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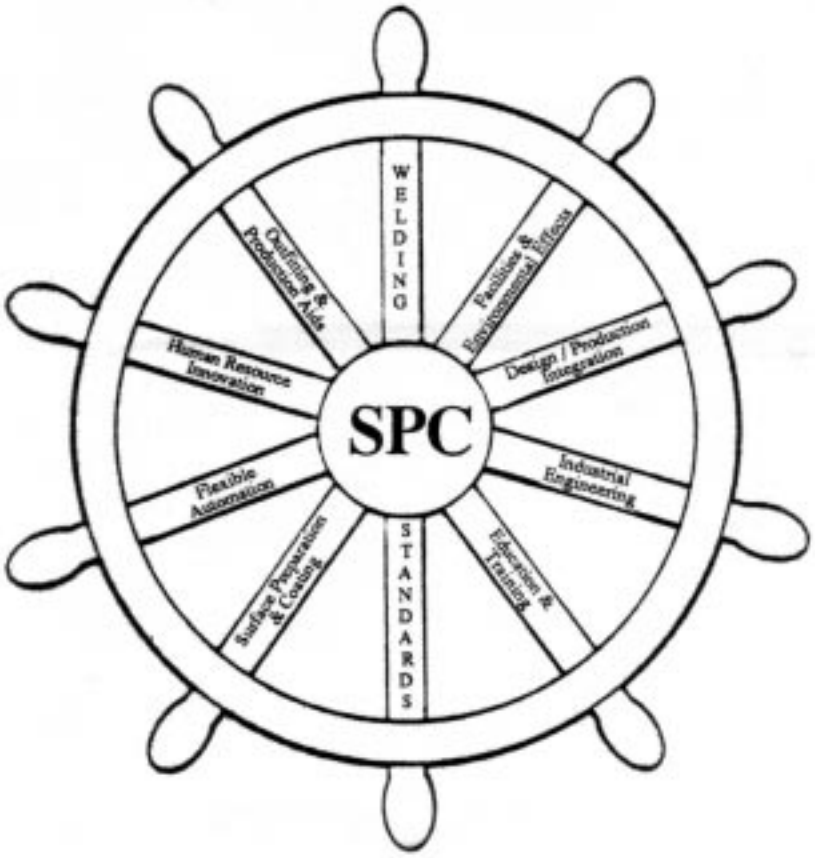


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# Managing the Environmental/Health/Safety Risks at a Major Shipyard

IB-2

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*ABSTRACT*

The complexity of shipyard operations, in combination with the diverse and numerous hazardous materials used in manufacturing and repair, present unique environmental, health and safety challenges. One shipyard has taken a proactive approach to hazard identification, assessment and control in order to effectively manage these risks. This included a major risk screening, consequence modeling of the scenarios developed and the generation of practical risk control options. Such action facilitated the development of a comprehensive, multi-disciplinary emergency response plan as well as compliance with regulations promulgated as the result of the Superfund Amendments and Reauthorization Act of 1986.

## Introduction

The complexity of shipyard operations, in combination with the diverse and numerous hazardous materials used in manufacturing and repair, present unique environmental, health and safety challenges. Whether it be fabrication or repair or vessels with steel, fiberglass or wooden construction, there are inherent risks that may have the potential for significant on-site and off-site impact. For example, consider the drum storage of solvents, bulk propane stored in Lullets, cylinder storage of acetylene, or the tank storage of gasoline. While these installations are typical of shipyard operations, all present the potential for significant environmental/health/ safety risks when considering the consequences of major accidents. A proactive approach to hazard identification, assessment and control is recommended in order to effectively manage these and the other risks found in shipyards worldwide.

## The Need for State-of-the-Art RISK Management

There is a well-defined need for state-of-the-art risk management at shipyards as evidenced by the risks inherent in their operations and new regulations pertaining to hazardous materials and emergency response. The latter includes The Superfund Amendments and Reauthorization Act of 1986 (SARA). Section 303 of this document presents the need for a facility response plan which addresses the risks and appropriate response measures for releases of extremely hazardous substances. In Section 126, the Occupational Safety and Health Administration (OSHA) was required to issue a standard which would protect those workers engaged in hazardous waste operations and emergency response. The regulations promulgated called for the development of a hazardous waste operations health and safety program and the development of an emergency response plan.

