UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 14 TO FACILITY OPERATING LICENSE NO. NPF-58

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY, ET AL.

PERRY NUCLEAR POWER PLANT, UNIT NO. 1

DOCKET NO. 50-440

1.0 INTRODUCTION

Technical Specification (TS) 3.6.2.6 of the Perry Nuclear Power Plant (PNPP) Unit 1 TS requires that drywell average air temperature shall not exceed 135°F. It further requires that, if drywell average air temperature exceeds 135°F, the licensees shall reduce the average air temperature to within limits within 8 hours or be in the HOT SHUTDOWN condition within the next 12 hours and in COLD SHUTDOWN within the following 24 hours. By letter dated July 12, 1988, the Cleveland Electric Illuminating Company, et al. (licensees), submitted an application to change the drywell average air temperature limit from 135°F to 145°F. They also proposed to change the related Bases. The licensees have performed an analyses of the effect of this change on peak drywell and containment temperatures and pressures, drywell and containment structural design analysis, equipment and components and suppression pool swell loads, and have determined that no adverse safety consequences would exist if this change were approved.

2.0 DISCUSSION AND EVALUATION

The licensees evaluated the following effects of the proposed TS change:

A. Effect of Higher Initial Drywell Temperature on Drywell and Containment Responses

1. Peak Drywell and Containment Temperatures

Increasing the drywell average air temperature to 145°F would not challenge the design temperature of 330°F for the drywell during the period following a Loss-of-Coolant Accident (LOCA). As identified in the Updated Safety Analysis Report (USAR) Section 6.2.1.1.3.3.5.1, a small break LOCA (SBLOCA) would impose the most severe temperature conditions on the drywell structures and the safety equipment in the drywell, for the longest time period. The thermodynamic process associated with blowdown of primary system fluid is one of constant enthalpy. If the primary system rupture is so located that the blowdown flow consists only of reactor steam, the resultant steam temperature is significantly higher than the temperature associated with a liquid blowdown. This is because the constant enthalpy depressurization of high-pressure, saturated steam results in superheated conditions.

In the safety analysis, the peak drywell temperature is assumed to be the same as the drywell design temperature; see USAR Table 6.2.-1. As noted in USAR Section 6.2.1.1.3.3.5.4, the design temperature for the drywell is determined by finding the combination of primary system pressure and drywell pressure that produces the maximum superheat temperature during a SBLOCA. The maximum drywell temperature occurs when the reactor steam has undergone a constant enthalpy depressurization to approximately 450 psig and the drywell pressure is at its maximum. For design purposes, it is assumed that the drywell is at 15 psig. This combination of pressures produces the maximum possible superheated steam temperature of 330°F. Due to the theoretical and conservative nature of this calculation, this 330°F is independent of the initial drywell temperature condition.

Peak containment temperatures are unchanged due to a 10°F drywell temperature increase. Peak containment temperature is controlled by suppression pool temperature. As noted in USAR Sections 6.2.1.1.3.3.5.2, 6.2.1.1.3.3.1.6 and 6.2.2.3.1, suppression pool temperature peaks when the residual heat removal (RHR) heat exchanger heat removal rate equals the decay heat release rate. The conservative analyses contained in the USAR (LOCA, loss of offsite power (LOOP), single diesel failure, minimum ECCS, only one RHR heat exchanger, RHR heat exchanger fully fouled, no heat losses other than through the RHR heat exchanger) show that peak suppression pool temperatures occur at about 6 hours post-LOCA, when this equilibrium is reached. The energy addition to the suppression pool from a 10°F drywell air temperature increase is negligible compared to the energy contributed from the LOCA blowdown and decay heat (see USAR Table 6.2-8). Also, the drywell air is carried over to the suppression pool early in the event, well before the RHR heat exchanger capability is challenged.

2. Peak Drywell and Containment Pressures

As described in USAR Section 6.2.1.1.3.3.5.2, for drywell design purposes, the small break LOCA results in a drywell pressure increase at a rate dependent upon the size of the steam leak. Following a reactor scram and containment isolation, the drywell pressure increase lowers the water level in the annulus until the level begins to clear the vents. At this time, air and water start to enter the suppression pool. The steam is condensed and the air carries over to the containment free space. The air carry-over results in a gradual pressurization of the containment at a rate dependent upon the size of the steam leak. Once all of the drywell air is carried over into the containment, short term containment pressurization ceases and the system reaches an equilibrium condition. The drywell contains only superheated steam and continued blowdown of reactor steam is condensed in the suppression pool.

