UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

June 20, 1997

NRC INFORMATION NOTICE 97-37: MAIN TRANSFORMER FAULT WITH ENSUING OIL SPILL INTO TURBINE BUILDING

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a scenario in which a large amount of transformer insulating oil could bypass fire hazard control features, such as oil impoundment pits, and spill into the turbine building and other areas of a nuclear power plant. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On March 7, 1997, Boston Edison Company's Pilgrim Nuclear Power Station was in a refueling outage with the core offloaded to the spent fuel pool. The startup transformer was out of service for maintenance. Offsite power was being supplied to the safety-related buses from the 345 kV system through the main transformer and the unit auxiliary transformer with the main generator disconnected. A fault in the main transformer caused severe mechanical agitation, breaking one of the low-voltage bushings and one of the high-voltage lightning arresters. Oil leaked out of the broken low-voltage bushing and spilled into the turbine building via the isolated phase (iso-phase) bus duct.

Approximately 4,300 gallons of oil entered the turbine building. Some oil leaked under the doors to the A essential switchgear room and into some nonsafety-related electrical cabinets but stopped short of safety-related switchgear. Because Pilgrim is a boiling water reactor, the turbine building is divided by a concrete biological shield wall, which limited the area of the oil spill.

Turbine building equipment potentially affected by the oil spill included the iso-phase bus cooling unit, the generator hydrogen seal oil unit, the stator winding liquid cooling unit, the low- pressure carbon dioxide storage unit, the fire protection deluge valves for the

transformer fire protection systems, and the trucklock bay (where trucks are loaded and unloaded). In addition, oil flowed down a stairwell and collected in an area that included the radwaste monitoring tanks, the treated radwaste holdup tanks, and the instrument air compressors.

As a result of the loss of offsite power caused by the main transformer fault, the B train emergency diesel generator (EDG) started and picked up its safety-related loads. The A train EDG was out of service for maintenance. The A train safety loads were supplied by the secondary source of offsite power (the 23 kV system) via the shutdown transformer.

Discussion

The Pilgrim main transformer (700 MVA, 3-phase, 60 hz, shell type) is configured so that the iso-phase bus ducts from the turbine building are routed on the same horizontal plane as the low-voltage bushings, which protrude from the side of the transformer, about 4 feet from the top. The iso-phase bus ducts are air-cooled ducts that surround each of the three phases of electrical bus and connect the main generator to the main transformer. All three ducts terminate in a common junction box on the side of the transformer where the iso-phase buses are connected to the low-voltage (23 kV) bushings. The high-voltage (345 kV) bushings then connect the transformer to the 345 kV transmission lines to supply power from the unit generator to the grid during normal operations. During the outage, the licensee was using the transformer as a step-down transformer (backscuttle mode) to supply offsite power from the grid to the station auxiliary loads.

There is no standard configuration for large power transformers used at nuclear power plants. The configuration at Pilgrim may exist at other plants. Licensees may wish to consider the configuration not only of the main transformer and duct work at their plants, but of any of the large power transformers (such as the unit auxiliary or start up transformers) to see if there are paths by which transformer insulating oil could leak into areas where fire would pose a significant hazard to the plant.

Faults of large power transformers at power plants are not uncommon. The event at Pilgrim demonstrates that a large amount of a combustible oil may be introduced into the turbine building. During power operations, a transformer fault may cause a fire if the insulating oil is ignited by the arc that results from the fault. If the transformer fault at Pilgrim had occurred at power, a serious turbine building fire could have ensued.

The combustibility of the mineral oil used as the transformer insulating oil had a flash point of approximately 275°F. A fire could have propagated into the trucklock and down into the radwaste tank area.

Smoke and hot gases could have been transported via the open trucklock area to elevations above the floor directly affected by the fire. Smoke and hot gases could have entered the B essential switchgear room (located on the next level above the fire) via the ventilation wall opening. Oil seeping under the door to the A essential switchgear room could have allowed

the fire to spread to that room and could have resulted in the loss of the A switchgear as well.

The Pilgrim licensee enhanced the fire protection design in the turbine building by installing containment curbs at the fire doors leading to the A essential switchgear room and the stairway leading to the radwaste holding tanks, and modified the iso-phase bus duct by installing an 8-inch diameter downcomer drain line on each of the three phases. Each drain line is routed to drain into the oil leak retention pit, and will be equipped with a rupture disc designed to open under 2 psig of static oil pressure in the drain line down-comer.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Seymour H. Weiss for

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LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
97-36	Unplanned Intakes by Worker of Transuranic Airborne Radioactive Materials and External Exposure Due to Inadequate Control of Work	06/20/97	All holders of OLs and CPs permits. All licensees of of nuclear power reactors in the decommissioning stage and fuel cycle
97-35	Retrofit to Industrial Nuclear Company (INC) IR100 Radiography Camera to Correct Inconsistency in 10 CFR Part 34 Compatibility	06/18/97	All industrial radiography licensees
97-34	Deficiencies in Licensee Submittals Regarding Terminology for Radiological Emergency Action Levels in Accordance With the New Part 20	06/12/97	All holders of OLs or CPs for test and research reactors
97-33	Unanticipated Effect of Ventilation System on Tank Level Indications and Engineering Safety Features Actuation System Setpoint	06/11/97	All holders of OLs or CPs for nuclear power reactors
95-36, Supp. 1	Potential Problems with Post-Fire Emergency Lighting	06/10/97	All holders of OLs or CPs for nuclear power reactors

OL = Operating License
CP = Construction Permit

- NRC Information Notice 90-47, "Unplanned Radiation Exposures to Personnel Extremities Due to Improper Handling of Potential Highly Radioactive Sources," dated July 27, 1990.

- NRC Information Notice 92-75, "Unplanned Intakes of Airborne Radioactive Material by Individuals at Nuclear Power Plants," dated November 12, 1992.

This information notice does not require any specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below.

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