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ENCLOSURE

EVALUATION OF PLANT-SPECIFIC FEATURES, PROCEDURES, AND TRAINING RELATED TO THE PROPOSED HARDENED WETWELL VENT CAPABILITY AT THE JAMES A. FITZPATRICK NUCLEAR POWER PLANT

1.0 INTRODUCTION

By letter dated July 25, 1990, the Power Authority of the State of New York (PASNY) indicated that a substantial portion of the existing wetwell vent pathway in the reactor building was hardened. The portion of piping, which could rupture under high pressure venting conditions, was located in a separate building outside the reactor building. Since this piping is located outside of the reactor building, PASNY claimed that an adequate hardened vent path presently exists which satisfies the NRC concerns regarding accidents involving loss of decay heat removal capability. PASNY indicated that the piping within the reactor building was fully capable of withstanding the anticipated pressures resulting from venting when it was required by procedures, and meets the NRC staff's objectives for requiring hardened vent capability at James A. FitzPatrick Nuclear Power Plant (FitzPatrick).

On August 22, 1990, the NRC staff visited the FitzPatrick site to inspect the existing wetwell vent path and verify that the piping in the reactor building meets the NRC objectives. The results of the NRC inspection are summarized as follows:

2.0 WALKDOWN

PIPING

The post-accident wetwell vent pathway is the same pathway used during normal venting evolutions. The piping is open to the wetwell air space and contains 24-inch containment isolation valves, with 2-inch bypass valves around the 24-inch valves for pressure control. The piping continues through the reactor building to the reactor building wall and to valves located at the inlet to the standby gas treatment system (SGTS), which is located in a building attached to the outside of the reactor building. The outlet piping of the SGTS is routed to the plant stack. The piping in the reactor building is rated at 150 psi.

Except for the piping in the immediate vicinity of the isolation valves, the piping supports and hangers are designed for dead weight loads only, with supports located approximately 20 feet apart and where there is a directional change in the piping. The seismic portion consists of the wetwell piping out to and including the outer containment isolation valve and a portion of the SGTS piping. Beyond the valves in the SGTS room, the piping changes to sheet metal square ducting, which, in turn, connects to the inlet of the SGTS filter trains. Both the sheet metal ducting and the SGTS are considered to be low pressure boundaries, with rupture expected at a few psig (Nameplate Rating: Maximum Working Pressure - 0.5 psi, Test Pressure - 1 psi, Maximum Operating Temperature - 150F).

SGTS ROOM

Normal entry to the SGTS room is via a single metal door. This door opens into the SGTS room from the railway entrance areas to the reactor building, between the two secondary containment boundary railroad doors (one of which leads to the reactor building and the other leads to the outside). To enter the SGTS room, it is necessary to first pass through one of the railroad doors. These three doors are normally shut and are interlocked.

In an emergency, exit from the SGTS room is possible through a double sheet metal door which opens to the outside.

BYPASS VENT LINE OPERATION

The use of the 2-inch bypass line during high pressure, post-accident venting has been analyzed by the licensee, but venting using the larger valves has not been analyzed. The analysis using the 2-inch bypass indicates that no damage is expected to the vent piping, which is consistent with similar analysis performed by other licensees with Mark I Containments.

MAIN VENT LINE OPERATION

In the event that the 24-inch valves were used as the wetwell vent path rather than the 2-inch valves, it is expected that the low pressure ducting at the inlet to the SGTS system, and the SGTS train enclosure itself, would rupture. This would most likely cause electrical failures of the SGTS equipment in the room since the equipment was not designed to withstand a harsh environment. Because the SGTS room is not vented, the double doors most likely would be forced open by the pressure increase in the room. This should terminate the pressure rise, thereby stopping any further damage to safety-related equipment. Even if the pressure buildup in the SGTS room forced open the door into the railroad access area, it should have no significant effect on the safety equipment in the reactor building since the railroad door would remain shut.

