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J.E. Pollock
Site Vice President
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February 27, 2008

Re: Indian Point, Unit No.1
Docket No. 50-003
NL-08-035

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

Subject: **Reply to Request for Additional Information (RAI) Regarding Indian Point 1 License Amendment Request (LAR) for Fuel Handling Building Crane**

References: (1) Letter: F. Dacimo, Entergy to USNRC; "License Amendment Request (LAR)-Unit 1 Fuel Handling Building Crane", License No. DPR-5; Docket No. 50-003, NL-07-033; dated February 22, 2007, ADAMS Accession No. ML070740552.

(2) Letter: T. Smith, USNRC to J. Pollock, Entergy; "Request for Additional Information Regarding Entergy Nuclear Operations Inc. Request for Amendment to Indian Point Unit 1 License for Use of Fuel Handling Building Crane", Docket 50-003; Dated January 31, 2008

Dear Sir or Madam;

Entergy Nuclear Operations, Inc. (ENO) submitted a License Amendment Request (LAR) Reference (1), to the Indian Point Unit 1 Provisional Operating License regarding the use of the Fuel Handling Building crane in support of the Dry Fuel Storage project.

Reference (2) is a second Request for Additional Information (RAI) in order for the USNRC to complete its review of the LAR. The responses to the questions are provided in Attachment 1 of this letter.

The additional supporting information provided in this letter does not alter the conclusions of the no significant hazards evaluation that supports the license amendment request.

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There are no new commitments identified in this submittal. If you have any questions or require additional information, please contact Robert Walpole, Manager, Licensing, at 914-734-6710.

I declare under penalty of perjury that the forgoing is true and correct.

Executed on 2/27/08
Date

Sincerely,

J. E. Pollock
Vice President – Operations
Indian Point Energy Center

Attachment 1: Additional Information for IPEC Unit 1 Fuel Handling Building crane License Amendment Request .

Attachment 2: Second RAI Figures and Tables for RAI IPEC Unit 1 Fuel Handling Building Crane License Amendment Request

cc: Mr. John P. Boska, NRR Senior Project Manager
Mr. Samuel J. Collins, Regional Administrator, Region 1
Mr. Theodore B. Smith, Reactor Decommissioning Branch, Project Manager
Mr. Paul Eddy, Public Service Commission
Mr. Paul D. Tonko, President NYSERDA
IPEC NRC Resident Inspector's Office

ATTACHMENT 1 TO NL-08-035

SECOND RAI
ADDITIONAL INFORMATION FOR IPEC UNIT 1
FUEL HANDLING BUILDING CRANE
LICENSE AMENDMENT REQUEST

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT UNIT NO. 1
DOCKET NO. 50-003

1. Provide the basis for the 1% failure strain limit for stainless steel cladding subjected to the burnup and temperatures of the Indian Point Unit 1 (IP-1) spent fuel.

In response to NRC staff RAIs related to License Amendment Request (LAR) Sections 4.7.1 and 4.7.2, The cask vendor, Holtec International (Holtec) developed a comparative evaluation approach to demonstrate that stainless steel fuel rod integrity is maintained for the 39'-2" drop of the transfer cask onto the impact limiter located on the pool slab. Using the impact results from NUREG-1864, (*A Pilot Probabilistic Risk Assessment of a Dry Cask Storage System At a Nuclear Power Plant,* March 2007) for Zircalloy clad fuel rods; Holtec compared the properties of the Zircalloy rods to those of the stainless steel rods to assert that the NUREG-1864 results bound the IP-1 analysis for the stainless steel rods.

To make the point Holtec constructed a table comparing various metrics of the Zircalloy rods with the stainless steel rods, and asserted by this comparison that the strain in the stainless steel clad fuel rod would be less than the maximum strain experienced by the Zircalloy rod for the same drop height onto a concrete floor. Specifically, it was stated that "The metrics in the above table indicate that results for the NUREG-1864 Reference fuel will bound results for the IP-1 Analysis Basis fuel (i.e., the PI-1 fuel has lower burnup, has fuel rods of lower total weight, has a larger critical buckling load, and requires a smaller lateral movement before contact with the fixed wall of the storage cell." The merits of these four metrics, in-so-far-as they are bounding, are discussed below.

