFR 1915.81](#), OSHA requires all walkways and working surfaces to be free of hazards such as debris, obstructions, and slippery conditions. Slips, trips, and falls can be caused by conditions such as ice, standing water, grease, polished decks, loose boards or uneven walking surfaces, poorly placed electrical cords, and damaged ladder steps. The controls needed to prevent these hazards are usually simple, such as keeping walkways and stairs clear of debris, coiling up extension cords and hoses when not in use, keeping electrical and other wires out of the way, wearing appropriate footwear, and clearing parking areas, stairs, docks and walkways in snowy weather. The sections below give information on walkway and working surface hazard prevention.

Walkways and Working Surfaces

Employers are responsible for establishing and maintaining good housekeeping practices to eliminate hazards to workers ([29 CFR 1915.81\(a\)\(1\)](#)). Good housekeeping practices for walkways and working surfaces that employers must pay particular attention to include:

- Eliminating slippery conditions, such as snow and ice, on walkways and working surfaces. Where employers are unable to remove slippery conditions, two alternatives are appropriate: (1) restricting worker passage or access to safe areas ([29 CFR 1915.81\(a\)\(2\)\(i\)](#)), or (2) providing workers with slip-resistant footwear ([29 CFR 1915.81\(a\)\(2\)\(ii\)](#)).
- Storing materials in a way that will prevent tripping or struck by hazards ([29 CFR 1915.81\(a\)\(3\)](#)).
- Allowing adequate access to emergency notification devices, firefighting equipment, and exits (e.g., ladders, staircases, scaffolds, and gangways) ([29 CFR 1915.81\(a\)\(4\)](#)), as well as providing walkways that are free from tools, debris, and electrical cables or hoses obstructing safe passage ([29 CFR 1915.81\(b\)\(1\)](#)).
- Preventing or immediately responding to processes that create wet conditions (e.g., standing water) for workers. Employers must maintain dry standing places for workers through drainage, false floors, mats, or other protective measures, or provide workers with protective footwear where dry conditions are not possible to maintain ([29 CFR 1915.81\(c\)\(3\)](#)); and
- Making sure that workers have sufficient planking for safe footing while work is being performed in a boiler ([29 CFR 1915.77\(b\)](#)).

Ladders

Ladders are often used by workers in ship repair and shipbuilding operations, as there is usually limited permanent access available for access to work areas. The frequent inspection of ladders is necessary to identify any that are damaged, need repair, or require disposal. Employers must:

- Immediately remove ladders with defects from service. This includes broken or missing rungs or steps, broken or split side rails, corroded parts, or improper construction ([29 CFR 1915.72\(a\)\(1\)](#)).
- Ensure that portable ladders are lashed, blocked, or otherwise secured to prevent displacement during use ([29 CFR 1915.72\(a\)\(3\)](#)).
- Verify that any ladder repairs have been done in accordance with [29 CFR 1915.72](#).

- Ensure that any sections of ladders spliced were placed with ends abutted, and no fewer than two cleats securely nailed or bolted to each rail ([29 CFR 1915.72\(a\)\(2\)](#)).
- Barricade gratings, walkways, and catwalks where sections or access ladders have been removed ([29 CFR 1915.73\(g\)](#)).

Guarding Deck Openings and Edges

In shipyard employment, workers may be exposed to deck openings and unguarded edges during the construction and repair of vessels. Employers must protect workers from falls from unguarded openings and edges. The following measures, as required in ([29 CFR 1915.73](#)), can help to protect workers:

- Flush manholes or other small openings must be covered or guardrails installed at least to a height of 30 inches.
- Coamings at least 24 inches high must be present around open hatches or other large openings; otherwise, guardrails must be installed that reach a height of 36 - 42 inches.
- Unguarded edges of decks, platforms, and other flat surfaces that are more than 5 feet above a lower level must have guardrails containing a top rail height of 42 - 45 inches, unless the use of such guardrails is impracticable as a result of the nature of the work or physical conditions of the work location. Where workers are working on vessels afloat with edges of decks left unguarded, employers must ensure workers wear a personal flotation device to protect them if they fall into the water.