HYDROGEN CONTROL

Aside from the dangers of pressure increases as a result of a rupture, a potential of hydrogen detonation exists in the SGTS room if the water vapor, nitrogen, and hydrogen being vented form a combustible mixture with the air inside the room. Several ignition sources exist and it is possible that the resulting pressure surge may cause damage to the common wall that the SGTS room shares with the reactor building. However, the safety equipment located in the reactor building is not expected to be significantly affected.

PROCEDURES

The following procedures are available should venting of the primary containment become necessary:

EOP-4	Primary Containment Control
F-AOP-35	Post Accident Venting of the Primary Containment
F-OP-20	Standby Gas Treatment System
F-OP-37	Nitrogen Ventilation and Purge; Containment Atmosphere Dilution (CAD); Containment Vacuum Relief and Containment Differential Pressure Systems

Section PC/P (Primary Containment Pressure Control) and Section PC/H (Primary Containment Hydrogen Control) of Emergency Operating Procedure 4 (EOP-4) direct the operator to vent the primary containment using Procedure F-AOP-35. Other actions are also described which are intended to control atmospheric conditions in the primary containment, including hydrogen concentrations. The procedure was written according to the Boiling Water Reactor Owners Group (BWROG) Emergency Procedure Guidelines, Revision 4.

Procedure F-AOP-35 is entered only if EOP-4 requires venting in order to control the primary containment pressure or combustible gas concentrations. The operator is specifically directed to perform the venting evolutions regardless of the radioactive release rate. The operator is directed to use the 2-inch vent valves initially and then, if specified conditions exist, to use the 24-inch vent valves. Venting of the wetwell would be started initially, followed by venting of the drywell if necessary.

Procedure F-OP-20 contains steps for automatic and manual operation of the SGTS under normal and abnormal plant conditions.

Procedure F-OP-37 describes operator actions for using the Containment Atmosphere Dilution (CAD) system to vent the primary containment while adding nitrogen. The system uses the same piping and valves described in other venting procedures.

OPERATOR TRAINING AND UNDERSTANDING OF PROCEDURES

Operators showed a firm understanding of the significance of the required wetwell venting. In order to preclude containment rupture, they would expeditiously initiate venting when required by the procedures, irrespective of the radioactive release concerns. However, based on operator interviews, the staff concludes that: (1) operators are untrained regarding venting consequences and do not expect a rupture in the SBGT portion of the venting pathway; (2) operators are not familiar with other methods expected to be employed to stretch out the time to reach containment failure pressure and other decay heat removal pathways; (3) present simulator scenarios involving loss of decay heat removal sequences do not result in containment venting; and (4) procedural guidance is not provided to determine when to secure venting once it has been started. In addition, the procedures do not clearly indicate the conditions which would require use of the drywell, suppression chamber, or both, vent paths. Also, F-AOP-35 contains human factors weaknesses which could prove detrimental to operator use of the procedure.

3.0 EVALUATION

The NRC staff's evaluation of FitzPatrick's existing wetwell vent path indicates that the existing vent design does not fully meet the hardened vent general design criteria (Letter from NRC to BWR Owners Group, dated April 16, 1990). We have evaluated the deviations in design and their impact on safe and adequate venting to assure that the desired reduction in the frequency of core damage can still be achieved.

Criterion (a): The vent shall be sized such that under conditions of (1) constant heat input at a rate equal to one percent of rated thermal power (unless lower limit justified by analysis), and (2) containment pressure equal to the primary containment pressure limit (PCPL), the exhaust flow through the vent is sufficient to prevent the containment pressure from increasing.

The FitzPatrick hardened vent is sized to prevent the containment pressure from increasing, when a constant input of energy occurs at a rate equal to one percent of rated thermal power and when containment pressure approaches the primary containment pressure limit specified in the procedures. Since the capability of the vent when the bypass line is used is inadequate to satisfy the capacity requirement, only the use of the main vent was considered acceptable in satisfying Criterion (a).

Criterion (b): The hardened vent shall be capable of operating up to the PCPL. It shall not compromise the existing containment design basis.

Criterion (f): The hard vent path shall be capable of withstanding, without loss of functional capability, expected venting conditions associated with the TW Sequence.