An approach to effective technological risk management can involve the following steps as presented in Figure 1:

*Hazard Identification:* the systematic identification of property, casualty, or liability hazards that may result from corporate operations and product use;

*Risk Screening:* the ranking or ordering of identified hazards according to their relative degree of risk, so that risk management resources can be invested where the need is the greatest;

*Risk Estimation* : for those risks deemed sufficiently important, the estimation of both the expected frequency of adverse events and the magnitude of losses that might result;

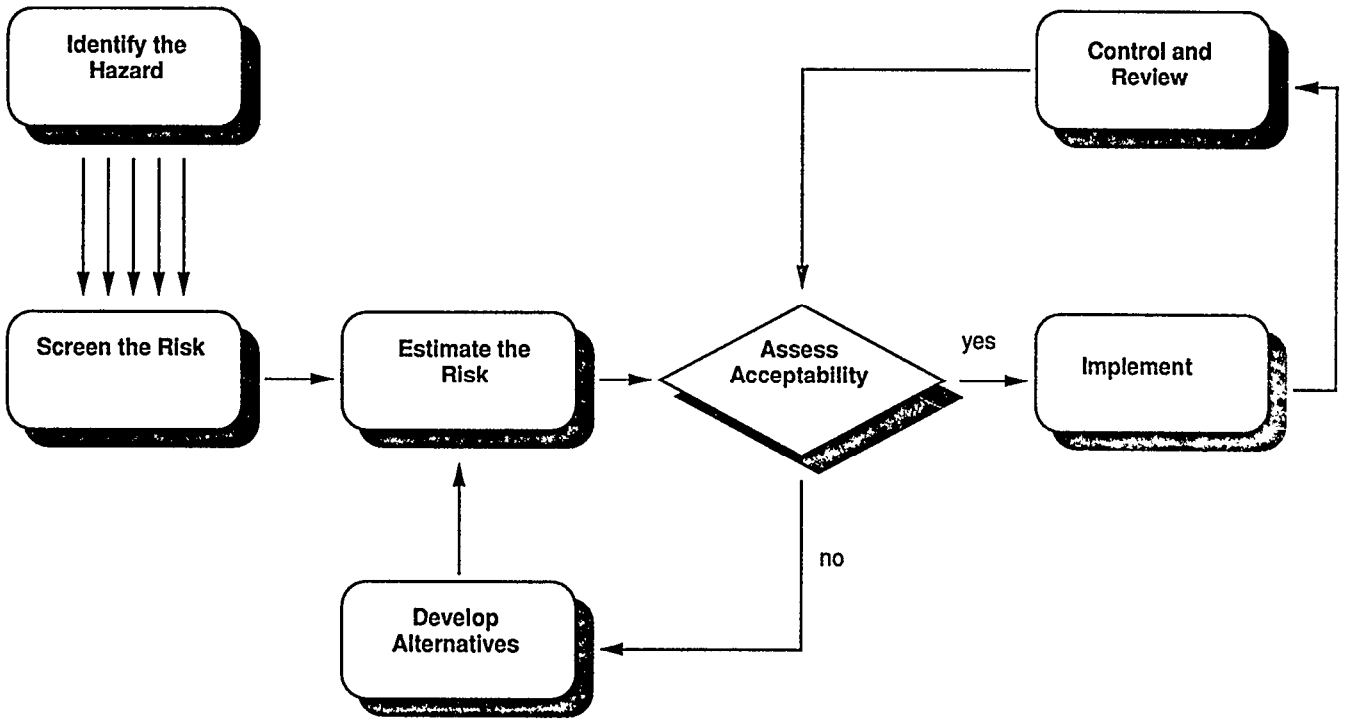


FIGURE 1
PROCESS FOR MANAGING RISKS

*Acceptability Assessment:* the evaluation of risks that have been identified and estimated in the previous steps to determine whether these risks can be tolerated;

*Development of Alternatives:* the selection of cost-effective actions for reducing or mitigating unacceptable risks, including technological and management controls; and

*Implementation, Control, and Review :* implementation of necessary mitigation measures to control risk to acceptable levels and periodic monitoring and review of risks.