Stairways

Stairs brought in and installed for worker access to the vessel or within the vessel during construction, repair or overhaul must comply with the provisions specified in [29 CFR Part 1910](#):

- Fixed stairs must be provided for access from one structure level to another where operations require regular travel between levels, including access to operating platforms for any equipment that requires routine attention during operations.
- Any fixed stairway must be designed and installed to carry a load of five times the normal live load anticipated or at least 1,000 pounds, whichever is greater.
- Stair treads and nosings must be reasonably slip resistant.
- Railings must be installed at all stairway and platform locations where open sides are present. Closed stairways require a handrail on at least one side, preferably on the right side, in a descending direction.

Areas of Concern – Lighting

Slips, trips and falls, electric shock and burns, or the inability to exit a space are examples of the hazards created or made worse by improper lighting. Well-lit workplaces, whether on vessels, vessel sections, or at landside areas, are essential to prevent such incidents.

Employers must provide adequate lighting for workers to safely walk in walkways and work areas, and while performing their assigned tasks ([29 CFR 1915.82\(a\)\(1\)](#)). For walkways, accessways, stairs, gangways, and exits aboard vessels or vessel sections, 3 lumens are required, while work areas must have 5 lumens on any vessel or vessel section. In general landside areas, such as walkways, 5 lumens are required, 10 lumens are required for landside work areas (such as workshops, equipment rooms, and outdoor work areas) ([29 CFR 1915.82\(a\)\(2\)](#)).

The table below outlines the minimum lighting requirements for each area and walkway to allow workers to safely perform their assigned tasks and transit between job sites ([29 CFR 1915.82](#)).

Minimum Required Lighting Levels*				
Lumens (foot-candles)	3	5	10	30
Areas of Operation	General areas on vessels and vessel sections such as: <ul style="list-style-type: none"> • accessways • exits • gangways • stairs • walkways 	General landside areas such as: <ul style="list-style-type: none"> • corridors • exits • stairs • walkways 	Landside work areas such as: <ul style="list-style-type: none"> • machine shops • electrical equipment rooms • carpenter shops • lofts • tool rooms • warehouses • outdoor work areas 	First-aid stations
		Landside tunnels, shafts, vaults, pumping stations, and underground work areas		
				All assigned work areas on any vessel or vessel section

*This table does not apply to emergency or portable lights.

Where required lighting levels cannot be achieved from permanent lighting sources, temporary lighting may be used in combination with permanent lighting to achieve the minimum required lighting levels ([29 CFR 1915.82\(a\)\(4\)](#)). Neither matches nor open-flame devices are permitted for lighting purposes ([29 CFR 1915.82\(a\)\(5\)](#)).

Temporary Lighting

To adequately protect workers, employers must ensure temporary lighting is:

- Guarded when bulbs are not completely recessed to prevent workers from coming into contact with a hot bulb ([29 CFR 1915.82\(b\)\(1\)](#)).
- Equipped with electrical cords designed with sufficient capacity to safely carry the electric load, protecting workers from electric shock and fire hazards ([29 CFR 1915.82\(b\)\(2\)](#)).
- Kept in a safe working condition, maintaining electrical cord connections and insulation that are free from being broken, cracked or otherwise damaged ([29 CFR 1915.82\(b\)\(3\)](#)).
- Not suspended unless designed by the manufacturer to be suspended in this way ([29 CFR 1915.82\(b\)\(4\)](#)). Cords can become frayed or broken if used to suspend lights or lighting stringers when they are not designed to be used in this manner.
- Protected from possible electrical and fire hazards associated with circuit overloading. Branch circuits must be equipped with overcurrent protection to prevent exceeding the rated current-carrying capacity of the cord ([29 CFR 1915.82\(b\)\(5\) and \(6\)](#)).
- Used with cord splicing only where the insulation on the splice exceeds the capacity of the original insulation ([29 CFR 1915.82\(b\)\(7\)](#)). This will help prevent worker injury and ignition of combustible materials should a surplus of energy or a “hot spot” occur at the splice junction.
- Grounded, either through a third wire in the cord or a separate wire, when non-current-carrying metal parts are exposed. Grounding must be done in accord with 29 CFR Part 1910, Subpart S ([29 CFR 1915.82\(b\)\(8\)](#)).