The first metric is that "IP-1 fuel has lower burnup." While it is true that low burnup Zircalloy fuel rods are more ductile than high burnup Zircalloy rods, the problem at hand is not a comparison of two Zircalloy fuel rods with different burnups, but rather a comparison of a high burnup Zircalloy rod with a low burnup stainless steel rod. The ductility of stainless steel rods responds differently to burnup than Zircalloy rods, and some studies have shown that the ductility of stainless steel rods may be quite sensitive to burnup. For this metric to be bounding, therefore, it must be shown that for the burnup and temperature of the IP-1 stainless steel rods the failure strain is above the 1% strain limit used for the Zircalloy rods in NUREG-1864.

With respect to the second, third and fourth metrics, the staff agrees that they are bounding.

RESPONSE TO RAI - QUESTION 1

References:

(1) Nuclear Systems Material Handbook, TID 26666, Volume 1, Section 2, Oak Ridge National Laboratory, 1986

(2) Klueh, R. L. and Grossbeck, M. L.; "Tensile Properties and Swelling of 20% Cold-Worked Type 316 Stainless Steel Irradiated in a High-Flux Isotope Reactor (HFIR)", Effects of Radiation on Materials: Twelfth International Symposium, ASTM STP 870, Philadelphia, 1985, pp. 768-782.

Reference (1) contains information concerning the ductility of irradiated stainless steel. This information shows a constant elongation between 20% and 28% when exposed to neutron fluence up to approximately $2x10^{21}$ n/cm^2, and then reduces to a value between 1% and 3.5% at a fluence of $2x10^{22}$ n/cm^2. The source term calculations performed to calculate dose rates from the IP1 fuel determined that the fluence in the fuel assembly is about $8x10^{21}$ n/cm^2 for a bounding burnup of 30 GWD/MTU. For this value, Reference (1) shows an average total elongation of 15%, and a minimum value of 6%. This is substantially larger than the limit of 1% assumed in the calculations.

The data in Reference (1) is reported for a temperature range of 371 to 649 Deg C (700 to 1200 Deg F). It is not clear whether this is the irradiation temperature or the test temperature. Therefore, to further support the conclusion from Reference (1), additional material was reviewed to obtain information on the temperature influence on the ductility of irradiated stainless steel.

In Reference (2), test results are discussed that cover a temperature range of 285 to 625 Deg C (545 to 1157 Deg F) during irradiation, and 300 and 600 Deg C (572 to 1112 Deg F) during measurement, for an irradiation fluence up to approximately $2x10^{22}$ n/cm^2. These temperature ranges are comparable to, or bound those for the IP1 fuel, where the temperature during irradiation would have been about 300 Deg C (572 Deg F), and an estimated temperature during storage between 100 and 200 Deg C (212 to 392 Deg F) apply.

The studies in Reference (2) show elongations in the range of 5 to 12%, which is consistent with the results from Reference (1). In general, Reference (2) reports that there is little change in uniform and total elongation from irradiation, and that the elongation of the irradiated specimens is generally comparable to those obtained from un-irradiated samples. Only three of the tests resulted in a total elongation below 5%, with a minimum of 1.1%. However, these three tests were at irradiation temperatures of 470 Deg C (878 Deg F) and above, and test temperature of 550 Deg C (1022 Deg F) and above, and are therefore not applicable to the IP1 fuel.

In summary, the data in Reference (1) and (2) indicate that the minimum total elongation would be about 5%, and therefore significantly larger than the value of 1% assumed in the assembly evaluation. The assumption of 1% is therefore valid and conservative.

2. Provide an analysis and evaluation of consequences for the MPC lid drop onto the Transfer Cask flange that conforms to the guidance of NUREG-0612, Appendix A.

Because the IP-1 Fuel Handling Building Crane is not single failure proof, the applicant evaluated the consequences of several hypothetical drops of heavy loads associated with cask loading consistent with the guidance of NUREG-0612 (*Control of Heavy Loads at Nuclear Power Plants, July 1980).* One such event, summarized in Section 4.7.2 (e), is the drop of the MPC lid onto the Transfer Cask flange and subsequent impact of the lid on the fuel basket. The MPC lid, which weighs approximately 10,000 lbs, falls 7.5 feet in air and 14.8 feet in water before impact. The lid is assumed to fall through water in a perfectly horizontal orientation before impacting the cask flange, then rotate and impact the fuel basket. The lid impacts the cask flange at a velocity of 220 in/sec, which is less than the velocity at which the lid enters the water (264 in/sec).

