GPU Nuclear

GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057-0191
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number

February 11, 1986
5211-86-2025

Office of Inspection and Enforcement
Attn: W. F. Kane, Director
Division of Reactor Projects
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

Dear Mr. Kane:

Three Mile Island Nuclear Station Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
EFW System Walkdown

In response to your Inspection Report 85-26 of December 12, 1985 enclosed please find the information requested as a result of the walkdown of the EFW System on November 7, 1985.

Sincerely,

J J Colitz for H. D. Hukill

H. D. Hukill
Director, TMI-1

HDH/gpa:2824f

Attachment

cc: R. Conte
J. Thoma

REQUEST FOR ADDITIONAL INFORMATION
TMI-1 EMERGENCY FEEDWATER SYSTEM MODIFICATIONS

ITEM 1 — Confirm that ducting, piping and other components that could potentially impact the backup instrument air bottles in the diesel generator room are either seismically supported or, if not, that their failure would not result in loss of function of the backup air bottles. For equipment that is seismically supported, provide the criteria used to establish seismic qualification (e.g., Regulatory Guide 1.29).

RESPONSE — The ducting for the air supply to the diesel generator located above the backup air bottles was upgraded to seismic (SSE) for HVAC system according to the design basis criteria for the FSAR. This reinforcement work was performed under NM-46 and ECM-S-131 in 1982. There is no piping located above the air manifold for the backup air system. The cable in conduit, although not specifically seismically mounted, by engineering judgement would not fall onto the backup air manifold and render it inoperable.

ITEM 2 — Provide a discussion which justifies the proposal to change the failure mode for the new emergency feedwater flow control valves (EF-V30s) to closed rather than open on loss of air. This discussion should address the importance of assuring reliable emergency feedwater flow against other considerations such as overcooling/overfilling.

RESPONSE — When the EFW system was redesigned to include parallel EFW flow control valves to each OTSG, the failure position of each of the valves (upon loss of either air or control signal) was changed to closed (Ref. 8 & 9).

Failure in the new design of one flow control valve per steam generator, in the closed position, will not affect the ability of the EFW system to deliver and automatically control EFW to a steam generator. Therefore, manual action would not be required to mitigate the consequences of a single failure. This design philosophy is predicated on the assumption that only one flow control valve will fail closed since no single failure can cause a loss of air control signal to both valves in one OTSG. The instrument air supplies are reliable air systems. Note that during low power (3%) natural circulation testing, the final bottle pressure in the two (2) hour back-up instrument air system after two hours was 1020 psig (from an initial pressure of 1880 psig). Therefore, in the event of a loss of all AC power, this system provides sufficient air for more than 2 hours of operation.

If the valves were designed to fail open, manual action would be required in order to prevent overfilling/overcooling an OTSG thus resulting in a less than fully automatic EFW system. While the installation of the cavitating venturis will limit the maximum flow achievable to a fully depressurized steam generator, it does not provide complete control of EFW. The cavitating venturis buy time in that it allows for diagnosis of a potential overfilling/overcooling condition which would then need to be rectified by manual action to close one of the failed open valves or its associated block valve. Therefore, a fail open mode, while technically acceptable, would not provide a fully automatic EFW system.

ITEM 3 Describe those features (indications) and actions relied on to alert the operators of flooding in the tendon access gallery in the intermediate building, for example, as a result of a main feedwater line break. Specify the design basis for these features. This discussion should also address the actions taken in the event of inadvertent indication of flooding and an assurance that these actions will not cause unnecessary challenges to safety systems.

RESPONSE As previously discussed in our letters of 4/13/84 (5211-84-2095), 8/1/84 (5211-84-2193) and 4/29/85 (5211-85-2151), following a main feedwater line break inside the Intermediate Building, Control Room indication of the following symptoms currently exist:

1. Reactor trip on high RCS pressure.
2. Turbine trip following a reactor trip.
3. High feedwater flow (SP8BFE, FE-7 and FE-8) and low feedwater flow* (SP8AFE).
4. Low pressure and water level in both OTSGs.

