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Fred Dacimo
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February 22, 2007
Re: Indian Point Unit 1
Docket No. 50-003
License No. DPR-5
NL-07-033

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: License Amendment Request (LAR)-Unit 1 Fuel Handling Building Crane

Reference:
1. NRC Bulletin 96-02, "Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety-Related Equipment"
2. NRC Letter to M. Kansler, "Indian Point Nuclear Generating Station, Unit 1-Issuance of Amendment RE: Changes to Effectively Coordinate Indian Point Nuclear Generating Station, Units 1 and 2, Programs (TAC. No MB5259)" Amendment 52, August 11, 2003; Accession Nos. ML032240282/ML032240393

Dear Sir:

Entergy Nuclear Operations, Inc. (ENO) submits a License Amendment Request to the Indian Point Nuclear Generating Unit No. 1 Provisional Operating License DPR-5 . The proposed license amendment seeks approval for the use of the Fuel Handling Building (FHB) 75 ton crane for dry spent fuel cask handling operations.

Entergy intends to construct and operate an Independent Spent Fuel Storage Installation (ISFSI) at Indian Point under the general license provisions of 10 CFR 72, Subpart K. Unit 1 has 160 fuel assemblies stored in the Unit 1 spent fuel pool and upon transfer of the assemblies to dry cask storage, ENO is planning to drain the Unit 1 spent fuel pools which will eliminate any leakage pathway from the pools to the environment. Implementation of dry spent fuel storage for Indian Point Unit 1 requires the lifting of heavy loads using the 75 ton crane inside the Part 50 facility.

In the response to NRC Bulletin 96-02 (Reference 1), a commitment was made to submit a License Amendment Request should spent fuel cask handling operations be resumed in the Unit 1 Fuel Handling Building and if a cask was to be lifted over the spent fuel pool or in a manner otherwise outside the licensing basis.

The NRC reviewed and approved the use of the non-single-failure-proof FHB 75 ton crane for the loading of the General Electric (GE) IF-200 shipping cask and the crane and cask system have previously been used to load and ship 244 fuel elements to an off-site reprocessing facility.

The existing licensing basis, which allows the loading and transfer of the GE IF-200 shipping cask, did not address those hypothetical accident initiators which could result in damage to the shipping cask or the spent fuel inside the cask. As a 10 CFR 71-certified shipping cask, the IF-200 was designed to withstand drops and other accident conditions required by the regulations without significant damage to the cask or contents. Consequently damage to the spent fuel inside the cask from a hypothetical load drop of the shipping cask was not specifically evaluated at the power plant under the Part 50 licensing basis, as this was included as part of the 10 CFR 71 certification.

The Holtec HI-STORM 100 System is a 10 CFR 72-certified spent fuel storage system which utilizes a dual-purpose certified Multiple Purpose Canister (MPC). The MPC is only certified for transportation when deployed in its 10 CFR 71-certified, steel HI-STAR overpack (NRC Docket 71-9261). For dry storage preparation activities inside the Part 50 facility, the MPC, when loaded with fuel is lifted and handled inside the HI-TRAC transfer cask, which is not a shipping cask. Therefore the transfer cask/MPC assemblage is not designed or certified to the transportation criteria of 10 CFR Part 71.

This difference in regulatory bases introduces the need to assess cask drop accidents inside the Part 50 facility (i.e. potential damage to fuel contained in the MPC) that have not been previously evaluated by the NRC.

Consequently ENO has concluded that the lifting of the HI-STORM System, with the existing non-single-failure-proof FHB 75 ton crane, is outside the current licensing basis of Indian Point Unit 1 and requires the submittal of this License Amendment Request for approval by the NRC.

The existing Technical Specifications, as last amended by Amendment 52 per Reference 2 above, do not require revision as a result of this License Amendment Request.

The consequences of the drop of a shipping cask on the Fuel Handling Building systems, structures, and components (SSCs) were previously evaluated (Reference 2 of Attachment One) and it has been concluded that use of the HI-STORM 100 System also does not adversely affect SSCs due to cask handling evolutions.

ENO has evaluated the proposed amendment in accordance with the criteria in 10 CFR 50.92 and has concluded that there are no significant hazards considerations involved as discussed in Attachment One.