Some facilities use temporary lighting as a power supply for portable electric tools. In such cases, measures should be taken to ensure that the tools do not overload the circuit, which could activate the over-current protection device (tripping the breaker or blowing the fuse). This would result in the loss of adequate illumination in the area and create unsafe working conditions. In some cases fire, electric shock or electrocution can result if protective measures, such as over-current protection devices, malfunction or are not in place.

Emergency or Portable Lighting

Emergency or portable lights are different from temporary lighting and should not be used to meet the minimum required lighting levels. They are only intended for short-term use, such as evacuating a space, and are prohibited from being used to perform work tasks unless it is in addition to the already existing lighting ([29 CFR 1915.82\(c\)](#)). Examples of emergency or portable lighting may include flashlights, head lamps, glow sticks, and clamp or magnetic portable lights.

Employers must equip workers with emergency or portable lights when:

- Entering dark areas where permanent or temporary lights are not available.

- Lighting is not readily accessible or working.
- The only means of illumination are lighting sources not part of the vessel or vessel section.
- Natural sunlight provides insufficient illumination.

Explosion-proof, Self-contained Lighting

In any area where the atmosphere contains a concentration of flammable vapors that are at or above 10 percent of the lower explosive limit (LEL), explosion-proof, self-contained temporary and portable lights must be used. All explosion-proof, self-contained temporary and portable lights must be approved by a nationally recognized testing laboratory (NRTL) ([29 CFR 1915.82\(d\)](#)).

For more information on safe lighting practices:

OSHA Fact Sheet -- [Safe Lighting Practices in the Shipyard Industry](#)
(www.osha.gov/Publications/osha3677.pdf)

Shipyard Employment eTool -- [Lighting](#)
(www.osha.gov/SLTC/etools/shipyard/standard/working_conditions/lighting.html)

Areas of Concern – Hazardous Waste and Emergency Response

OSHA's requirements concerning worker protection in the control of spills are primarily found in two standards. The provisions in [29 CFR 1910.120](#) address hazardous waste operations and emergency response while on vessels and on shore. In addition, the requirements for emergency action plans are addressed in [29 CFR 1910.38](#). However, these provisions apply only on shore and do not include work aboard vessels or vessel sections.

Employers engaged in emergency response must develop and implement an emergency response plan to manage anticipated emergencies associated with hazardous substance releases ([29 CFR 1910.120\(q\)](#)). The plan must be in writing and must be made available for inspection or copying ([29 CFR 1910.120\(q\)\(1\)](#)). Included in this plan should be procedures for the control of spills (a spill response plan). An effective spill response plan considers many factors, such as the physical characteristics and volume of materials being handled, their potential for toxic exposure, and their potential for release.

A Spill Response Plan should include:

- Names and telephone numbers of individuals to be contacted in the event of a spill.
- Evacuation plans.
- Instructions for containing the spilled material, including potential releases to the environment.
- Inventory of spill control materials and personal protective equipment (PPE).
- Means for proper disposal of cleanup materials including contaminated tools and clothing.
- Decontamination of the area following the cleanup if needed.

In the event of a chemical spill, employers must provide the appropriate PPE for the hazards to be encountered ([29 CFR 1910.120\(q\)\(3\)\(iii\)](#)). Such hazards must be identified, to the extent possible, before exposure occurs ([29 CFR 1910.120\(q\)\(3\)\(ii\)](#)). Here are general guidelines to be followed for a chemical spill:

1. **Assess the Risk.** Immediately alert area occupants and the supervisor, and evacuate the area if necessary.
2. **Protect Yourself.** If there is a fire or medical attention is needed, contact Public Safety (call 911).
3. **Stop the Source/ Confine the Spill.** If a volatile, flammable material is spilled, immediately warn everyone, control sources of ignition, and ventilate the area. Prevent any release into the environment. Spill socks and absorbents may be placed around drains.
4. **Help Others.** Attend to any personnel who may be contaminated.
5. **Clean Up.** Don PPE, as appropriate to the hazards. Decontaminate the surface where the spill occurred when appropriate.
6. **Report.** Notify the proper authorities of the spill and of actions taken.