This approach can be adapted as a function of the shipyard or facility, its anticipated risks and a need to comply with specific regulations.

## Hazard Identification and Risk Screening

Considering the need for shipyards to comply with the Superfund Amendments and Reauthorization Act of 1986 regulations, hazards must be identified and screened as a function of potential risk. This can be done in two separate but related efforts. The first involves the field application of process hazard, safety management and fire protection and emergency response protocols to develop a list of "most likely" and "worst case" release scenarios or events that would have potential for major impact on human life, and/or company assets. These scenarios can then be further examined to set the stage for appropriate emergency response measures for releases of extremely hazardous substances as mandated in Section 303.

The second, related effort in response to the Occupational Safety and Health Administration regulations involves hazardous waste site characterization with associated hazard identification and evaluation. After review of applicable site information, e.g., site plans, material safety data sheets. materials inventory, waste manifests, etc., established protocols can then be used when conducting a thorough inspection of hazardous waste operations. In addition to identifying and evaluating potential chemical, physical, biological and ergonomic hazards, this should also include an evaluation of safety inspection procedures, industrial hygiene monitoring, personal protective equipment programs, the Worker Right-to-Know program, employee training, medical surveillance, equipment safety programs and waste handling areas.

## Consequence Modeling

Having identified a list of "most likely" and "worst case" scenarios, risk assessment efforts can then be conducted to better understand the magnitude of losses that might result. If one considers the potential risks associated with releases of propane, oxygen, acetylene, gasoline, ammonia, methyl-ethylketone and solvents, use of the following hazard assessment models is appropriate:

- thermal radiation hazards from pool fires;
- unsteady state thermal radiation hazards from a boiling liquid expanding vapor explosions (BLEVEs);
- flammable vapor dispersion hazards;
- toxic vapor dispersion hazards; and
- explosion overpressure hazards.

Use of these models results in the characterization of potential events and the estimation of the area or population affected by the release, assuming no mitigation. This is a critical component of the emergency response plan called for in Section 303 of Superfund Amendments and Reauthorization Act of 1986.

## Generation of Risk Control Options

The natural byproduct of the hazard identification and risk assessment efforts is the generation of risk control options. Considering the major hazards identified and the occupational safety and health characterization of the waste site, there would be risk control options generated as related to each effort. For example, propane tanks should have a safe separation distance from buildings and property lines. Ignition source control measures should also be taken in the vicinity of the storage and transfer areas. Considering the more straight-forward fire risks, there should be hydraulic calculations readily available to facilitate determination of the adequacy of the fire protection water supply in terms of design density, i.e. gallons per minute/square foot over an operating area. Related environmental risk control options could include the need for proper containment of releases and spills.

Adequate diking and drainage is key to minimizing potential environmental damage and complying with the Clean Water Act.

Considering the occupational safety and health characterization of the hazardous waste site, a potential recommendation could involve the need for an on-site source of breathing air to refill self-contained breathing apparatus. Perhaps there is a need for dike repair or improvement. A frequent area for programmatic improvement is the periodic need for hazardous material awareness training.

**Development of a Comprehensive Emergency Response Plan**

Having identified and assessed the potential risks and mitigated them to the extent possible through the implementation of risk control options, efforts should then be directed towards the development or enhancement of a comprehensive emergency. response plan. Included in this document should be the following:

- introduction, e.g., purpose/ scope, revision policy, distribution list;
- program description, e.g., organizational structure and chain of command, site description;
- pre-emergency planning, e.g., coordination with public authorities and private contractors;
- hazard analysis/hazard characterization, e.g., events identified, listing of wastes;
- hazard communication program, e.g., chemical inventory, material safety data sheets;
- communication and notification, e.g., internal, external;
- site control/security, e.g., facility access, guard coverage;
- evacuation routes and procedures, e.g., notification, means of egress, drills;
- emergency response equipment, e.g., types and quantities, supplies;
- personnel and area air monitoring, e.g., equipment, procedures, frequency;
- hazardous material/waste containment, control and cleanup, e.g., methods and techniques, land or water;
- personal protective and safety equipment, e.g., levels of protection, selection and types, use and limitations;
- decontamination program, e.g., work zones, procedures, equipment;
- medical surveillance/ medical emergencies, e.g., frequency and types of examinations, internal and external emergency medical services;
- training, e.g., content of OSHA and RCRA programs, frequency, trainers;
- post emergency response operations, e.g., on-site, off-site, damage assessment, restoration of the environment, waste disposal;
- public relations, e.g., authorized spokesperson, media contact list, "press kits;"
- new technology program, e.g., roles and responsibilities, program contents;
- quality assurance program,e.g., preventive maintenance, drills, audit program;
- hazardous material data sources, e.g., library, other sources; and
- appendix, e.g., detailed hazard analyses, impact zones.