If the drywell air temperature is raised from 135°F to 145°F, the resulting initial air density is lower. If a design basis accident (DBA)-LOCA occurs, the peak drywell pressure would be lower than when the initial drywell temperature is 135°F. In the USAR, as described above, the drywell air is assumed to be swept into the containment during a DBA-LOCA. Thus, the calculated peak drywell pressure currently in the USAR is actually independent of the initial drywell air temperature. Hotter initial drywell air also results in a lower air mass within the drywell. The USAR assumed that the initial drywell air is swept into the containment in a DBA-LOCA, and this lower drywell air mass would result in a reduction of the peak containment pressure of 11.31 psig.

B. Effect of Higher Initial Drywell Temperature on Structural Design and Analysis

The effects of increasing the average drywell temperature from 135°F to 145°F on drywell structural design were evaluated by the licensees. Structures including the drywell top slab; reinforced concrete cylinder; vent structure; steel platforms; supports for cable tray, conduit and ducts; biological shield wall; and the drywell liner were evaluated and all were found to be acceptable for the increased temperature. Hot fluid drywell penetrations were also evaluated to assure that the increase in drywell temperature would not cause any penetration to exceed American Society for Mechanical Engineers (ASME) Code Division 2 allowable temperatures. The evaluations concluded that no penetrations exceeded the ASME Code allowables.

C. Effect of Higher Initial Drywell Temperature on Equipment and Components

Equipment aging and operability assessments were conducted by the licensees for equipment, components and piping which would be exposed to the higher drywell average air temperature. The results concluded that all the items would remain operable at 145°F and would perform their intended safety function. The only potential impact would be the accelerated aging of some equipment such as seals, solenoid valves and limit switches. This would result in the need to replace these components at an earlier date than presently scheduled by the licensees' Equipment Qualification (EQ) program. The licensees will continue to monitor the environmental temperatures through their Environmental Monitoring Program to ensure the timely replacement of these items prior to exceeding their new qualified life.

The EQ assessments conservatively assumed that the items under evaluation would remain at 145° on a continuous basis year-round. Use of this assumption resulted in the shortest recommended maintenance interval for items inside the drywell being 4 years, which is substantially greater than one operating cycle. The majority of items remained qualified for the 40-year life of the plant. The items whose recommended maintenance

intervals would change based on the 145°F assumption include solenoid coils for valve actuators (5 years to 4 years), an epoxy potting compound used for sealing of junction boxes (40 years to 23 years) and limit switch housing gaskets and o-rings (12 years to 6 years).

As noted in paragraph A. above, the post-LOCA temperatures and pressures in drywell and containment are unchanged or reduced as a result of the initial drywell temperature increase. Therefore, the original USAR analyses remain bounding, and the LOCA EQ profiles are still valid.

D. Effect of Higher Initial Drywell Temperature on Pool Swell Loads

Initial drywell temperature is not significant with respect to hydrodynamic loads due to LOCA or safety relief valve (SRV) actuation. Reviews of loads including pool swell, vent flow, condensation oscillation, chugging, and SRV loads such as SRV discharge line reflood height, were performed by the licensees. The reviews showed either no effect or only a negligible effect on any of these phenomena.

Based on these evaluations, the licensees concluded that the higher drywell average air temperature will not adversely affect any design/operational considerations and that Perry Unit 1 will continue to be in compliance with all General Design Criteria of 10 CFR Part 50, Appendix A.

Based on its review of the licensees' analyses of the effects on increasing the drywell average air temperature limit, the staff concludes that the licensees have adequately addressed all areas of potential safety significance. These include the effect of initial drywell temperature on accident temperature, pressure and loads; past accident equipment qualification; and on equipment aging. The licensees' analysis and conclusions with respect to these issues are consistent with the NRC staff review and conclusions in the case of two similar reviews (i.e., Fermi-2 and River Bend). The staff agrees that the only significant effect of the drywell temperature change is on equipment aging. The staff also concludes that the licensees' analyses of the effect on aging and the incorporation of these effects and their resultant changes on expected equipment life into the Perry environmental monitoring program will continue to assure that the quality and reliability of drywell equipment is maintained.

3.0 EMERGENCY CIRCUMSTANCES

The licensees have provided arguments with respect to the emergency circumstances existing with respect to the amendment request as follows:

Last summer (1987) was the first summer in which the Perry Nuclear Power Plant operated in Operational Condition 1. However, the plant was still in the Startup Test Program and did not have extended operation periods, nor extended periods of operating at high power levels during the summer months. In fact, the plant was in a major maintenance outage from July 3, 1987 to August 21, 1987. Therefore, no problems with maintaining drywell average air temperatures below 135°F were experienced.

Although Perry has not yet experienced any derating of the plant because of drywell average air temperature, the plant has entered and is in a Technical Specification Action Statement which requires the reduction of average air temperature to 135°F "within 8 hours or be in at least HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN within the following 24 hours."