Training is required for all personnel who work directly with chemicals and who are expected to respond outside their work area to assist with spill cleanup. The extent of training must be based on the duties and role

of each worker involved in responding ([29 CFR 1910.120\(q\)\(6\)](#)). For shore-side facilities, employers must review the emergency response plan with each worker (1) when the plan is first developed, (2) upon initial assignment of a worker to a particular job covered by the plan; (3) when the worker's responsibilities under the plan change; and (4) when the plan is changed ([29 CFR 1910.38\(f\)](#)).

Know what the chemical is and its hazards through the Safety Data Sheet (SDS)

It is important that employers review the material's Safety Data Sheet (SDS) or other references for recommended spill cleanup methods and materials, and the need for PPE. Information on hazardous chemicals used in the workplace must be shared with workers ([29 CFR 1910.1200\(h\)\(1\)](#)). Site-specific factors of significance include:

- The chemical, physical, and toxicological properties of the wastes.
- The pathogenicity of infectious wastes.
- The amount, location, and containment of contaminants.
- The potential for, and location of, exposure based on assigned worker duties, activities, and functions.
- The potential for wastes to permeate, degrade, or penetrate materials used for personal protective clothing and equipment, vehicles, tools, buildings, and structures.
- The proximity of incompatible wastes.
- The movement of personnel and equipment through different zones.
- Emergency procedures.
- The methods available for protecting workers during decontamination.
- The impact of the decontamination process and compounds on worker safety and health.

Employers should make sure that the proper spill control materials and PPE are available in the event of an emergency. Spill kits may include:

- PPE such as chemical splash goggles, gloves, shoe covers, plastic or Tyvek[®] aprons and/or Tyvek[®] suits ([29 CFR 1910.120\(g\)\(3\) through \(g\)\(5\)](#)).
- Absorption materials that include spill pillows, spill socks, pails, polyethylene liners, and loose absorbents.
- Clean-up tools such as a polypropylene scoop or dust pans, polypropylene bags, sealing tape, pH test papers, waste stickers, and DANGER signs.

Areas of Concern – Material Storage

The improper storage of materials can lead to worker injuries through the blockage of access and egress points, falling objects, and trip hazards. Employers are responsible for the safe storage of materials so that they do not create a hazard for workers ([29 CFR 1915.81\(a\)\(3\)](#)). Materials such as bags, containers, and bundles must be stacked, blocked, interlocked and limited in height to prevent sliding or collapse ([29 CFR 1910.176\(b\)](#)). Also, storage areas should be kept free from accumulated materials that may cause trip hazards, fires or explosions, or that may contribute to the infestation of vermin (such as insects, birds, and rodents). This is especially true near walkways and working surfaces frequented by workers (see [29 CFR 1915.81\(a\)\(2\) through \(a\)\(5\)](#), [\(b\)](#), [\(c\)](#) and [29 CFR 1915.88\(j\)](#)).

It is paramount that employers train workers to recognize hazards associated with the storing of different materials in the workplace. Training should also cover the appropriate height and weight of stored materials, the safe configuration of material storage (i.e., stacked or piled), the accessibility to the materials being stored, and the importance of continued accessibility to entrances, exits, and emergency equipment (see [29 CFR 1915.81\(a\)\(4\)](#)).

Any flammable liquid must be stored in tanks or closed containers ([29 CFR 1910.106\(e\)\(2\)\(ii\)](#)). While containers usually must be made of metal, glass or plastic containers may be used where the content may lead to the degradation of the metal and certain other requirements are met ([29 CFR 1910.106\(d\)\(2\)\(i\)](#)).

Flammable liquids must be stored in a storage room or cabinet meeting OSHA standards (see [29 CFR 1910.106\(d\)\(3\) and \(4\)](#)). However, a small amount may be kept outside designated storage areas ([29 CFR 1910.106\(e\)\(2\)\(ii\)\(b\)](#)):

- 25 gallons of Category 1 flammable liquids in containers.
- 120 gallons of Category 2, 3, or 4 flammable liquids in containers.
- 660 gallons of Category 2, 3, or 4 flammable liquids in a single portable tank.

Where limited storage space is available, containers of flammable liquids may be piled one upon the other, so long as they are separated by dunnage (such as pieces of wood, matting, or similar material) sufficient to provide stability and to prevent excessive stress on container walls. The height of the pile must be consistent with the stability and strength of the containers ([29 CFR 1910.106\(f\)\(1\)\(iii\)](#)).