Attachment Two provides a proposed mark-up for Sections 3.5.1 and 6.0 of the Unit 1 FSAR based on information and evaluation presented in Attachment One.

There are commitments contained in this letter as identified in Attachment Three. They include implementation of the general guidelines of NUREG-0612 with regard to the 75 ton crane: (1) establishment of safe load paths; (2) development of procedures; and (3) training and qualification of crane operators.

Pursuant to 28 USC 1446, I declare under penalty perjury the foregoing is true and correct. Executed on _________.

If you have any questions of require additional information, please contact Patric W. Conroy, Manager, Licensing at 914-734-6668.

Sincerely,

Fred R. Dacimo
Site Vice President
Indian Point Energy Center

Attachments:

One: Safety Analysis Regarding Unit 1 Fuel Handling Building 75 Ton Crane
Two: Marked up Unit 1 FSAR Pages for License Amendment Request
Three: Commitments

cc: Mr. Ted Smith, Project Manager, NRC FSME DWMEP
Mr. John P. Boska, Senior Project Manager, NRC NRR DORL
Mr. Samuel J. Collins, Regional Administrator, NRC Region I
NRC Resident Inspector's Office
Mr. Peter R. Smith, President, NYSERDA
Mr. Paul Eddy, New York State Department of Public Service

ATTACHMENT ONE TO NL-07-033

SAFETY ANALYSIS REGARDING UNIT 1 FUEL HANDLING BUILDING 75 TON CRANE

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT ENERGY CENTER, UNIT 1
DOCKET 50-003

1.0 DESCRIPTION

This letter is a request to amend the Provisional Operating License DPR-5, for Entergy Nuclear Operations Incorporated, (ENO), Indian Point Nuclear Generating Unit 1 (IP-1) in support of dry spent fuel cask operations in the Fuel Handling Building (FHB). ENO intends to implement dry spent fuel storage at the Indian Point Energy Center (IPEC) under the general license provisions of 10 CFR 72, Subpart K (Docket No. 72-51). As a result of a review of the existing design and licensing basis, certain hypothetical heavy load drop events, and the physical differences between the General Electric IF-200 shipping cask and the Holtec HI-TRAC 100D™ Version IP1 transfer cask with the MPC-32 canister, ENO concluded that a license amendment is required to update the FSAR and implement the procedure changes associated with the use of the Holtec cask system at IP-1.

A glossary of terms used in this license amendment request (LAR) is provided below. These terms are taken from a request for amendment to the HI-STORM 100 System 10 CFR 72 certificate of compliance (CoC) currently under review in the NRC's Division of Spent Fuel Storage and Transportation.

- **MPC-32:** A 32 assembly PWR fuel storage multi-purpose canister. The MPC-32 to be used solely for storage of IP-1 fuel is custom fabricated to be nominally 157 inches tall. This component may also be referred to by the interchangeable terms "MPC" or "canister" throughout this document.

- **HI-STORM 100S Version B, Type 185:** An IP-1 specific cask system, including the overpack and MPC-32 custom sized for IP-1 fuel. The HI-STORM 100S Version B, Type 185 is nominally 185 inches tall with the overpack lid installed and 166 inches tall without the lid installed. This component may also be referred to by the interchangeable terms "HI-STORM overpack," "HI-STORM," or "overpack" throughout this document.

- **HI-TRAC 100D Version IP1:** An IP-1 specific transfer cask, custom fabricated to be nominally 162 inches tall with the top lid installed and 161 inches tall without the top lid installed. This component may also be referred to by the interchangeable terms "HI-TRAC transfer cask," "HI-TRAC," or "transfer cask" throughout this document.

When the terms "MPC," "canister," "HI-STORM," "HI-STORM overpack," "overpack," "HI-TRAC," "HI-TRAC transfer cask," and "transfer cask" are used herein, they refer solely to these custom-designed models used only at IP-1.

The Holtec HI-TRAC 100D Version IP1™ is a one-of-a-kind variant of the generic transfer cask designed specifically for use at IP-1 for operations supporting dry spent fuel storage. Holtec International License Amendment Request 1014-5, dated June 23, 2006 (Ref. 1) describes the Holtec cask system in detail. The major difference between the HI-TRAC 100D-IP1 and the Holtec generic HI-TRAC 100D transfer cask is in the lighter weight of 75 tons, loaded, compared to 100 tons. The lighter weight transfer cask is required to accommodate the existing 75 ton capacity of the IP-1 Fuel Handing Building Crane.

