DEFLAGRATION SUPPRESSION SYSTEMS

INTRODUCTION

Deflagration suppression systems detect and arrest a subsonic combustion process in a confined space before damage can occur. Systems responding during the incipient stage of combustion prevent the development of pressure that could deform or rupture the container. Deflagration suppression is one of several types of explosion protection systems listed in NFPA 69 for use in preventing or limiting damage after ignition has occurred.

POSITION

Management program administrators should report to top management through the minimum number of steps. They should also institute adequate loss prevention inspection and audit programs to communicate program effectiveness to top management. This management feedback is a key feature of *OVERVIEW* (PRC.1.0.1). In developing a program, pay particular attention to the following important areas:

Process Hazards Evaluation

Develop a program to determine the explosion potential of all reactants, intermediate products, by-products and end-products in the plant. Choose test conditions that best represent all possible operating conditions. Include scaling factors (bench, pilot, semi-works or full scale) when establishing the safety parameters.

Operator Training

Educate process operators in purpose and use of the suppression equipment. Forbid them to run the process when this equipment is out of service. Schedule periodic re-education and training at least annually. Include testing to assure proper understanding of the suppression equipment.

Preventive Maintenance and Inspection

Contract with the manufacturer to perform quarterly inspection and maintenance of each suppression system in accordance with NFPA 69.

Management of Change

Apply each management program to any changes made to the facility's physical plant or operating procedures. Restrict modifications to suppression systems to those performed by the system supplier.

Other Management Programs

Consider potential problems when incorporating the following features into the comprehensive management program for loss prevention and control:

- Welding, cutting, and other “hot work” permit programs.
- A program to supervise impairments of fire protection equipment using AXA XL Risk Consulting’s “RSVP” program. (Treat any lock-out of an deflagration suppression system as an impairment to protective equipment and follow the procedures recommended in PRC.1.1.0.).
- Smoking regulations.
- Plant security and surveillance.

Design Considerations

When designing deflagration suppression systems, keep the following considerations in mind:

- When designing processes, reduce material hold-up, thus reducing the size of a potential deflagration.
- Have deflagration suppression equipment designed and specified by qualified contractors and operating personnel who consider both normal and abnormal operating conditions. Pay particular attention to suitability of the equipment to handle the process materials and to endure the operating environment.
- Design and construct equipment to withstand a minimum of 1.0 psig (0.071 bar) to 1.5 psig (0.107 bar) for at least as long as it takes the deflagration suppression system to operate.
- Do not install deflagration suppression equipment in normally occupied rooms or enclosures.
- Require the supplier to adhere to NFPA 69 during design, installation and modification of any deflagration suppression system.
- For particularly high value, critical, or hazardous operations, consider backing up deflagration suppression systems by installing explosion venting in accordance with NFPA 68.

DISCUSSION

A deflagration suppression system consists of high speed detectors, electrically fired initiators and a supply of suppressant. Detectors may be either fixed pressure, rate-of-pressure-rise or infrared type. The initiators are electrically detonated explosive charges that open the suppressant container. Suppressant materials vary with the nature of the combustion process. Water, Inergen, FM200 sodium bicarbonate and monoammonium phosphate are some materials used. Halon agents were previously used in deflagration suppression systems, however the use of Halons has been virtually eliminated due to the Montreal Protocol limitations on Halon use.

Deflagration suppression can be successfully applied to systems containing gases, vapors, mists and dusts. In some situations, it may not be possible to find a suitable suppressant or to design a system fast enough for the combustion process. Some of these involve:

- Materials that detonate, disproportionate or undergo other types of violent chemical decomposition.
- Processes with operating temperatures approaching 1000°F (537.8°C).
- Processes with operating pressures approaching 100 psi (7.1 bar).
- Equipment not designed to withstand the incipient pressure of a deflagration. Hence the need to design equipment to withstand the 1.0 psig (0.071 bar) to 1.5 psig (0.107 bar) of the incipient deflagration.

Deflagration suppression systems are not recommended for normally occupied rooms or enclosures because the speed of the system precludes warning and evacuation, so resultant panic and injury are possible.

The design of a deflagration suppression system requires knowledge of the process, specific details of equipment arrangement and a series of tests of the materials to be handled. Because of these factors, the initial design and future modifications to systems must be done by the supplier after consultation with the operator.

General requirements for deflagration suppression systems are found in NFPA 69. Specific design requirements for deflagration systems are largely proprietary; involvement with a qualified contractor or equipment manufacturer is essential.

A frequent question is whether deflagration venting is required when suppression is installed. NFPA 69 does not require venting with suppression; however, other standards requiring vents may not consider the installation of suppression as a substitute. Good loss prevention indicates the installation of a passive vent system in accordance with NFPA 68 as a backup to the active suppression system is desirable and further reduces the risk of damage. However, sometimes the physical configuration of the equipment makes it impossible or impractical to provide the proper vent area.

Deflagration suppression systems are only as reliable as the inspection and maintenance service they receive. NFPA 69 specifies inspection on a quarterly basis by personnel trained by the system's manufacturer. Because the testing and inspection of the system deals with electric circuits and explosive charges, the AXA XL Risk Consulting recommends that a service contract from the manufacturer be obtained.

Maintenance of equipment protected by a deflagration suppression system requires that the suppression system be disabled for the safety of the maintenance personnel. The lock-out procedure should specify that process equipment must be shut down prior to lock-out and must not be run until the system is restored. The lock-out should be considered an impairment to protective equipment and the procedures recommended in PRC.1.1.0 should be followed.