Title: Process Safety Management

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Abstract: With the May 1992 Occupational Safety and Health regulation that was passed, entitled Process Safety Management of Highly Hazardous Chemicals, management in industry will be faced with increasing costs and must be made aware of the alternatives that they have available. These alternatives include good engineering practice in design processes, process documentation, process hazard analysis and management of change. These are some of the issues addressed in this study.

Process Safety Management

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PROCESS SAFETY MANAGEMENT

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In May of 1992, the Occupational Safety and Health Administration passed a new regulation, 29 CFR 1910.119, which is Process Safety Management of Highly Hazardous Chemicals. Process Safety Management(PSM) requires the management of hazards associated with processes using highly hazardous chemicals. The goal is the prevention and the minimization of the consequences of accidents involving highly hazardous chemicals.

Specifically, this regulation applies to any process involving a chemical specifically listed. This regulation is a concern to engineering management because it covers chemicals that are not normally considered to be hazardous chemicals and of concern to a manager in an industrial plant. These chemicals are normally used and had not had a high priority previously. These chemicals are listed and regulated when the quantity of chemical is above the Threshold Quantity (TQ) or a flammable liquid or gas in one location in excess of 10,000 pounds. Some of these chemicals listed are: chlorine, bromine, and ozone. These chemicals are used for disinfection to prevent disease from drinking water and deposition on heat transfer surfaces. In addition, these chemicals are also used in the pulp and paper industry in the process of making bleached wood pulp to make white paper. The analysis of this paper will primarily deal in these two fields because of their proximity to the Pacific Northwest.

As industry begins to implement Process Safety Management into their organizations between now and 1996, management should be aware of the costs that they are subject and the alternatives which

are available.

HAZARD DESCRIPTION

The key to OHSA's 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, is the type and quantity of chemical at a specific location within an industrial plant. Appendix A of OSHA's 29 CFR 1910.119 lists the following chemicals which are used for industrial plants:

Chemical Name	CAS*	TQ**
Bromine	7726-05-6	1500
Chlorine	7782-50-5	1500
Chlorine Dioxide	10049-04-4	1000
Ozone	10026-15-6	100

* Chemical Abstract Service Number

** Threshold Quantity In Pounds(Amount necessary to be covered the standard)

With this description, the standard one ton chlorine cylinders are covered in Process Safety Management. However, these cylinders are classified as low-level hazard based upon regular routine maintenance performed by owners as required by regulations. The two exceptions that prevent the achievement of the low-level status are the possibility of fire exposure and mechanical damage. These concerns can be minimized by providing a dedicated storage area for

the cylinders, safe movement practices for the cylinders, and following written procedures for spotting and removing cylinders. Higher-level risks are found at the application sites with the vaporization of the chemical. Chlorine releases can result from corrosion, excessive temperatures, moisture, mechanical damage, and operator error.

Chlorine dioxide and ozone also fall into Process Safety Management when storage levels are maintained in excess of the Threshold Quantity. It should be noted that bromine is not normally supplied as an elemental product. It is supplied in a compound form, and therefore, it is not covered in Process Safety Management.

PROCESS SAFETY MANAGEMENT COSTS

Process Safety Management is an entirely new regulation to the industry. Now, companies will have to update their systems and document their safety programs. Listed below are specific areas companies have to address when they use chemicals in excess of the threshold quantity of process safety management.

Engineering

Good engineering practice is a design process that applies appropriate design guidelines and industry codes and standards based upon proven technology and regulatory requirements. Each installation requires its own unique design. However, there are places in which an engineer can find assistance. For example, the

Chlorine Institute provides useful, related design information and good engineering practices for chlorine operations. In addition, compliance with industrial codes can be achieved using ASME Section VII, Division I, Boiler and Pressure Vessel Code and ANSI B31.3, Chemical Plant and Petroleum Refinery Piping. By following Process Safety Management, a design should provide for safe and efficient maintenance including equipment isolation, system purging, and the testing of controls and safety equipment.

Process Documentation

Compliance with OSHA 29 CFR 1910.110, Process Safety Information requires an industrial plant to compile written process safety information on listed process chemicals, process technology, and process equipment for all processes covered by the regulation. All facilities should maintain and keep up to date certain documents: process flow sheets, piping and instrumentation diagrams, safety component test reports, operating procedures, material safety data sheets, incident and accident reports, process hazard analysis reports, and operating logs.