The existing licensing basis, which allows the loading and transfer of the GE IF-200 shipping cask, did not address those hypothetical accident initiators which could result in damage to the shipping cask or the spent fuel inside the cask. As a 10 CFR 71-certified shipping cask, the IF-200 was designed to withstand drops and other accident conditions required by the regulations without significant damage to the cask or contents. Consequently damage to the shipping cask or the spent fuel inside the cask was not specifically evaluated for loading operations at the power plant under the Part 50 licensing basis, as this was included as part of the 10 CFR 71 certification. The consequences of the drop of a shipping cask on the Fuel Handling Building systems, structures, and components were evaluated (Ref 2).

The Holtec HI-STORM 100 System is a 10 CFR 72-certified spent fuel storage system which utilizes a dual-purpose certified MPC. The MPC is certified for transportation when deployed in its 10 CFR 71-certified, steel HI-STAR overpack (NRC Docket 71-9261). For dry storage preparation activities inside the Part 50 facility, the MPC, when loaded with fuel is lifted and handled inside the HI-TRAC transfer cask, which is not a shipping cask. Therefore the transfer cask/MPC assemblage is not designed or certified to the transportation criteria of 10 CFR Part 71. This difference in regulatory bases introduces the need to assess cask drop accidents inside the Part 50 facility (i.e. potential fuel damage and cask damage) that have not been previously evaluated in the IP-1 FSAR.

2.0 PROPOSED CHANGES

The proposed amendment requires changes to the Final Safety Analysis Report as discussed below. IP-1 currently has a provisional operating license and is being maintained in the “SAFESTOR” mode.

As presented in Attachment Two, ENO requests Section 3.5.1 of the FSAR/Decommissioning Plan be revised from:

> “All spent fuel will continue to be stored in the spent fuel pools of Unit 1 fuel handling building until it is shipped to an appropriate permanent off-site facility.”

To:

> **“All spent fuel will continue to be stored in the spent fuel pools of Unit 1 fuel handling building until it is shipped to an appropriate permanent off-site facility or temporary storage.”**

ENO requests Section 6.0 of the FSAR/Decommissioning Plan be revised from:

> “The spent fuel stored in the Unit 1 fuel building has decayed sufficiently such that, even in the unlikely event of a loss of water in the pool, this fuel can be adequately cooled by ambient air.[1]”

To:

> “The spent fuel stored in the Unit 1 fuel building has decayed sufficiently such that, even in the unlikely event of a loss of water in the pool, this fuel can be adequately cooled by ambient air.[1] Fuel is to be moved out of the spent fuel pool to defuel it. Based on additional analysis, inspections, and load testing, the 75 ton HI-TRAC 100D-Version IP1™ transfer cask loaded with spent fuel can be handled by the 75 ton crane main hoist with a load drop being a highly unlikely event that would meet regulatory criteria for such an event. Five transfers of the cask with fuel are planned to remove all fuel to the Independent Spent Fuel Storage Installation (ISFSI). Hypothetical drops of heavy loads associated with cask loading have been analyzed to ensure their consequences were acceptable. When handling spent fuel transfer casks, mechanical stops or electrical interlocks will be provided that prevent movement of the overhead crane load block and cask over or within 15 feet horizontal of the spent fuel pool, and all heavy loads movements will be administratively controlled. Postulated drops are the loaded vertical transfer cask drop into the Cask Load pool, inclined loaded vertical transfer cask drop into the Cask Load pool, and loaded transfer cask tips into the Cask Load pool. In all cases the calculated cask deceleration is below the allowable g force for the fuel in the cask so

