SECTION 3: PROCESS SAFETY MANAGEMENT

3.1 PROCESS SAFETY MANAGEMENT

3.1.1 Background

The Occupational Health and Safety Administration (OSHA) of the United States created the PSM regulation in response to several large industrial accidents in the 1980s and early 1990s. These incidents involving hazardous materials occurred throughout the world in locations such as Bhopal, India and Channel View and Pasadena, Texas. This regulation requires certain facilities to adhere to a specific set of standards.

In response to these incidents, OSHA drafted a regulation and obtained input and feedback from the chemical industry and other organizations. The result of this collaboration was a new regulation; Process Safety Management that became effective on May 26, 1992 (Read the regulation in 29 CFR 1919.119). OSHA recognized that this regulation meant an opportunity to achieve a major reduction in fires and explosions, fatalities, and injuries/illnesses. OSHA also recognized that the PSM standards could enhance plant productivity and product quality.

Incidents Leading to the Development of the PSM Regulation:

Worldwide:
- 1976: Seveso, Italy – Major dioxin release
- 1985: Bhopal, India – 2000+ fatalities, 10,000+injuries – toxic chemical release

United States:
- 1989: Phillips (Pasadena, TX) – 24 fatalities, 314 injuries, loss of facility -- explosion
- 1990: Arco Chemical (Channelview, TX) – 17 fatalities
- 1990: BASF – 2 fatalities, 41 injuries – explosion and fire
- 1991: IMC (Sterlington, LA) – 8 fatalities, 128 injuries – fertilizer plant explosion
- 1995: Lodi, New Jersey – 4 fatalities, loss of facility -- explosion

PSM Expectations

- Reduce fires and explosions by 80%.
- Reduce related fatalities by 260 per year
- Reduce related injuries by 1200 per year
- Significantly improve operations in the following areas:
  - Productivity
  - Product quality
  - Mechanical reliability
SECTION 7: ENVIRONMENTAL OPERATIONS

7.1 OVERVIEW
Complying with Federal, State and local Environmental Regulations is crucial to the continued and successful operation of a chemical manufacturing facility.

7.2 SOME BENEFITS OF ENVIRONMENTAL COMPLIANCE
In addition to the obvious benefits of reducing noncompliance, there are a number of other benefits which can be realized as a result of compliance with Federal, state and local regulations. Some of these benefits are listed below:

- Reduced negative environmental impact;
- Improved product stewardship;
- Improved operations as a result of environmental related training;
- Improved community relationships;
- Reduced waste by an aggressive pollution prevention program; and
- Increased employee morale and pride.

Environmental regulations cover nearly every process in a chemical operation. Federal Environmental Protection Agency (EPA) regulations can be found in Volume 40 of the Code of Federal Regulations (CFR) which contains hundreds of pages of regulatory text pertaining to air, water, hazardous waste, chemical reporting and other environmental regulations. Dedicated and coordinated efforts are required to achieve environmental compliance in a chemical manufacturing facility. Environmental compliance cannot be fully achieved by an “Environmental Officer” or by management alone. It demands the informed and willing cooperation of every employee.

Achieving total environmental compliance is also not a one time action but an ongoing process which requires attention and continuous effort. The compliance process can be broken down into 7 steps:

- Determining the applicable regulations;
- Identifying the requirements of the applicable regulations;
- Evaluating the operations in light of regulatory requirements;
- Developing a well thought out, prioritized action plan;
- Updating or creating permits, written programs and procedures;
- Taking predetermined and definite actions; and
- Monitoring for compliance.

7.2.1 Determining the applicable regulations
This is usually done by someone sufficiently knowledgeable of environmental regulations to ensure that all aspects are considered. It may require an informal interview and a walk-through inspection of the facility or a formalized audit.

7.2.2 Identifying the specific requirements
SECTION 13: CONTROL SYSTEMS

Control systems are an integral part of any chemical manufacturing process. They provide a means of indicating and controlling process variables such as temperature, flow, pressure, level, pH and composition. A system may be controlled automatically or manually, but it is up to the chemical plant operator to run the process in a safe, efficient, and environmentally sound manner and ensure that the final product meets the customer’s specifications.

13. 1 EVOLUTION OF CONTROL SYSTEMS

13.1.1 The Concept of Automatic Control: Open Loop vs. Closed Loop

An automatic controller device or system is one which measures a process variable and operates to keep the variable in a prescribed range or at a desired value. The desired value is often called the set point. Simple devices like a light switch or the heat control on a cooking stove can be called controllers, but not automatic controllers. They would be referred to as “open loop” controllers. There is no feedback to tell the light switch to turn off or to tell the heating element in the burner to turn off. If we consider the human operator as a part of the system these everyday examples become automatic controllers. In the case of the light switch, the human operator must be present with his finger on the switch and his eyes sensing the light in the room. This satisfies our definition of a control system since a measurement is taken and an operation is performed in response to it. In some cases, a light switch may also include a dimmer or different levels of light which can be adjusted by its user. Some everyday examples of completely automatic systems are the household refrigerator, temperature setting on an electric iron, the automatic water heater, and the automatic heating system in your home. Control of temperature in the oven of your electric range constitutes an automatic control system in terms of the oven air temperature. The cooking process itself, however, is not a true automatic control system. When a timer clock is provided, the duration of cooking must be set so that the oven is automatically turned off after a prescribed length of time has elapsed. The roast may or may not be done. To constitute what we would call an automatic controller, a measurement of temperature of the roast would constitute an indication of cooking completeness. Feeding the signal of this measurement to a controller which would operate the oven switch would make the cooking process itself automatic. This setting would also be dependent upon whether it is desired to have the roast rare or well done. This is a matter of preference in the same sense that one customer may require 99% pure product vs. another who demands 99.9% purity. The process conditions and product treatment would be different for these different customers.

Every completely automatic control application has a closed loop. Consider an operation which is done manually and attempt to formulate a closed loop out of it. Figure 13-1 shows a human subject operating an electric switch to a heater. In this example the objective is to maintain a constant temperature in the enclosed space. To accomplish this, we have to first measure the temperature and the ordinary mercury in glass thermometer shown is for this purpose. The human operator has one hand on the switch and an eye focused on the thermometer. It is the coordination of the eyes and hand of the human operator which make this a closed loop system. The maintenance of the reference temperature is dependent upon the human operator being alert at all times. Now we can see how the loop is closed. The eyes see the temperature and through the mental and body processes a signal is sent to the hand to operate the switch manually either to energize the heater when the temperature is low or to de-energize the heater when the temperature is high.