The vent piping consists of piping with different schedules, but all piping is at least Schedule 10. The schedule varied with line diameter but the pressure rating is a constant 150 psi. The piping up to the SGTS room is capable of withstanding, without loss of functional capability, all expected venting conditions. However, the vent design deviates from the design criteria due to the SGTS, which is designed to handle pressures of a few psi only. At greater pressures the system will rupture. The probable pressure relief path from the SGTS room will be through the double door to the outside, resulting in a ground level release of fission products. The NRC staff estimates related to NUREG-0851 studies indicates that the radiological consequences of noble gas releases are small compared to the averted consequences used in the NRC staff's backfit analysis. Therefore, the benefits of elevated release of noble gases are not expected to be significant.

Since the SGTS trains are expected to fail during venting, the criteria (b) and (f) are not fully met. However, the damage of SGTS outside the reactor building could be an acceptable deviation, pending completion of IPE.

Criterion (c): The hardened vent shall be designed to operate during conditions associated with the TW sequence. The need for station blackout venting will be addressed during the IPE.

The licensee has not addressed this Criterion.

Criterion (d): The hardened vent shall include a means to prevent inadvertent actuation.

To prevent inadvertent actuation of the vent, the plant relies on operator training and adherence to the EOPs. Upgrading procedures to address actions resulting from the consequences of using the vent path, once these conditions are analyzed and the results determined, would enhance operator awareness and ability to handle such conditions, and could decrease the potential for inadvertent actuation under adverse conditions. Therefore, the staff believes that procedure changes should be addressed as soon as practicable. The staff concludes that the existing design does not meet Criterion (d).

Criterion (e): The vent path up to and including the second containment isolation barrier shall be designed consistent with the design basis of the plant.

The second containment isolation barrier consists of the piping up to and including the second outboard isolation valve. Since the equipment in this vent path has not been modified by the licensee, it continues to meet the design basis of the plant. Therefore, the design meets criterion (e).

Criterion (g): Radiation monitoring shall be provided to alert control room operators of radioactive releases during venting.

The capability to monitor the radiation level for releases during venting was not addressed by the licensee because it was assumed that the operators would vent irrespective of the radiological consequences. The staff concludes that the existing design does not meet design Criterion (g).

Criterion (h): The hardened vent design shall ensure that no ignition sources are present in the pipeway.

Because the equipment in the SGTS room will remain energized from the safety bus, there exist sources which could ignite the hydrogen released in the room as a result of rupture of the SGTS. Therefore, there is a potential of a hydrogen deflagration upon rupture of the SGTS ducts.

The procedures do not consider the potential damage to the SGTS resulting from using a particular vent path. Also, in the recovery phase, the procedures do not require a check for possible damage to the SGTS or the SGTS room, nor is there a requirement to check the atmospheric conditions in the room. In fact, there is no method of sampling the atmosphere in the SGTS room without opening one of the access doors. It was noted that the outside door cannot be opened from outside the building, because the outside door handles have been removed. The staff concludes that the existing design does not meet Criterion (h).

4.0 CONCLUSION

The wetwell venting pathway at FitzPatrick has been found to be hardened between the primary containment and the location outside the reactor building (SGTS room). The piping would remain intact within the reactor building. The safety-related equipment located in the reactor building will not be damaged due to wetwell venting, and will be available to bring the plant to a safe condition and maintain it in that condition for an extended period of time.

The vent pathway does not completely meet the hardened vent criteria as defined by the staff. The venting is expected to result in the loss of the SGTS and, as a minimum, will result in a ground level release of contamination rather than a desirable elevated release through the plant stack. However, the differences in the consequences of ground level release and the elevated release are not expected to be significant when compared to the risk averted by venting.

The staff finds that the capabilities of the existing wetwell vent path acceptable to meet most of the safety objectives of a primary containment hardened wetwell vent, and the existing venting capability is expected to achieve the desired reduction in core damage frequency. It is, therefore, reasonable that PASNY should be allowed sufficient time to properly integrate the results of its IPE program into its decision to fully implement the approved hardened vent general design criteria.