there is no fuel damage provided the lift height is limited to the analyzed value. The Cask Load pool floor slab is acceptable and the west concrete wall suffers only minor damage. Dropping the loaded transfer cask vertically onto the concrete floor at elevation 70' 6" results in the most significant g force but is below the allowable g force for the fuel in the cask therefore there is no fuel damage provided lift height is limited to the analyzed values. Dropping of the MPC lid into the MPC and onto the transfer cask flange were also evaluated and may damage some fuel but not cause criticality. For bounding purposes 32 assemblies were assumed damaged. Similarly, two fuel assemblies may be damaged by dropping fuel into the cask. Radiological analyses were performed and the damage to 32 assemblies was bounding in all cases. A regulatory limit of 25 percent of Part 100 was used for the exclusion area boundary (EAB) and low population zone (LPZ) and GDC 19 limits were used for the control room. The doses were zero whole body and less than one REM thyroid (less than 2 percent of regulatory limits) in all cases. Reference ENO letter to NRC, "License Amendment Request (LAR) – Unit 1 Fuel Handling Building Crane," February 2007 (NL-07-033) "

The current operating license and technical specifications provide for the loading of a shipping cask in the cask load pool with the existing Fuel Handling Building 75 ton crane. Cask lifts over or near the spent fuel pools are prohibited by the IP-1 technical specifications and are not required by design. At IP-1, unlike many other facility designs, individual fuel assemblies are transferred from the spent fuel west pool to and through the fuel disassembly pool to the cask load pool and inserted into the cask (see Figures 1, 2, and 3). Therefore changes to the technical specifications or license conditions are not required.

With this amendment, ENO is requesting NRC approval to use the Fuel Handling Building 75 ton crane which is non-single-failure-proof and non-safety-related. This request solicits NRC prior approval that the IP-1 Fuel Handling Building 75 ton crane is adequately designed and is operated, inspected, tested, and maintained in a manner that makes it acceptable for use in spent fuel transfer cask lifting and handling activities. NRC approval of this proposed amendment is requested based on the fact that load drop events remain highly unlikely and the consequences of hypothetical load drop events involving certain components of the HI-STORM 100 System have been analyzed and found to be acceptable.
IP-1 currently plans to load all IP-1 fuel currently in wet storage into dry storage casks in a single fuel loading effort. Upon completion of the fuel cask loading effort, all the fuel will have been removed from IP-1 and placed at the site ISFSI. ENO will then schedule a license amendment request which will terminate the major portion of the license conditions and technical specifications which would no longer remain applicable to a "SAFESTOR" and defueled facility. The FSAR will also be updated to reflect the defueled condition.

The entire IP-1 spent fuel pool inventory of stored fuel assemblies is planned to be loaded into five HI-STORM 100 storage systems. Upon completion of the transfer of the fuel to the ISFSI, it is planned that the spent fuel pools, fuel disassembly pool, and cask loading pool will be drained.

There are commitments contained in Attachment Three. They include implementation of the general guidelines of NUREG-0612 with regard to the 75 ton crane: (1) establishment of safe load paths; (2) development of procedures; and (3) training and qualification of crane operators.

3.0 BACKGROUND

3.1 Fuel Handling Building 75 Ton Crane Design and Licensing Considerations

The IP-1 Fuel Handling Building (FHB) 75 ton crane was designed and procured in 1958 and installed in the FHB for plant startup in 1962. It is a non-safety-related, commercial-grade crane originally designed and licensed to lift and handle a spent fuel shipping cask. The crane, with the General Electric IF-200 shipping cask, was used to load and transport 124 Core A fuel assemblies and 120 Core B fuel assemblies from IP-1 to an off-site fuel reprocessing facility. The loading and transport, which utilized two casks and was completed without incident, required several hundred lifts of the 30 ton IF-200 casks.

The crane was also used to lift and move individual spent fuel assemblies within the spent fuel pool and between the spent fuel pool and the cask loading pool.

The FHB 75 ton crane is a bridge-and-trolley design that is not single-failure-proof as defined in NUREG-0612 and its design pre-dates publication of that document. However many of the criteria contained in NUREG-0612 pertaining to crane design, maintenance, and inspection, as well as operator training, safe load paths, and design of lifting devices associated with cask handling are, or will be met as part of the dry cask storage project at IP-1. A matrix comparing the IP-1 cask handling operation to NUREG-0612 criteria is contained in Table 4.

The FHB 75 ton crane main hoist has a rated load of 75 tons and the auxiliary hoists have a rated load of 15 tons and 3 tons respectively. Only the main hoist is used to lift the transfer casks.