Although previous reviews of drywell heat load calculations with all plant systems operable at full power had identified the potential for difficulties in meeting the current Technical Specification limit, the licensees felt that special system lineups including the running of additional fans would allow the plant to operate during this current summer period. These contingency measures would result in higher in-plant use of generated power, but would allow for this Technical Specification change request to be processed on a normal time schedule. Recent events indicate that this is not sufficient. Lake temperatures have been rising more rapidly than normal this summer due to the elevated temperatures and lower lake levels during the drought. Higher lake water temperatures lead to decreased efficiency of the drywell air coolers, which act as heat exchangers inside the drywell. On the morning of July 9, 1988, temperatures of the water drawn from the lake increased significantly from 70°F to 75°F within several hours. By Sunday, July 10, at 1825 hours, intake water temperatures had reached 77°F and drywell average air temperature was over 134°F. Plant operators maximized cooling water flow to the drywell air coolers and aligned the drywell fans to the configuration that has resulted in the lowest temperatures. This configuration utilizes four fans rather than the three normally in use. Operators were able to reduce drywell temperatures below 133°F temporarily, but by Monday morning, July 11, 1988, the temperature had returned to nearly 134°F. At 1652 hours on July 12, 1988 drywell average air temperatures could no longer be maintained below 135°F, and the Technical Specification 3.6.2.6 Action Statement was entered.

As discussed above, the licensees believed until recently that system operating configurations would allow the plant to continue to operate at least for the time period necessary to process a Technical Specification change request under the normal notice and comment process. Historical lake temperature maximums occur in the month of August. Engineering design changes and maintenance efforts to alleviate the temperature concerns have been actively pursued. All efforts to maintain and reduce temperature through maximizing system flow rates are being pursued, but these actions have not been effective in maintaining the drywell air temperature below the Technical Specification limit of 135°F. Unexpected lake temperature increases over the last several days have accelerated the time frame for the need of this amendment.

The staff has evaluated the licensees' arguments concerning emergency circumstances and has determined that the need for immediate relief from the TS under consideration could not have been anticipated by the licensees and that, therefore, as defined by 10 CFR 50.91(a)(6) valid emergency circumstances exist.

4.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION:

The standards used to arrive at a determination that a request for amendment requires no significant hazards consideration are included in the Commission's Regulations, 10 CFR 50.92, which states that the operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated, (2) create the possibility of a new or different kind of accident from any accident previously evaluated, or (3) involve a significant reduction in a margin of safety.

The licensees have provided the following discussion as to whether the proposed change involves a significant hazards consideration:

1. The proposed change to increase the drywell average air temperature to 145°F does not involve a significant increase in the probability or consequences of an accident previously evaluated. The change does not involve a physical modification to the plant or a change in operating practices. The change does involve a change in the limiting conditions for operation, and has been evaluated against environmental qualification requirements, drywell concrete design requirements, the balance of safety-related mechanical and electrical equipment in the drywell and the bounding safety analysis accident (LOCA). Operation at the proposed higher temperature would potentially impact some equipment by accelerated aging. This would only result in the need to replace some components at an earlier date. Equipment and component operability, however, would not be affected and the intended safety function performance would not be degraded.

   Thus, there is no significant increase in the probability or consequences of an accident previously evaluated.

2. The proposed change to increase the drywell average air temperature to 145°F does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change will not impact plant performance and will not provide an opportunity for the plant to enter a condition not previously evaluated.

   Thus, the change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. The proposed change to increase the drywell average air temperature to 145°F does not involve a significant reduction in a margin of safety. By increasing the drywell average air temperature for normal operations, there is no significant impact on the hydrodynamic loads or the containment response during a LOCA. The analysis indicates that the peak drywell pressure and peak containment pressure actually decrease with the increase in drywell temperature. The margin of safety in maintained with the increase in drywell average air temperature

Analysis also indicates that the increase in average drywell temperature to 145°F will not cause any drywell structural components to exceed ASME Code allowables, and that drywell equipment operability would not be detrimentally affected by the proposed increase in drywell temperature.

Thus, the change does not involve a significant reduction in a margin of safety.

The staff has reviewed and concurs with the licensees' arguments with respect to significant hazards consideration. The staff has determined that the licensees have adequately analyzed the effects of the proposed change and adequately determined its safety significance. The only significant effect will be that on equipment aging. The licensees have conservatively quantified the effect on reduced equipment life and have incorporated these effects into their Environmental Monitoring Program. Accordingly, based on the above discussions, the Commission has determined that the proposed amendment involves no significant hazards considerations.

5. STATE CONSULTATION

The staff made a good faith effort to contact the State of Ohio on July 13, 1988 to obtain comment on this amendment request. None of the state representatives were available.

6.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or a change to a surveillance requirement. The staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has made a final no significant hazards consideration finding with respect to this amendment. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

7.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

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