Consumers Power

POWERING MICHIGAN'S PROGRESS

Palisades Nuclear Plant: 27780 Blue Star Memorial Highway, Covert, MI 49043

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DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT
VSC-24 - VENTILATED STORAGE CASK - REQUEST FOR INFORMATION REGARDING 2.206 PETITION

By letter dated June 20, 1996, the NRC requested information regarding issues raised in the 2.206 Petition dated September 19, 1995. This letter provides the requested information.

The attachment to this letter lists each of the individual requests for information and provides the Consumers Power Company response.

SUMMARY OF COMMITMENTS

This letter contains no new commitments and no revisions to existing commitments.

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Manager, Licensing

CC Administrator, Region III, USNRC
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NRC Resident Inspector - Palisades

Attachment

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ATTACHMENT

CONSUMERS POWER COMPANY
PALISADES PLANT
DOCKET 50-255

**RESPONSE TO REQUEST FOR INFORMATION
BY NRC LETTER (DATED JUNE 20, 1996)
CONCERNING 2.206 PETITION, CASK UNLOADING PROCEDURE**

Response to Request for Information
by NRC letter (dated June 20, 1996)
Concerning 2.206 Petition, Cask Unloading Procedure

Below is the response from Consumers Power Company concerning the Request for Information by letter dated June 20, 1996.

Background

The Certificate of Compliance for the VSC-24 System, Section 1.1.7, "Requirement for First Cask in Place," directed the loading of the design basis heat load (24 kW) into the first cask placed in service. This section further specified provisions should the first user not have fuel capable of producing a 24 kW heat load. Palisades did not have spent fuel capable of producing a 24 kW heat load. The Nuclear Regulatory Commission (NRC) was informed of this fact prior to Palisades loading the first cask (VSCC-01) in May 1993. The maximum heat load loaded at Palisades to date is 11.94 kW loaded in cask No. VSCC-01. This heat load is the current bounding case for Palisades; therefore, all revisions of Palisades loading/unloading procedures support this bounding heat load.

General Response

The evaluations performed to support Palisades Nuclear Plant Permanent Maintenance Procedure FHS-M-34, "Unloading the Multi-assembly Sealed Basket," Revision 1, cannot be used to judge the acceptability of Revision 0 of the same procedure. Fundamental differences exist in the Multi-Assembly Sealed Basket (MSB) cooling process between the two revisions. Most significantly, the Revision 0 unloading cooling process is regulated based on the MSB pressure, whereas the Revision 1 unloading cooling process is based on a set cooling water flow rate. It was implicitly assumed in the Revision 0 unloading cooling process that the cooling flow rate may need to be adjusted and even stopped for short periods of time to maintain the MSB pressure within the administrative limit.

During process enhancement efforts in preparation for the unloading of Multi-Assembly Sealed Basket No. 4 (CMSB-04), it was recognized that the Revision 0 unloading cooling process could take an extended period of time to complete and would require significant operator attention to adjust the water flow rate to regulate the MSB pressure. As such, alternate MSB cooling approaches were investigated. To simplify the engineering analyses required to support the evaluation of these alternate cooling approaches, conservative assumptions and methodologies were developed. These assumptions include but are not limited to:

a. MSB temperatures are determined assuming no heat transfer through the top or bottom of the MSB. This assumption simplifies the heat transfer analyses and conservatively estimates the MSB temperatures and hence the amount of heat that must be removed in the cooling process.

b. MSB temperatures are determined using a horizontal slice through the hottest section of the fuel. This assumption simplifies the heat transfer analyses, conservatively estimates the temperatures at the bottom and top of the MSB and, hence, the amount of heat that must be removed in the cooling process.

c. The rate of heat transfer to the cooling water and, hence, the rate of steam generation is calculated based on conservative heat transfer coefficients. This simplifies the heat transfer analyses and conservatively estimates the steam flow rate through the Swagelok valve.

d. During the steady-state fill-up, cooling water entering the MSB is conservatively assumed to become instantly saturated water. In reality, the water enters the MSB at 100°F and will absorb heat from the MSB to reach saturated water conditions. This assumption was used to establish an upper bound on the steam generation rate during the steady-state fill up phase of the unloading cooling.

e. Credit is not taken for heat transfer as the steam passes through the hotter section of the MSB. This simplifies the heat transfer and steam flow analyses and conservatively estimates the steam flow rate through the Swagelok valve.

The summation of the above conservatisms resulted in the apparent need for a larger vent path to accommodate the calculated pressure accumulation within the MSB. This conservative approach was deemed necessary for the first cask unloading. The unloading process for CMSB-04 includes extensive monitoring of the critical cask parameters during the unloading cooling process (MSB pressure, cask inlet flow, discharge water temperature, and MSB internal water temperature). The intention for this monitoring was to collect data which would be used to further refine the unloading cooling process.

Specific Response to Questions

Question

1. *Assuming the MSB contains fuel with the design heat load (24 kilowatts), would it be possible to cool the MSB to support the unloading process using the original cask vent design (e.g., Swagelok valve)? In responding to this question, describe the assumptions you make in order to evaluate the cooling process.*

Explain, if applicable, where my evaluation of the data as described in the Background is in error.

