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ILLINOIS POWER

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Docket No. 50-461

Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Clinton Power Station's (CPS) Response to Generic Letter (GL) 92-01, Revision 1, "Reactor Vessel Structural Integrity"

Dear Sir:

This letter provides Illinois Power's (IP) response to GL 92-01, Revision 1, dated March 6, 1992. GL 92-01, Revision 1, was issued by the Nuclear Regulatory Commission (NRC) to obtain information needed to assess compliance with requirements and commitments regarding reactor vessel integrity. IP's response to the request for information, which is broken into three specific areas, is provided below.

Request 1 -

Certain addressees are requested to provide the following information regarding Appendix H to 10 CFR Part 50:

Addressees who do not have a surveillance program meeting ASTM E 185-73, -79, or -82 and who do not have an integrated surveillance program approved by the NRC, are requested to describe actions taken or to be taken to ensure compliance with Appendix H to 10 CFR Part 50. Addressees who plan to revise the surveillance program to meet Appendix H to 10 CFR Part 50 are requested to indicate when the revised program will be submitted to the NRC staff for review. If the surveillance program is not to be revised

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to meet Appendix H to 10 CFR Part 50, addressees are requested to indicate when they plan to request an exemption from Appendix H to 10 CFR Part 50 under 10 CFR 50.60(b).

Response -

IP's surveillance program (CPS No. 9846.01 - REACTOR VESSEL IRRADIATED SURVEILLANCE SPECIMEN REMOVAL AND EXAMINATION) is in accordance with Appendix H to 10 CFR Part 50. IP determined this based on a comparison of CPS Procedure No. 9846.01 and the American Society of Testing and Materials (ASTM) Standard E 185. Also, IP's response to GL 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Impact on Plant Operations," dated April 27, 1990 (IP letter U-601633), was reviewed.

It should be noted, however, that there is a slight difference in the procedure withdrawal schedule, which specifies capsule withdrawals at 10 and 20 effective full power years, versus the 6 and 15 effective full power years in ASTM E 185. The ASTM E 185, Table 1 schedule is based on the presumption that the surveillance capsule lead factor is between 1 and 3 effective full power years (see 7.3.1 of ASTM E 185-82). However, the CPS capsules have a lead factor of 0.67. In order to have at least 6 effective full power years of irradiation at the capsule, which is the intent of ASTM E 185, the capsule must stay in the vessel for at least 9 effective full power years. Therefore, the first scheduled withdrawal at effective full power years is consistent with the intent of ASTM E 185.

Request 2 -

Certain addressees are requested to provide the following information regarding Appendix G to 10 CFR Part 50:

a. Addressees of plants for which the Charpy upper shelf energy is predicted to be less than 50 foot-pounds at the end of their licenses using the guidance in Paragraphs C.1.2 or C.2.2 in Regulatory Guide 1.99, Revision 2, are requested to provide to the NRC the Charpy upper shelf energy predicted for December 16, 1991, and for the end of

their current license for the limiting beltline weld and the plate or forging and are requested to describe the actions taken pursuant to paragraphs IV.A.1 of V.C. of Appendix G to 10 CFR Part 50.

b. Addressees whose reactor vessels were constructed to an ASME Code earlier than the Summer 1972 Addenda of the 1971 Edition are requested to describe the consideration given to the following material properties in their evaluations performed pursuant to 10 CFR 50.61 and Paragraph III.A. of 10 CFR Part 50, Appendix G:

(1) the results from all Charpy and drop weight tests for all unirradiated beltline materials, the unirradiated reference temperature for each beltline material, and the method of determining the unirradiated reference temperature from the Charpy and drop weight test;

(2) the heat treatment received by all beltline and surveillance materials;

(3) the heat number for each beltline plate or forging and the heat number of wire and flux lot number used to fabricate each beltline weld;

(4) the heat number for each surveillance plate or forging and the heat number of wire and flux lot number used to fabricate the surveillance weld;

(5) the chemical composition, in particular the weight in percent of copper, nickel, phosphorous, and sulphur for each beltline and surveillance material; and

(6) the heat number of the wire used for determining weld metal chemical composition if different than Item (3) above.