Process Hazard Analysis

A good engineering design is not sufficient in ensuring that an operation is safe. A formal process hazard analysis is required by the OSHA regulation. Section 'e' of the regulation contains samples of process hazard procedures such as What-If, Hazard and Operability, and Fault Tree. A review team from the industrial

plant will be necessary to conduct the analysis. They can use the procedures which are included in the regulation but may not deviate from the regulation. As the review conducts its analysis or audit of the application of the regulated chemical, they should ensure that they inspect the physical site as well as all documentation.

Management of Change

This OSHA regulation also contains a section called the Management of Change. The purpose of a formal management of change policy is to control and manage all modifications to process equipment, procedures, raw materials, and processing conditions other than "replacement in kind" by identifying and reviewing them before implementing the change. The initial documentation which needs to be completed are written procedures that:

* Adequately address the technical basis for the change.
* Determine the potential impact on safety and health.
* Identify necessary modifications to operating procedures.
* Estimate the time during which the change will be made.
* Specify all authorizations required before proceeding with the change.

Training

Training is associated with the operating procedures. This OSHA regulation requires the plant site to perform initial training, refresher training, and documentation. Operating

procedures are not effective unless the operators are trained in the operation in which the process chemical is used. All operations have some hazards. The effect of human error needs to be noted by the operator with specific action plans to be completed. In addition, operators need specific training of safety equipment and personal protection. Finally, contractors, who are working within close proximity of any application of a regulated process chemical, also need to have training about that facility, and the contractor needs to be evaluated about their safety record and experience around potentially hazardous areas.

Emergency Response and Planning

Emergency response and planning is required of the company to prevent unwanted hazardous contact between the highly hazardous chemicals and personnel. Planning should include the immediate area, in addition to scenarios when exposure could be noted. Modeling should be used. All results should be recorded within the written procedures and training programs.

DISCUSSION

Assessing a monetary value to the above listed items is a difficult process because it is contingent upon the variety and complexity of hazards on a plant site. When the U.S. Government's Office of Management and Budget reviewed the proposed regulation, they indicated that the costs may be higher than estimated and may adversely affect profitability. OSHA reviewed their cost estimates and they determined that the costs did not significantly outweigh

the benefits of reduced work place incidents and injuries.

The intent of the regulation is to minimize the risk of a highly hazardous chemical causing death or injury. A company should consider reducing the amount of chemical below the Threshold Quantity within specific locations or investigate alternatives which are not listed under process safety management to reduce these risks.

In the water treatment, alternatives which need to be investigated are contingent upon the application. The first criteria is whether the water is potable or non-potable. Second, what are the discharge limitations of a treated water streams. In the pulp and paper industry, bleaching alternatives are based on costs of the conversions.

Alternatives in water treatment are very diversified. Changes from gaseous chlorine can be as simple as going to sodium hypochlorite solution or as complex as going to a non-oxidizing biocide. Any changes first need to be based upon criteria for effective biological control, and second, on the costs of the chemical. A good water treatment consultant can determine an effective replacement for a current product which is currently covered under PSM. The cost of the chemical will be based upon usage and the recommended product. The cost comparison will be comparing a product with PSM to a product without PSM.

In the bleach plant operations, the decision process is far more complex than the scope of this paper. An engineering manager not only has to look at the capital costs of any conversion, but the quality of the bleach pulp produced and the possible by-products produced. Current desire of the consumers is to use only Totally Chlorine-Free bleached pulp. Such practices reduce the risk of forming toxics in the effluent streams. With these toxic formations, chlorine and chlorine dioxide products are not deemed desirable products. Other effective products used in bleaching are hydrogen peroxide, oxygen, ozone, and enzymes. Hydrogen peroxide, oxygen, and enzymes are not listed under PSM.

CRITICAL AREAS

As engineering managers begin to look at the costs associated with chemicals, there are variations that need to be analyzed. First, different chemicals have varying effectiveness base upon the conditions and amounts which they are applied. Cost of chemicals depend on the wholesale price and the overhead of the supplier. Finally, the quality of the chemical is related to the cost of the chemical. Therefore, as an engineering manager beings looking at PSM for her organization, there are different options to look at and costs to be analyzed. The answers are contingent upon the installation and the application of the hazardous chemical. All options should be surveyed to ensure that a cost effective option is being used.

CONCLUSION

The costs associated with Process Safety Management can be successfully managed. For some companies, the application of a cost analysis could indicate an alternative chemical would be acceptable. However, for others implementing a comprehensive process safety management program may be required.

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