Case History



Figure 1: Burnt out wreck of a fishing vessel (view from port side)



Figure 2: Burnt out wreck of a fishing vessel (looking aft)

Approximately 20 minutes after a fishing vessel steamed out of harbor, containing 40 lobster creels and 1 mile of back rope on deck, the crew was forced to abandon ship. Also onboard were 800 liters combined of diesel, hydraulic, and lubricating oils.

While sailing, the crew heard a change in engine pitch, as if a cylinder had stopped firing. However, they were unable to verify this because the only access hatch to the engine room was blocked by several of the heavy creels they had on board. The crew had two options available: (1) shoot all the pots and clear the access, or (2) return to port. They decided on the latter. Turning back for port would give them a chance to make harbor before the tide turned.

As the engine ran at full power, smoke began to fill the wheelhouse. The skipper decided to ground the boat on a nearby sandbank and evacuate the crew. Within minutes of grounding the vessel and deploying the life boat to abandon ship, the wheelhouse became engulfed in flames. The vessel's engine continued to race, despite it being brought to "all stop," which fueled the rapid burning of the vessel.

Analysis and Preventive Measures

Fortunately none of the crew were harmed; however, the costly damage to the vessel could have been avoided had the engine access not been blocked. If the crew was able to enter the engine room, it would have been immediately apparent that fuel was spraying in the space. The crew could have then taken immediate steps to stop the leak and make repairs, preventing the engine from racing when brought to "all stop" as ordered at the engine control. When the air inlet to the engine is contaminated with fuel, it can continue to provide an air-fuel mixture to the engine, allowing continued support of combustion.

Other precautions that may have helped to limit the severity of the incident include: the creation of an alternative access point to the engine room (e.g., wheelhouse), installation of audible smoke detectors, regular maintenance (e.g., check and tighten fuel pipes and their fittings), and use of a diesel engine safety shutdown (air intake shutdown).

Reference: [Marine Accident Investigation Branch \(MAIB, Safety Digest, Lessons from Marine Accident Reports – 2/2014.](#)

Case History



A welder and a pipefitter were working in the fan room of a vessel under construction when a container of paint thinner ignited.

While the welder was crawling into the fan room to begin work, his welding torch rod came into contact with the container of paint thinner and it exploded. It was determined that the container of thinner had been left open overnight.

Both workers suffered severe burns as a result of this incident.

Analysis and Preventive Measures



Flammable materials stored in fire-resistant containers.

Good housekeeping could have protected both the welder and the pipefitter from injury. The container of paint thinner never should have been left out overnight. The employer is responsible for ensuring the safe storage of materials so that they do not create a hazard for workers. Had the following precautions been taken, the incident could have been prevented.

The employer should have:

- Enforced the proper storage of flammable liquids in tanks or closed containers;
- Trained workers to identify potential hazards that can occur in the workplace due to stored materials; and
- Inspected the workspace, at the start and completion of work.

Case History

A painter was working aboard a fishing vessel, preparing a crab hold for painting. After sandblasting the hold, he sprayed approximately 3 - 5 gallons of acetone on all surfaces of the confined space. This was done to settle the dust created from the sandblasting operation, as well as to help dry its surface more quickly. The worker then placed a fan at the opening of the hold to blow air into the space. The fan, which had no exhaust duct affixed, ran for about one hour, at which point the worker entered the space to begin vacuuming up the sandblasted material.

As the worker turned on the shop vacuum, the acetone vapors in the space ignited, resulting in a fire and ultimately an explosion. The worker, who was wearing polyester coveralls, received third-degree burns over 90 percent of his body and later died.

Analysis and Preventive Measures



No matter what type of media is used, sandblasting is a messy job. However, there are safer methods than the spraying of acetone to contain the dust created. The employer should have ensured that the appropriate exhaust ventilation was used while the sandblasting was taking place.