Response:

As discussed above, the procedures at the Palisades Nuclear Plant solely support those activities intended to be conducted at this facility. The Palisades responses will justify the adequacy of the original cask unloading procedure (Revision 0) for our bounding case of 11.94 kW.

The 0.035 kg/sec steam rate noted on Page 16 of Attachment 2 (EA-SC-93-083-04, "Evaluation of Multi-Assembly Sealed Basket (MSB) Unloading Process," Revision 0) is based on a fixed water flow rate of 8 gpm. Although, the conservative analyses prepared to evaluate Revision 1 of FHS-M-34 cannot be applied directly to evaluate Rev. 0, some of the information provided in these analyses can be used to develop a bounding estimate of the steam generation rate during the steady-state fill up phase of the unloading cooling process. Using the methodology outlined on page 16 of Attachment 2, we estimate that the water flow rate during the steady-state fill up phase of the Rev. 0 unloading process would be 1.5 to 2.0 gpm. This flow rate would be adequate for the fill up and cooling of the MSB. Because of the lower flow rate, the MSB fill up would take a longer period of time.

It should be noted that the data presented on Attachment 6 ("Maximum Fill Rate vs. Discharge Temperature") to Attachment 2 is based on complete flashing of the fill water to steam. As shown on page 16 of Attachment 2, during the steady-state fill up of the MSB, only a portion of the incoming water turns to steam. As such, the above calculated flow rate should not be directly compared to the graphs in Attachment 6 to Attachment 2.

The Background section of the June 20, 1996, correspondence attempts to correlate the data in Attachment 6 ("Maximum Fill Rate vs. Discharge Temperature") to Attachment 2 and Attachment 8 ("Time to Cool Cask to 120°F vs. Flow") to Attachment 2. These attachments can not be directly compared because they describe the vent system response during two different phases of the MSB cooling process. The analysis supporting Attachment 6 was prepared to investigate the steam venting capabilities during MSB cooling and fill up. The analysis conservatively assumes that all the fill water flashes to steam. The analysis supporting Attachment 8 investigates the heat removal from the MSB once the fill up phase is complete and the MSB is filled with water (steam is no longer being produced during this phase of the unloading cooling). The flow rate on Attachment 8 is a water flow rate through the Swagelok valve. Based on vendor data, the flow capacity of the Swagelok valve is approximately 6 gpm. From Attachment 8 it can be seen that this flow rate is adequate to support cooling of the MSB to 120°F.

Based on discussions with the VSC-24 cask vendor, Sierra Nuclear Corporation (SNC), our consensus is that if the flow rate is sufficient to dissipate 24 kW, the system will be eventually cooled to the point of no boiling. Assuming that water is supplied at the rate of Swagelok venting capacity (0.012 kg/sec at 38.3 psig) the heat required to evaporate the water is:

heatup + evaporation =[4.2 kJ/kg°K (414°K - 310°K) + 2190kJ/kg]· 0.012kg/sec = 31.5 kW,

which is higher than 24 kW and, therefore, the MSB can be reflooded.

In summary, Revision 0 to FHS-M-34 was based on the use of administrative controls to regulate the MSB pressure during cooling. This approach is significantly different than the cooling process employed by Revision 1 to FHS-M-34.

The unloading cooling process using Revision 0 would have taken longer to cool and fill the MSB than the approach described in Rev. 1 but either approach would be successful.

<u>Question</u>

2. *Revision 0 of the unloading procedure restricted the pressure in the cask to no more than 10 PSIG. If you consider this additional restriction, and again assuming the MSB contains fuel with the design heat load (24 kilowatts), would it be possible to cool the MSB to support the unloading process using the original cask vent design? In responding to this question, describe the assumptions you make in order to evaluate the cooling process.*

<u>Response:</u>

As discussed above, the procedures at the Palisades Nuclear Plant solely support those activities intended to be conducted at this facility. The Palisades responses will justify the adequacy of the original cask unloading procedure (Revision 0) for our bounding case of 11.94 kW.

Since the Revision 0 unloading procedure was based on administrative controls rather than a pre-selected flow rate, detailed analyses were not required to demonstrate acceptability of the process. The 10 psig maximum pressure identified in Revision 0 is a conservative administrative limit that is not based on design basis requirements. Although a maximum allowable pressure is not provided as part of the original MSB documentation, Section 11.2.7 of the VSC-24 System Safety Analysis Report (SAR) does identify an accident pressure of 34.6 psig and shows that the stresses resulting from this pressure are well below code allowables. As such, although an administrative limit was placed on the process, this limit was not considered critical to the successful implementation of the procedure. If during the unloading process using Revision 0, the administrative limit had been identified as too restrictive, sufficient information existed in the VSC-24 System SAR to justify an increase in the maximum pressure during unloading cooling. Adequate administrative controls for changes to the procedure existed to allow this administrative limit to be increased, if necessary.

Again, based on discussions with SNC, our consensus is that even at the more restrictive pressure of 10 psig, sufficient flow is available to cool the MSB. At 10 psig (saturated steam temperature 240°F or 388°K) the Swagelok capacity is 0.155 gpm (0.010kg/sec) and the heat removal capability becomes:

heatup + evaporation =[4.2 kJ/kg°K (388°K - 310°K) + 2190kJ/kg]· 0.010kg/sec = 25.2 kW,

This value is higher than 24 kW generated in the system, hence, cooldown is still possible although it would take a long time.