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LOFT FIRE PROTECTION

INTRODUCTION

This presentation addresses quantified criteria that was developed and applied to provide in-depth fire protection for the Loss of Fluid Test (LOFT) Facility. The presentation describes the evolution process that elevated the facility's fire protection from "minimal" to that required for a "highly protected risk" or "improved risk". Explored are some infrequently used fire protection measures that are poorly understood outside the fire protection profession.

The LOFT reactor is a 50 MW (thermal) PWR that has the capability of simulating a loss of coolant accident (LOCA). One of the primary objectives of the LOFT Program is to provide data required to evaluate the adequacy of, and to improve, the analytical methods currently used to predict LOCA response of large pressurized water reactors. It is extremely important to provide a high level of fire protection to minimize disruption of the test schedule, to protect a unique and costly facility, and to ensure nuclear control of the reactor.

FACILITY DESCRIPTION

The LOFT Facility is located in southeastern Idaho at the Idaho National Engineering Laboratory (INEL). Portions of the facility were constructed in the late 1950's for the Aircraft Nuclear Propulsion (ANP) Program. The balance of the facility is on new design for the LOFT program. The basic structures are constructed of non-combustible concrete and steel. A continuously manned fire station is located approximately 1½ miles from the facility.

FIRE PROTECTION CRITERIA

The structures built for the ANP Program and the LOFT construction before 1973 were designed to comply with the Uniform Building Code Requirements for Life Safety. This protection consisted of a single fire water supply and pumping system with outside fire hydrants, inside fire hoses and automatic sprinklers in rooms containing flammable liquids. Fire detection was limited to electrical rooms, the control room, data acquisition rooms, and the containment vessel.

Following the fire at Rocky Flats, the USAEC (now DOE) and its contractors increased the emphasis was placed by the USAEC (now DOE), on the protection of government property and minimization of delays to important programs by increasing their level of fire protection. Construction of the facility was in progress and an upgrade plan was developed and initiated. The philosophy adopted was to incrementally improve the fire protection such that the improvements kept pace with the increasing value of the facility as more equipment was installed.

The first phase of the LOFT fire protection upgrade was installed in 1973, coincident with installation of control and data acquisition equipment. This phase consisted of improvement of fire cutoffs, increased fire pump power source reliability, installation of a fire hydrant near the vital power storage batteries and installation of five additional automatic fire sprinkler systems in 46,000 square feet of the facility.

Considerable discussion was generated between program management and fire protection personnel regarding the advisability of installing automatic sprinklers in the control and data acquisition rooms since the occupancy of these rooms is primarily electrical and electronic equipment. Published literature was used to convince the program personnel that water damage from a fire severe enough to cause sprinkler discharge would be less than would be caused by fighting the fire with hose streams or permitting the fire to burn unchecked. To minimize the possibility of inadvertent water discharge in these rooms, a supervised pre-action type sprinkler system was selected. In that type system, the incipient phase of a fire is sensed by detectors which open the valve that admits water to the sprinkler piping (up to the closed heads) and causes alarms to sound in the control room and at the fire station. No water can be discharged until sufficient temperature (165^{o}F) is produced by the fire to fuse the sprinkler head. The delay between the detector sensing the fire and the sprinkler fusing permits investigation and possible extinguishment of the fire by hand extinguisher without sprinkler operation. To prevent a sprinkler piping leak or break to go undetected, air pressure at 1½ psig is maintained in the sprinkler piping so that piping leaks will cause the air pressure to decay. This loss of air pressure is also annunciated at the fire station and control room permitting investigation and repair. Remaining sprinkler systems are of the normal wet-pipe or dry-pipe type, depending upon the minimum ambient temperature expected.

The Brown's Ferry fire reemphasized the need for a level of fire protection for nuclear facilities that will prevent a fire from degrading reactor safety systems or interrupting plant operation.

In 1976, the operating contractor, Aerojet Nuclear Co. (now EG&G, Idaho) with the endorsement of the USDOE performed a comprehensive evaluation of the LOFT facility fire protection and made 42 recommendations for improvement. Implementation of these recommendations resulted in installation of Halon fire suppression systems in the control room, data acquisition rooms, cable spreading room and instrumentation preamplifier rooms (causing the previously installed sprinklers in these areas to revert to secondary protection). Halon systems were also installed in the 13.8 kV switchgear rooms. Additional detection and an open head, low density (0.10 gpm/ft^2) spray sprinkler system were installed as supplementary protection in areas containing vital electrical cables. An automatic, high density (0.50 gpm/ft^2) spray sprinkler system was installed to protect the vital electrical power storage batteries. The water supply was improved by the addition of a second, redundant water storage tank and a diesel engine driven fire pump.

CONCLUSIONS

The present level of fire protection has resulted in a significant reduction in risk of fire in the LOFT facility. Since LOFT is the only facility available to perform simulated loss of coolant accidents on an operating reactor, the decisions to retrofit the facility with a high level of fire protection has proven to be in the best interests of the industry, especially after the Three Mile Island events have focused a great deal of attention toward the LOFT program.

The retrofitting of additional fire protection to an existing facility is feasible and can be attained without increasing the facility costs beyond sound economic restraints.