Safety in Solvent Extraction Plants – USA

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ABSTRACT

The history of the National Fire Protection Association, Solvent Extraction Committee, is discussed with particular emphasis on the impact of the Occupational Safety and Health Act of 1971. A review of the important features standardized in NFPA No. 36, "Solvent Extraction Plants," is discussed, with particular emphasis on their relevance to construction of new plants and expansion of existing plants.

The safe operation of any solvent extraction plant is based on three principles. The plant must be designed and constructed so that the physical facility is capable of being operated safely; it must be managed by people who are dedicated to safe operation; and it must be operated by workers who are not only well trained in the proper manner to operated their plant, but also are trained in the techniques of safe handling of flammable liquids and gases.

Time is not available to discuss all of these subjects in any depth. Therefore, I will confine my remarks to the area of design and construction. In doing so, I want to especially state that this area is no less important or no more important than the other two areas.

Prior to the mid-1950s, each owner with his engineer and insurance company agreed as to the design of his solvent extraction plant. Governmental authorities in the U.S. have a measure of control through their control of building permits; however, these entities are local in the case of the U.S., and in those days the expertise rested with the engineering and insurance companies.

A number of fires and explosions occurred in the decade after World War II which could have been avoided by better design. It was also recognized that the processing of oilseeds presented special hazards inherent to the combining and separating of combustible solids with flammable liquids.

A group of engineers within the American Oil Chemists' Society felt that, if suggestions could be presented by an industry-wide committee, then the incidence of disasters would be greatly reduced, lives would be saved, and insurability would be maintained at reasonable premiums. Through the major insurance associations, contact was made with the National Fire Protection Association. That Association set up the Solvent Extraction Sectional Committee, which produced the first tentative standards for plants in 1957. These standards were revised and officially adopted in 1959. Further revisions occurred in 1962, 1964, and 1967.

In 1971, the U.S. Congress passed a law setting up the Occupational Safety and Health Administration. This authority adopted the NFPA standards as federal standards. What had previously been a guideline used by an owner and his insurance company to gain the latter's approval of a design now had the effect of law throughout the U.S.

The NFPA standard on Solvent Extraction Plants was then revised in 1972, 1973, and 1974 as the committee wrestled with the problem of writing standards for an industry that has largely grown by expanding existing plants. Our moderator, Mr. Lou Kingsbaker, has represented the American Oil Chemists' Society, and I have represented the National Soybean Processors Association during this latter period.

The basic philosophy of the standard is to keep the three ingredients of fire separated from each other at all times. The three ingredients are, of course, fuel, oxygen, and a source of ignition.

All portions of the process containing fuel are operated at conditions which are well above the upper explosive limit of the solvent.

The processing area is kept a good distance from any source of ignition. The distance requirements shown in Figure 1 state the following:

1. No sources of ignition (open flame, electrical, or any other) may be installed or brought within 15 meters of the extraction process, unless the process is purged of all solvent.
2. There may be no sources within 30 meters of vapor travel. Vapor barriers of noncombustible construction may be used to accomplish this objective.
3. The fill spout of any solvent storage tank and the tank itself, if above ground, must be 7.5 meters from the process building.
4. A fence restricting access must be built 15 meters

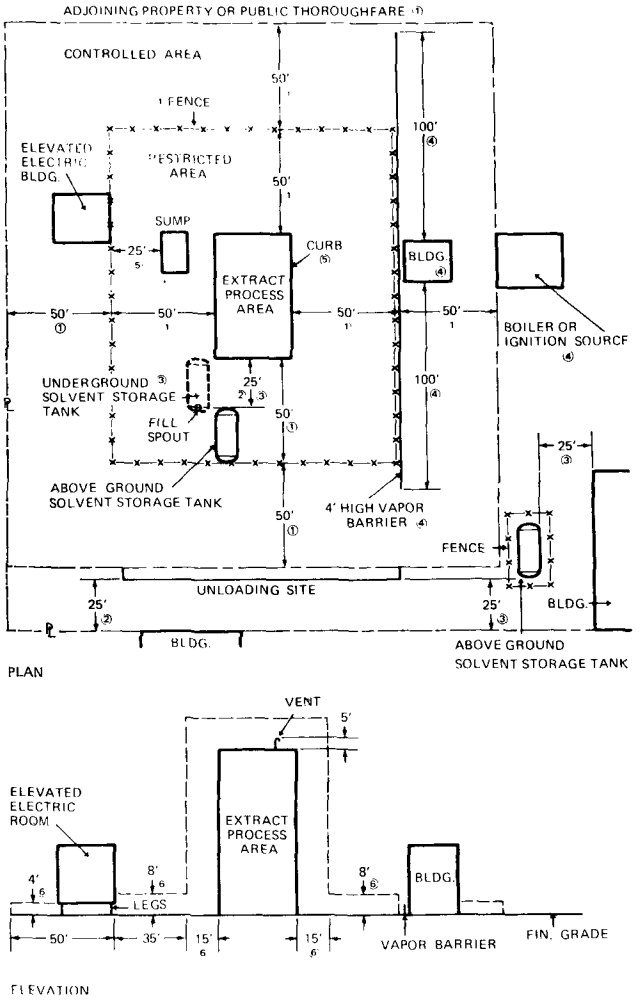

FIG. 1. A typical distance diagram. Index: 1. 5020, 5040; 2. 3010; 3. 3020; 4. 5050, 5051, 5052, 5310; 5. 5140; 6. 54.

from the process. The public must be kept 30 meters of vapor travel from it.

There is some easing of this requirement based on the nature of the solvent. The solvents used, mostly hexane, are much heavier gases than air and tend to travel along the ground. The lower portion of Figure 1 shows that sources of ignition may be located between 4 and 15 meters if 3 meters off the ground, and between 15 and 30 meters if 1.5 meters off the ground.

The standard also provides for adequate ventilation of the extraction building, although the trend is toward "pagoda" type or open type buildings.

All of the following are required in the extraction area which is not complete:

1. Explosion-proof electrical apparatus.
2. Deluge sprinkler system connected to a firm source of water and powered by redundant pumps. Foam is accepted.
3. Rubber belts are prohibited.
4. Spark producing tools are prohibited.
5. Exits must be protected.
6. Vessels, piping, and buildings must be grounded.
7. Dust collection must be installed where required.
8. Emergency cooling water must always be available by gravity supply or its equal.

Although I can go on and recite every item in the standard, the thing to do is to read it. Copies can be obtained from the National Fire Protection Association (470 Atlantic Ave., Boston, MA 02210) for a nominal cost. The Association provides interpretive assistance.

ACKNOWLEDGMENT

The National Fire Protection Association granted permission for use of the slides which accompanied this presentation.