

Extended Abstract

Protecting Process Areas and Process Structures where Flammable and Combustible Liquids are Handled

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In NFPA 30-2003, operations involving flammable and combustible liquids are covered in Chapter 7. However, there is little or no detailed guidance in how to provide fire protection for areas where operations such as mixing, blending, reaction, and distillation are performed. Chapter 7 simply indicates that an analysis of the hazards should be performed by a competent engineer to decide prevention and protection features.

Actually, the engineering analysis is necessary in deciding what type of protection is the most cost effective. Any protection scheme must consider:

- Fixed protection – waterspray, foam-water, monitor nozzles
- Protective coatings (fire proofing)
- Drainage

All of these are interrelated and must be considered.

One of the best guides for making the engineering analysis is a Center for Chemical Process Safety publication *Guidelines for Fire Protection in Chemical, Petrochemical, and Hydrocarbon Processing Facilities*

But once the decision is made to install protection and which protection scheme to follow, how do you design the protection?

There is guidance from sources outside of NFPA 30 such as:

- GE GAPS Guidelines (GAP 12.2.1.2 *Fixed Protection for Oil and Chemical Plants*)
- Factory Mutual Data Sheet (Data Sheet 7-14 *Fire and Explosion Protection for Flammable Liquid, Flammable Gas & Liquefied Flammable Gas Processing Equipment and Supporting Structures*)
- Factory Mutual Data Sheet (Data Sheet 4-1N *Fixed Water Spray Systems for Fire Protection*)
- American Petroleum Institute (API 2030 *Application of Fixed Waterspray Systems for Fire Protection in the Petroleum Industry*)
- NFPA 15 *Standard for Water Spray Fixed Systems for Fire Protection*
- NFPA 16 *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*

The use of these documents can be confusing as there are differences in the application densities for the deluge and water spray systems. For example: FM and API call for densities for area coverage in enclosed buildings of 0.30 gpm/ft²

above any solid floor, 0.30 gpm/ft² under the roof or any solid floor and 0.15 gpm/ft² under open grated floors. GE GAPS calls for 0.35 gpm/ft² above solid floors, 0.35 gpm/ft² under the roof or solid floors and 0.25 gpm/ft² under grated floors.

For area coverage in open process structures, FM and API call for 0.30 gpm/ft² under all intermediate floors with protection extending 30 ft above grade. On the other hand, GE GAPS recommends a density of 0.35 gpm/ft² under intermediate floors up to 35 ft above grade.

These are also differences between FM, GE GAPS, API, NFPA 15 and NFPA 16 in recommended densities for specific water spray coverage and area foam-water coverage.

How will these differences be resolved? Careful studies of available test data is the only answer. However there is little test data available.

Fire testing done by Factory Mutual in 1980 on two- and three-dimensional flammable liquids fires in a simulated process structure is available in abbreviated form. There was testing done during World War II by the Rubber Reserve Corporation and work done by Automatic Sprinkler Company in 1962 but the test data is not readily available.

If all of the research data is gathered together and compared with experience, a consensus could probably be reached so that meaningful protection criteria could be added to the operations chapter of NFPA 30.