An additional indication which is not readily quantifiable but would nevertheless occur is the resultant sound of the break and subsequent blowdown. For a break of the size postulated here, the noise would be audible throughout the plant and the doors between the Intermediate Building and Turbine Building would be forced open.

An immediate action in plant abnormal transient procedure ATP-1210-1, "Reactor/Turbine Trip" instructs the operator following a reactor trip to verify that the Integrated Control System (ICS) is automatically running back main feedwater (MFW) flow. If the ICS is not controlling MFW flow, the operator is instructed to manually control the MFW regulating valves and run MFW back to control OTSG level. If MFW flow is still excessive as indicated in the Control Room, the operator is instructed to trip both main feedwater pumps by tripping off steam supply to both MFW pump turbines. (Following this, the emergency feedwater pumps

*NOTE: SP8AFE would give a low feedwater flow indication due to the extremely low system resistance for flow through the break in the "B" loop into the Intermediate Building.

automatically start to feed both OTSGs.) Tripping of both MFW pumps also automatically closes both MFW pump discharge valves (FW-V-1A & B) and therefore isolates the flow to the break inside the Intermediate Building. The flood level of the Intermediate Building would reach no higher than the elevation of 295'-8" within 25 minutes which is more than enough time to perform the above operator action. This flood level will not jeopardize the function of the emergency feedwater system.

In addition, if there is a feedwater line break inside the Intermediate Building, both high level alarms for emergency feedwater pump room "A" and "B" sumps will be annunciated in the Control Room. This will also assist the operator to identify flooding of the Intermediate Building.

The design basis for the features described are contained in TDR-250 Rev. 1 which was provided to NRC in March 1985 and was placed in the docket by the NRC staff at that time.

A single indicator malfunction would not lead to immediate operator action. Twenty five minutes is available in a worst case scenario for diagnosis and operator action. Also as indicated above a variety of instruments are also available for cross-checking. With an accident of this magnitude, an operator would not respond to a single instrument indication to perform an action.

During Cycle 6 refueling the alligator pit level alarm will be installed using Class 1E components and environmentally qualified for a FW line break but not redundant. The level sensor will not be qualified for submergence since they will have completed their alarm function prior to submergence.

Reference: GPUN letter dated 4/13/84 (5211-84-2095), GPUN Letter dated 4/29/85 (5211-85-2057) and GPUN letter dated August 1, 1984 (5211-84-2193).

<u>ITEM 4</u> What are the additional hazards and/or effects on safety-related systems in the intermediate building (especially the emergency feedwater system) with the storage of hydrogen and oxygen calibration gas bottles in the vicinity of safety-related equipment?

<u>RESPONSE</u> A Reagent, Test, and Calibration gas are used in the operation of the H_2 Monitor. The storage locations (in compartments surrounded by reinforced concrete walls) for the gas cylinders used are (1) in the Intermediate Building, Elevation 295', south of the "B" Instrument Air Compressor and (2) Intermediate Building, Elevation 322' cubicle south of Intermediate Building Fan AH-E-73.

The Reagent gas at elevation 295' and 322' is a mixture of 99.6% Oxygen (224.1SCF) and 0.4% Nitrogen (0.9 SCF) and is stored in a size "B" cylinder.

The Test gas at elevation 295' is a mixture of 4% Hydrogen (8.4 SCF) and 96% Nitrogen (200.6 SCF) and is stored in a size "B" cylinder.

The Calibration gas at elevation 295' is a mixture of 10.3% Hydrogen (21.5 SCF) and 89% Nitrogen (187.5 SCF) and is stored in a size "B" cylinder.

The Calibration gas at elevation 322' is a mixture of 8.86% Hydrogen (18.5 SCF) and 91.4% Nitrogen (190.5) and is stored in a size "B" cylinder.