A review of the crane design, maintenance, and operational history was performed. This review concluded that with additional analysis, inspections, and load testing, the 75 ton HI-TRAC 100D-Version IP1™ transfer cask loaded with spent fuel can be handled by the 75 ton crane main hoist with a load drop being a highly unlikely event. An analysis was performed to demonstrate the crane can handle the rated load under the limiting loading conditions including a seismic event concurrent with a loaded ask suspended from the main hook. Inspections of welds, bolting, and structural steel were performed to provide reasonable assurance that the crane was installed according to the design drawings and specifications. However, consistent with the guidance in NUREG-0612, because the crane is not single failure proof, several hypothetical drops of heavy loads associated with cask loading have been analyzed to ensure their consequences were acceptable. (See Section 4.7 below.)

The HI-TRAC 100D-Version IP1™ transfer cask and the MPC must be lifted and moved several times during fuel loading operations in the Fuel Handling Building. At various points in the operation, the empty transfer cask with the empty MPC, the MPC lid, and the spent fuel-loaded transfer cask and MPC must be lifted and handled by the FHB 75 ton crane. Five lifts out of the cask load pool of a fuel-loaded transfer cask and MPC, approaching the 75 ton design rating of the crane, are planned to be performed to place the transfer cask and MPC at the cask preparation work station.

Five additional lifts of the spent fuel-loaded transfer cask and seal welded MPC are planned to place the transfer cask and sealed MPC on the air transporter pad for movement out of the Fuel Handling Building. These lifts are just a few inches in height, over the FHB truck bay floor (See Figure 2).

The locations where drops are postulated and evaluated comply with the applicable Part 50 licensing requirements, and are consistent with the guidance in NUREG-0612, NRC Bulletin 96-02, and Regulatory Issues Summary RIS-2005-25. A summary of the planned FHB cask handling sequence is provided in Table 3.

To mitigate the consequences of two of the postulated transfer cask drops, namely, the vertical cask drop into the cask load pool and a tilted transfer cask drop also into the cask load pool, an impact limiter will be employed on the floor of the cask load pool to limit the g forces to which the transfer cask, MPC, and fuel in the loaded MPC would be exposed. The impact limiter serves no Part 50 design function because:

- The transfer cask and MPC will not be lifted over or near (within 15 feet) the spent fuel pool,

- There is no safety related or essential-to-operation equipment in the Fuel Handling Building, and

- The entire travel path of the load is exclusively over concrete floors founded directly on bed rock or engineered fill.

3.2 Fuel Building Loading Operations Summary

The HI-STORM 100S Version B, Type 185 System™ will be used for dry cask storage of IP-1 spent fuel at the IPEC ISFSI. This IP-1 custom-designed dry spent fuel storage system is currently under NRC review as a proposed amendment to the Holtec HI-STORM 100 System 10 CFR 72 Certificate of Compliance (CoC). The ISFSI will serve as the temporary storage facility for spent fuel from IPEC Units 1, 2, and 3 until such time as the fuel is removed from the site and sent to a federal repository. Five of the storage systems will contain all of the fuel from the "SAFESTOR" Unit 1, and the remaining storage systems will contain fuel from operating Units 2 and 3.

The HI-STORM 100S Version B, Type 185 System™ consists of a multi-purpose canister (MPC-32) which is capable of holding 32 IP-1 fuel assemblies; a Transfer Cask (HI-TRAC 100D-Version IP1™), which contains the MPC during loading, unloading, and transfer operations; and a storage overpack (HI-STORM 100S Version B, Type-185™), which provides shielding, heat removal capability, and structural protection for the MPC during storage operations at the ISFSI. IP-1 fuel is stainless steel clad and the fuel rods are shrouded in a protective sheath. The assemblies are nominally 137 inches in length. Because of the unique configuration of the IP-1 fuel, the five HI-STORM 100S, Version B, Type185 ™ systems are specifically designed for IP-1 and are not interchangeable with Units 2 and 3 or any other PWR.

The 75 ton crane is required to lift and handle the HI-TRAC transfer cask and MPC (both empty and loaded with spent fuel) and the MPC lid in support of dry cask loading. The combined maximum lift weight, including rigging and lift yoke will not exceed 75 tons, which is the design rated load of the IP-1 FHB 75 ton Crane.