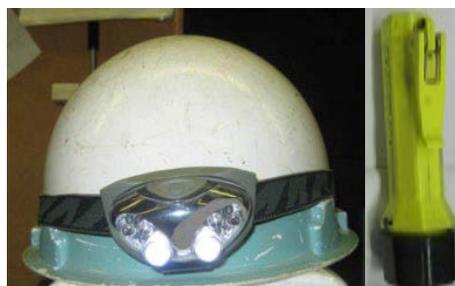
Atmospheric monitoring by a competent person was necessary to determine if a toxic and/or explosive atmosphere existed ([29 CFR 1915.13\(b\)\(2\)](#)). This would have indicated that further ventilation was necessary before the worker could enter the space, or that respiratory protection was necessary to eliminate exposure to toxic vapors. Also, only “intrinsically safe” or “explosion-proof type” motors are permitted in spaces where highly toxic, flammable and explosive solvents are present and contain a LEL greater than 10% ([29 CFR 1915.13\(b\)\(9\)](#) and [1915.36\(a\)\(4\)](#)). Any fans used in such environments must have non-sparking blades, and portable air ducts made up of non-sparking materials ([29 CFR 1915.13\(b\)\(12\)](#)).

Case History

A worker was performing general pipefitting activities inside the holds of a vessel in dry dock. The vessel had been converted from a cargo carrier to a container ship, requiring the previously guarded walkway to be dismantled to allow containers to fit in this area. The area he was working in had very little light and although he had a flashlight, it was not being used. Instead, he was following the light shining from beneath the doorway that led to cargo hold #2. The lighting was so poor that he did not see that the path he was following had an unguarded open-sided floor. As the worker was crossing from cargo hold #1 to cargo hold #2 to install lighting, he fell 19.5 feet to his death.

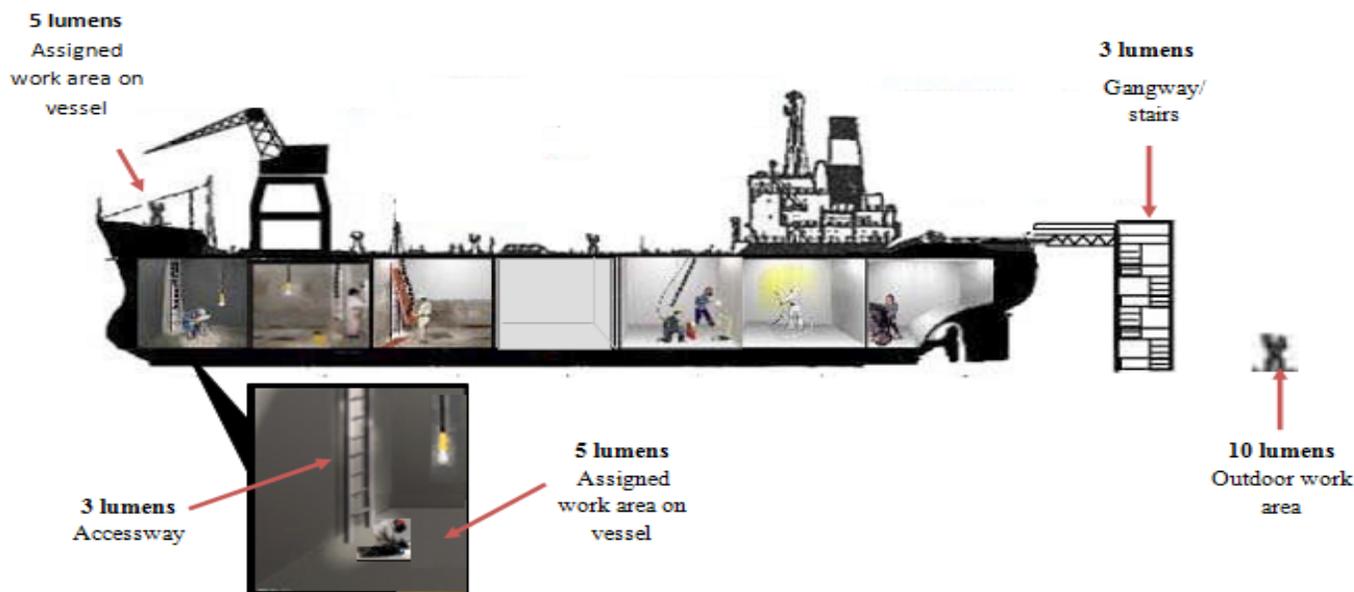


Magnetic portable light



Portable lights (head lamp and flashlight)

Analysis and Preventive Measures



Well-lit workplaces are essential to prevent incidents such as the one described above. Although the worker had a flashlight, he was not trained to use it when the lighting was inadequate. The employer should have trained workers on the importance of using temporary lighting (such as the flashlight) when the vessel's lighting was inadequate. Furthermore, the employer should have conducted a hazard assessment of the workplace before anyone was permitted to enter the holds. An assessment would have indicated that temporary lighting was necessary for the safe work and transit of workers while installing lighting fixtures.