For load drops over spent fuel, NUREG-0612 stipulates that "Analysis should conform to the guidelines of Appendix A." Section A.1 of Appendix A stipulates that "The following should be considered for any load drop analysis... (1) That the load is dropped in an orientation that causes the most severe consequences;" and "(7) The analysis should postulate the 'maximum damage' that could result..."

The analysis in Section 4.7.2(e) assumes the lid falls in a perfectly horizontal orientation through the water. This orientation maximizes the drag forces on the lid, which in turn minimizes the impact velocity on the cask flange, and therefore minimizes the consequences of lid impact on the fuel basket. On-the-other-hand, if the lid falls in a side first orientation, the drag forces are considerably less, the impact velocity significantly higher and the consequences more severe.

RESPONSE TO RAI – QUESTION 2

NUREG-0612 does stipulate that the most damaging orientation be considered when evaluating the consequences of a drop over fuel. However, it is our position that the intent of this statement in Section A.1 of Appendix A in the NUREG is to consider only the most damaging *credible* orientation.

Since the MPC lid is over 5'-7" in diameter, we do not consider it credible that an orientation change of 90 degrees will occur during the small time interval to accomplish the 7.5 ft drop of the lid to the water surface. The axis perpendicular to the lid top surface is a principal axis having the largest moment of inertia. Classical mechanics states that this is a stable axis so that if the lid is subject to small perturbations in orientation, these perturbations will decrease rather than increase. This leads to the conclusion that the lid will impact the water in a horizontal, or at worst, a near horizontal orientation.

Notwithstanding the above, if the hypothetical case of the lid dropping vertically (with minimal drag and increased impact speed) is considered, with a 9.5 inch thick lid, and with fuel cells in the basket approximately 8.5" square, the most damaging impact would be dead center on the diameter of the MPC and would impact only two rows of cells (12-14 cells at most would suffer damage depending on the rotational orientation into the MPC). The radiological evaluation presented in Section 4.7.3 of the original submittal, based on tables 2.1-1 and 2.1-2 of NUREG 0612, discusses the resultant dose consequences for damage to all 32 assemblies for the EAB case, the LPZ case, and the Control Room Case.

The consequences in the submitted evaluation bound the "worst case consequences" of damage resulting from a lid drop with the most severe orientation postulated. The resulting dose consequences are 1.1%, 0.4%, and 1.7% of the regulatory limits for the EAB, LPZ, and Control Room cases respectively.

Finally, the weight of the lid, with a drain tube, is about 10,000 lbs. Each of the four wire rope slings was tested to 14,140 lbs. The shackles, eyebolts, and bushings were rated or analyzed to a minimum 7070 lbs vertical load and the tested loads are higher. This is a four point lift on the lid and a two point lift on the Lift Yoke sling pins. (Two of the four slings are attached to each of the 1.5" diameter Yoke Sling Pins. Refer to attached sketch of Lift Yoke.)

The table which follows shows the actual safety factors against the failure of rigging. Each of the sling pins has a rated load of 50,000 lbs and has been certified to NDE standards, providing a safety factor of 10. The crane hook, cable, etc. have been subject to a 125% load test based on the 75-ton rating. Therefore, while carrying the MPC lid, the crane safety factor is well in excess of 10 against a structural failure.

Since the Unit 1 Dry Cask loading campaign will remove all the fuel from the Fuel Pool with only five casks, the limited number of lifts using this rigging, the robustness of the rigging design, and the procedural controls established provides reasonable assurance that an accidental lid drop is very unlikely.