Such a document would meet the requirements set forth in Section 303 of Superfund Amendments and Reauthorization Act of 1986 and the Occupational Safety and Health Administration regulations found in 29 CFR 1910.120.

**Development of a safety Plan**

Using information generated as part of the hazardous waste site characterization, a health and safety plan can be developed in accordance with the Occupational Safety and Health Administration regulation. This document should include the following:

- introduction, e.g., purpose/ scope, revision policy, distribution list.;
- rules and responsibilities of facility personnel, e.g., organizational Structure and chain of command, site description;
- site control/security, e.g., facility access, guard coverage;

- hazard communication, e.g., chemical inventory, material safety data sheets;
- medical surveillance/medical emergencies, e.g., employees covered, frequency and types of examinations;
- environmental, health and safety training programs, e.g., RCRA facility operator specific training, evaluation/ certification;
- personnel and area air monitoring, e.g., equipment, procedures, frequency;
- hazard control methodology, e.g., engineering controls, work practices;
- personal protective and safety equipment, e.g., levels of protection, selection and types, use and limitations;
- decontamination program, e.g., work zones, procedures, equipment;
- hazardous wastes and materials handling program, e.g., types and locations of wastes, materials handling equipment and procedures;
- RCRA facility emergency response program, e.g., emergency procedures for hazardous waste events;
- new technology program, e.g., roles and responsibilities, program contents; and
- general site safety and health policies, e.g., accident reporting, personal protective equipment.

There are similarities in the emergency response plan and the health and safety plan; in fact there is an identified need to eliminate any possible inconsistencies. Major differences include the detailed emergency procedures based on the risk screening and hazard analyses in the emergency response plan and the emphasis on hazardous waste-related issues in the health and safety plan.

**Benefits**

Once a corporation has adopted the techniques of risk management in the conduct of its business, there are numerous benefits to be gained. Anticipation and planning improves prevention and mitigation capabilities which can reduce the number of personnel injuries, property damage, accidental downtime and the resulting loss of revenue associated with business interruption. The exercise of risk analysis allows the evaluation of existing safety measures, and can point out weaknesses or potential problem areas in the overall safety design. In addition, human error can be an important source of risk, and risk analysis often points to positive changes in overall safety management structure and procedures. Specific benefits resulting from the activities presented above include the following items.

*Improved Understanding of Facility* Risks : The principal by-product of hazard identification and risk screening efforts is a more refined understanding of those events that have the potential for serious on-site or off-site impact.

*Identification and Prioritization of Risk Control Options:* Having identified and analyzed a facility's risks, one can then readily identify and prioritize those risk control measures that will reduce the probability or consequences associated with the events.

*Development of a Comprehensive Emergency Response Plan* : With limited resources for equipment and program development, technological risk management facilitates the development of a comprehensive emergency response plan that can be directed towards those risks that are more likely to occur and/or have consequences that are comparatively severe.

*Development of a Health and Safety Plan* : The programmatic development of a detailed health and safety plan should be based on a sound technical understanding of associated risk, whether it be for hazardous waste or other hazardous materials.

*Compliance with Applicable Regulations :* State-of-the-art technological risk management can be very valuable in helping a facility or a corporation comply with the regulations recently promulgated by Environmental Protection Agency (EPA) and the Occupational Health and Safety Administration. In addition, some state regulations require the application of risk assessment techniques.

In closing, it is important to note that while shipbuilding facilities present special environmental/ health/safety challenges, facility personnel are generally very eager to address them, and often serve as a catalyst for progress. Such situations present unique and very fulfilling opportunities for shipyard management and safety professionals to work together to effect changes aimed at minimizing the potential for fatalities, injuries, property damage and business interruption.