Where the minimum required lighting levels designated in [29 CFR 1915.82](#) cannot be met by permanent lighting, temporary lighting may be used in combination with permanent lighting to achieve the minimum required lighting levels ([29 CFR 1915.82\(a\)\(4\)](#)). This precaution would have prevented the worker's death by allowing him to see that it was not safe to walk where the path was unguarded.

SAMPLE -- Housekeeping Checklist*

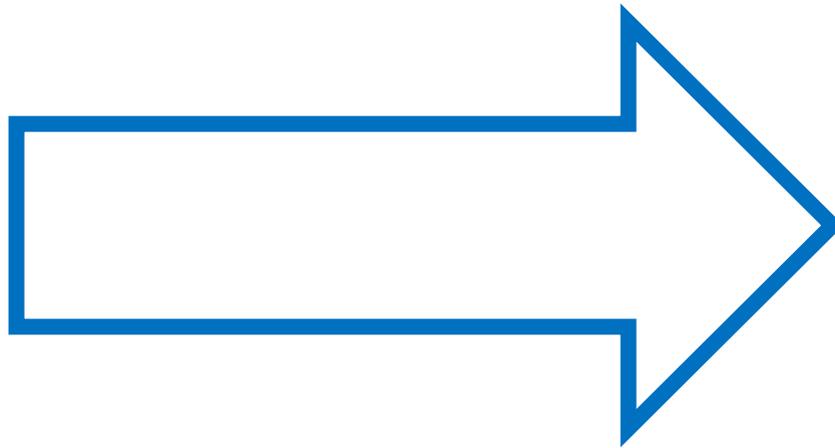
Vessel:	Area:	Date:
Responsible Area Inspector/Supervisor/Superintendent:		
<u>Area of Responsibility</u>		
<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Dust and Dirt Removal</i>
		Is there a program in place and followed that prevents the accumulation of dust on floors, decks, and ledges, particularly outside of abrasive-blasting enclosures?
		Is sufficient ventilation in place to (1) provide good operator visibility, (2) prevent dust from settling and accumulating in the room, (3) reduce dust concentrations, and (4) prevent the escape of contaminants into adjacent work areas or the environment?
		Are dust residues cleaned at regular intervals and in areas that may be normally overlooked (e.g., overhead)?
		Are cleaning methods in place to minimize dust clouds, particularly where ignition sources are present?
		Are vacuum cleaners approved for dust collection onsite and used?
<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Sanitation Facilities</i>
		Is potable water made available to workers for drinking, cooking, food preparation, worker health and personal needs?
		Are non-potable water outlets clearly marked “ NOT SAFE FOR HEALTH OR PERSONAL USE ”?
		Are toilets clean, serviceable, and adequate in number at the worksite?
		Are handwashing facilities adjacent to each toilet facility and do they contain: <i>hot and cold or lukewarm running water and soap, or waterless skin-cleansing agents; clean, single-use hand towels stored in a sanitary container, clean individual sections of continuous cloth toweling, or air blowers; and a sanitary means for disposing of single-use hand towels?</i>
		Is there a schedule for servicing, cleaning, and supplying each facility in place?
		Where a servicing, cleaning, and supplying schedule is in place, is it being followed?
		Are changing rooms available for workers to change into and from protective clothing to prevent contamination from hazardous or toxic substances?
		Do changing rooms provide privacy for each gender?
		Do changing rooms provide separate storage facilities for street clothes?
		Do changing rooms provide separate storage for protective clothing?
		Are designated areas provided for the consumption or storing of food, beverages, and tobacco products? Are these areas free from exposure to toxic substances?