Response -

a) As stated in IP's response to GL 88-11 (U-601633), all reactor vessel beltline materials at CPS were determined to be capable of maintaining their Charpy upper shelf energy above 50 foot-pounds.

b) The reactor pressure vessel at CPS was not constructed to an American Society of Mechanical Engineers (ASME) code earlier than the Summer 1977 Addenda of the 1971 Edition.

Request 3 -

Addressees are requested to provide the following information regarding commitments made to respond to GL 88-11.

a. How the embrittlement effects of operating at an irradiation temperature (cold leg or recirculation suction temperature) below 525°F were considered. In particular licensees are requested to describe consideration given to determining the effect of lower irradiation temperature on the reference [illegible] on the Charpy upper shelf energy.

b. How their surveillance results on the predicted amount of embrittlement were considered.

c. If a measured increase in reference temperature exceeds the mean-plus-two standard deviations predicted by Regulatory Guide 1.99, Revision 2, or if a measured decrease in Charpy upper shelf energy exceeds the value predicted using the guidance in Paragraph C.1.2 in Regulatory Guide 1.99, Revision 2, the licensee is requested to report the information and describe the effect of the surveillance results on the adjusted reference temperature and Charpy upper shelf energy for each beltline material as predicted for December 16, 1991, and for the end of its current license.

Response -

a. Operation with the CPS reactor vessel beltline region below 525°F was not considered in the Appendix G analysis because the steady state operating temperature of the coolant in the beltline region is higher. Based on the temperature in the recirculation suction piping, which draws water directly from the beltline region, the steady state irradiation temperature in the beltline region is greater than 533°F.

Only during startup and in certain cases of operations such as during a loss of feedwater heating, which occurs when feedwater heaters are bypassed or when the turbine is off-line and the reactor steam is routed through the turbine bypass valves, does the beltline experience coolant less than 525°F when the core is critical. The calculated neutron fluence at the beltline region for the plant's expected life of 32 effective full power years is 4.9×10^{18} n/cm^2. The calculated fluence accumulation for startups, over 40 years, is 2×10^{14} n/cm^2. Additionally, it should be noted that the feedwater temperature must decrease from the normal value of 420°F to less than 357°F before the beltline temperature becomes less than 525°F. Based on the occurrence of typical feedwater temperature transients (from operating cycle 2 and 3 data), the estimated fluence accumulated over 40 years at beltline temperatures below 525°F is approximately 1×10^{17} n/cm^2 over 40 years (based on 6 effective full power days per cycle with feedwater temperatures less than 357°F). Therefore, the total fluence due to startup and certain cases of operation with low feedwater temperatures is estimated to be on the order of 1×10^{17}. Thus, the fluence occurring at below normal operating temperature is expected to be a small fraction of the total and should not significantly affect beltline nil ductility reference temperature (RT_{NDT}) or upper shelf energy predictions.

It should finally be noted that since surveillance specimens are exposed to the same temperature conditions as the beltline materials, temperature effects, if any, will be reflected in the surveillance results. When the surveillance results are factored into the Appendix G analysis per Regulatory Guide 1.99, Revision 2, temperature effects, if any, will be accounted for inherently.

b and c These requests are not applicable to CPS because no surveillance testing of vessel material has been conducted.

I hereby affirm that the information in this letter is correct to the best of my knowledge.

Sincerely yours,

J. S. Perry for
J. S. Perry
Senior Vice President

WTD/mfm

cc: NRC Clinton Licensing Project Manager
NRC Resident Office
Regional Administrator, Region III, USNRC
Illinois Department of Nuclear Safety
Kurt Cozens - Nuclear Management and Resources Council