The National Fire Protection Association (NFPA) Standard for Bulk Oxygen Systems at Consumer Sites (NFPA-50), 1985 edition, states in Section 1-2.4 that the standard does not apply to Oxygen Storage Systems having capacities less than 20,000 standard cubic feet. Therefore, NFPA-50 requirements are not applicable to the H_2 Monitor oxygen Storage Area.

Since both the test gas and calibration gas cylinders are located in the same area, the total cubic feet storage capacity is to be used to determine applicability with NFPA codes. The Standard for Gaseous Hydrogen Systems at Consumer Sites (NFPA-50A), 1984 edition, states in Section 1-2.5 that the standard does not apply to single systems using containers having a total Hydrogen content of less than 400 standard cubic feet. The H_2 Monitor System has a total Hydrogen content of approximately 30 standard cubic feet (Elev. 295') and approximately 27 standard cubic feet (Elev. 322'). NFPA-50A requirements are not applicable to the H_2 Monitor Hydrogen Storage Area.

A flammable gas or vapor has a flammable range. The flammable range is the spread between the lower and upper flammable limits. For Hydrogen, the Lower Flammable Limit is 4.0%. The upper flammable limit is 75.0%. If the mixture of Hydrogen and air is below the lower flammable limit, it is too lean to burn; also a mixture of Hydrogen and air above the upper flammable limit is too rich to burn. Both Hydrogen cylinders for the H_2 Monitor have concentrations at or near the lower flammable limit (as determined by storage capacity of cylinders). If a leak would develop in the Hydrogen piping/cylinder, the concentrations of Hydrogen gas in the volume of air in the Intermediate Building would be below the lower flammable limits. This would result in a Hydrogen and air mixture too lean to burn. The Hydrogen gas would dissipate to upper elevations since its vapor density is 0.07. The Hydrogen gas may dissipate so rapidly that noticeable/detectable concentrations may not be obtained.

Section 4.5 of NUREG/CR-3551 identifies the concern of pipe whip for the pressurized piping system. It has been determined that pipe whip will not have a detrimental effect on surrounding systems. Normal downstream pressure from the regulator is 25 psig. The piping/tubing from the storage cylinders to the H_2 monitor cabinet has been supported as Seismic Class S1. Storage cylinders are normally received from the supplier at 2265 psig.

If the pressure regulator would fail and result in failure of system piping/tubing, the resul^ would be a small diameter low energy tubing break. Since the storage cylinder has such a small storage capacity, the expended energy from the system would occur over a short time period. The affected zone for the potential pipe whip should be an area approximately 60 inches on either side of the tubing. The normal hanger spacing criteria for this size tubing is approximately 60 inches. The damage resulting from the pipe/tubing whip would be minimal to surrounding systems.

If ignition of a hydrogen leak occurred, it would burn with a short, intense, pale blue flame that is almost colorless. The hydrogen gas may be ignited by the friction experienced by the escaping gas. During normal plant conditions, the H_2 Monitor gas storage area is free of combustible material. The installed ionization detection system will alarm and notify the Control Room of such conditions. With the absence of combustibles in the area, the potential of fire spread is minimal. With minimal fire spread, the operation of the Emergency Feedwater System should not be in jeopardy. Therefore, the installation is acceptable per the codes and the FHA.

References:

1. Flammable Hazardous Materials, Second Edition, James H. Meidl.
2. NFPA-50 "Standard for Bulk Oxygen Systems at Consumer Sites."
3. NFPA-50A "Standard for Gaseous Hydrogen Systems at Consumer Sites."
4. BTP APSCP 9.5-1.
5. OSHA Q1910.252.
6. Code Federal Regulations, Title 49 - Transportation.
7. NUREG/CR-3551 "Safety Implications Associated with In-Plant Pressurized Gas Storage and Distribution Systems in Nuclear Power Plants."
8. TMI-1 Restart Report Supplement 1, Part 3, Question No. 4
9. GPUN letter to NRC, #5211-83-232 dated August 23, 1983 subject: Long Term EFW Mods (NUREG-0737 II.E.1.1)