*The information contained in this sample housekeeping checklist reflects safety requirements for shipyard facilities and work activities performed in shipyards. However, for more detailed information, employers should refer to applicable provisions under Title 29 of the OSHA standards (also listed on page F-4 of this document).

<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Vermin Control</i>
		Is there a vermin control program in place that is maintained?
		Is the work area constructed, equipped, and maintained to prevent the entrance or harborage of rodents, insects, and other vermin?
<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Walkways and Working Surfaces</i>
		Are walkways and working surfaces clean and clear of debris?
		Are working surfaces kept dry, or are other protective measures in place that include drainage, false floors, platforms, mats, and designated dry standing areas?
		Are slippery conditions, such as snow and ice, eliminated in designated walkways and working surfaces?
		Are obstructions, such as nails, splinters, holes or loose boards eliminated from walkways and working surfaces?
		Are tools, materials, equipment, and other objects used during servicing or maintenance kept clear of walkways to allow for adequate passage?
		Are hoses and electrical service cords positioned to prevent injury to workers or damage to the hoses and cords themselves (e.g., crossover planks, beneath grating, stowed overhead)?
		Are exit routes clearly marked "Exit," as well as indicating the direction of travel to the exit, if not immediately apparent?
		Are doorways, emergency exits, fire protection equipment, electrical panels, eyewash stations, and safety showers free from obstructions?
		Are passageways, walkways, and working surfaces kept clear of steel shot or similar abrasives that may create a slipping hazard?
<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Lighting</i>
		Are lighting fixtures in good working order?
		Are lighting fixtures clean, allowing for optimal lighting levels?
		Are exit routes, accessways, gangways, stairs, work areas and walkways sufficiently lit in accord with 29 CFR 1915.82 ?
		Are workers provided with a flashlight or other portable light provided nearby before entering dark holds, compartments, decks, or other spaces?
<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Control of Spills</i>
		Is machinery and equipment clean and maintained regularly?
		Are drip pans and guards in place to catch possible spills?

<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Storage and Maintenance of Tools and Equipment</i>
		Are tools inspected, cleaned and repaired regularly?
		Are damaged or worn tools removed from service?
		Are all fire extinguishers, electrical panels, eyewash stations, and safety showers inspected and tested routinely and kept in working order?
<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Waste Disposal</i>
		Are there enough garbage cans in designated break areas and other locations where trash may accumulate? Are they big enough for the volume of waste?
		Are garbage cans constructed of noncorrosive, leak-proof, and easy to clean material, or are they disposable?
		Is there a schedule in place and followed for emptying garbage cans to prevent overfilling?
		Are garbage cans intended for disposing of food emptied daily and outfitted with solid tight-fitting covers?
<u>Satisfactory</u>	<u>Unsatisfactory</u>	<i>Material Handling and Storage</i>
		Are flammable and combustible substances, such as paint thinners, solvents, rags, scrap, and waste, being disposed of or stored in covered, fire-resistant containers at the end of each work shift, or when the job is completed, whichever occurs first?
		Has gear and equipment, used for materials handling and rigging, been inspected for safety before each shift and at intervals throughout the shift? Is defective gear or equipment replaced or repaired?
		Are appropriate danger or caution signs in place to notify workers of possible hazards?
		Are materials stored in their designated place and stacked to avoid fall or collapse?

MINI-POSTERS



SHIP SHAPE?



Everything in its place keeps you safe!

- Materials stored in their place**
- Tools (machinery, equipment, or systems) cleaned and stored properly**
- Waste placed in the correct bins/containers**
- Lighting maintained**
- Regular and routine cleaning of sanitation facilities**

PICKING UP EACH DAY KEEPS THE DOC AWAY

*Don't be the victim of bad housekeeping!
Use safe housekeeping practices to avoid . . .*

- Trips or falls over lines and leads in walkways and work areas
- Slips or falls on oily, wet, or ice/snow covered floors, vessel decks or other walkways and working surfaces
- Falls from a dock or vessel, presenting a drowning hazard
- Eye injuries from falling grit left in the overhead of a work site
- Fires due to oily rags left where hot work is performed
- Illness from unsanitary working conditions
- Electrical shock as a result of poorly maintained equipment or energy sources
- Lacerations and amputations when inadequate light is used
- Exposure to hazardous substances as a result of poor storage, ineffective labeling, or spills