ATTACHMENT 2 TO NL-08-035

SECOND RAI
FIGURES AND TABLES FOR RAI IPEC UNIT 1
FUEL HANDLING BUILDING CRANE
LICENSE AMENDMENT REQUEST

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT UNIT NO. 1
DOCKET NO. 50-003

TABLE 1

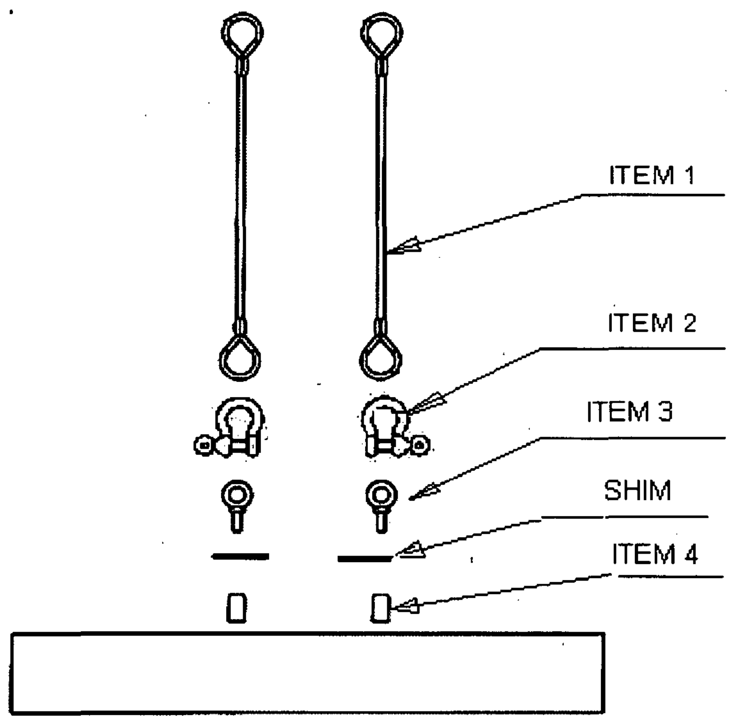
The following parts list is applicable when rigging the MPC Lid to the IP-1 HI-TRAC Lift Yoke. (See figures.)

Item	QTY	DESCRIPTION	TEST LOAD (lbs)	Safety Factor
1	**4**	**Stainless Steel Wire Rope Sling; 3/4" DIA x 30" LG; Stainless Steel Thimble on both ends; Stainless Steel Sleeves; ALL ITEMS OIL FREE; Minimum Rated Vertical Load = 7,070 lbs**	**14,140**	**5.65**
2	**4**	**S209 Screw Pin Shackle; Nominal Size = 7/8"; Rated Vertical Load = 13,000 lbs.**	**26,000**	**10.4**
3	**4**	**S279 Shoulder Type Machinery Eyebolt; thread size = 7/8-9UNC; thread length = 2 1/4"; Rated Vertical Load = 10,600 lbs.**	**21,200**	**8.48**
4	**4**	**Stainless Steel Bushing; Minimum Rated Vertical Load = 7,475 lbs**	**17,500**	**7.0**

Test load (factor of 2 over rated load) is for single item. The assumed MPC lid weight is approximately 10,000 lbs.

FIGURE 1

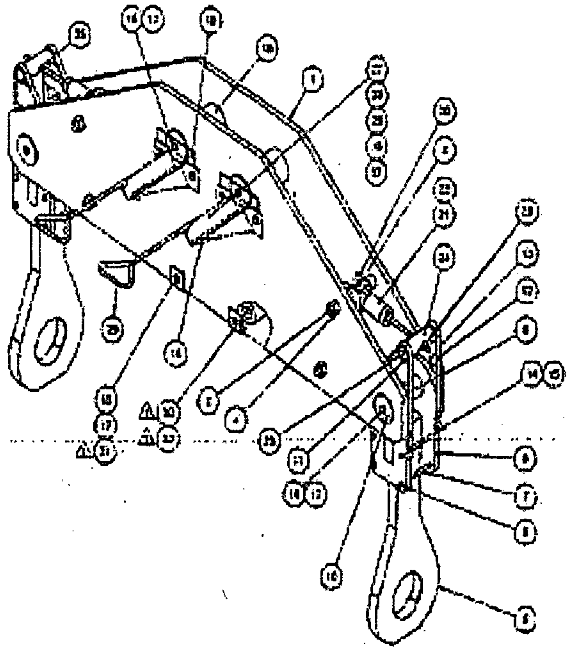
GENERAL CONFIGURATION



Note: Only (2) of the (4) sling legs are shown in the above configuration.

FIGURE 2

IP-1 75 Ton HI-TRAC Lift Yoke



Lid rigging sling pin assemblies are identified as Items 30,31, and 32
(with a Revision 1 Triangle notation)