All the IP-1 fuel is stored in the west fuel pool. The east fuel pool is currently not used for fuel storage. Refer to Figure 1 for the relative location of the west, east, disassembly and cask loading pools.

During each of the five cask loading evolutions, spent fuel assemblies are moved one at a time, from the spent fuel racks in the west pool, through a gate slot into the disassembly pool, through a second gate slot into the cask load pool and into the MPC. The cask load pool and the disassembly pool will have been previously flooded to the same level as the west spent fuel pool and the intermediate gates will have been removed. Once the MPC is loaded with 32 fuel assemblies, the MPC lid is installed under water, and the transfer cask with the loaded MPC inside is lifted by the 75 ton crane and placed on the 70'6" floor to the east of the cask load pool, as shown on Figures 2 and 3. The horizontal cask trolley movement totals approximately 22 feet from the cask load pool position to the cask preparation work station in the adjacent area to the east, where canister welding, draining, drying, helium backfilling, and leak testing takes place.

At the 70'6" location, the MPC is seal welded and the canister is drained, dried, and backfilled with helium and leak tested in accordance with the 10 CFR 72 Certificate of Compliance (CoC) and cask FSAR. The transfer cask containing the sealed MPC is lifted a few inches and placed on an air castor and moved northward out of the FHB. (Refer to Figure 2). A Vertical Cask Transporter (VCT) will move the transfer cask to the Unit 2 FHB where it is placed on top of an empty storage overpack using the Unit 2 single-failure-proof gantry crane. The Unit 2 gantry crane is disengaged from the transfer cask lifting trunnions and rigged to lift the MPC, which is inside the transfer cask. The MPC is lifted to take its weight off the transfer cask pool lid (Refer to Figure 4), which is then removed, and the MPC is lowered through the transfer cask into the overpack. After the overpack lid is installed, the HI-STORM overpack is transported to the ISFSI using the VCT.

The evolutions performed in the Unit 2 FHB with the gantry crane are essentially identical to the operations associated with the Unit 2 fuel handling operations reviewed and approved by the NRC (Ref. 6) except for the IP-1 MPC and transfer cask being shorter and lighter than the corresponding Unit 2 components.

4.0 TECHNICAL ANALYSIS

4.1 General Basis

The IP-1 FHB and the 75 ton crane were designed, procured, constructed and operated as a non-safety-related, non-single-failure-proof system. This design and procurement process took place in the late 1950's and predated the issuance of 10 CFR 50 Appendix B, NUREG-0612, and associated Generic Letters and Regulatory Guides. The IP-1 75 ton crane is completely enclosed inside the FHB.

As a result of various licensing actions, the NRC requested and Consolidated Edison (IP-1 previous owner) provided information regarding heavy load lifts and design information related to topics addressed by NUREG-0612 and other NRC communications. This submittal references the pertinent communications and discusses the commitments and conclusions as they relate to the design and licensing basis of the FHB and the 75 ton crane.

As part of the IP-1 Dry Cask Storage project, a comprehensive evaluation was undertaken to review the FHB crane original design and operational details and compare them to what is recommended by NUREG-0612 and current standard practice, design, and operational guidance. From this review and the results of additional calculations, inspections, and testing, it was concluded that the crane and superstructure are suitable for use in IP-1's dry storage cask loading operations.

4.2 Controls and Electrical Prime Movers

Based upon a thorough review and inspection of the existing electrical system and controls, which was performed during the Summer of 2006 by Whiting Services Inc. (Whiting), it was concluded that the availability of replacement parts and the technical expertise to support any required installation was limited.
Consequently, with the assistance of Whiting, it was decided to undertake an electrical refurbishment of the crane.

Each motor will be supplied with a new disc brake rated for 140% (minimum) of the available motor torque. The hoists will retain one or both of the existing shoe brakes, thereby providing redundant "hold fast" capability. This configuration also provides a means of safely lowering the load manually, if necessary.

In addition to replacing the motors and related controls, ENO will install a new, four motion, three speed pendant with auxiliary switches for start/stop and bridge zone control.

A new end of travel limit switch will be installed in the bridge travel path. This zone control bridge function will be key operated at the pendent. Operation in the "Safe" mode will restrict bridge travel to the area north of the west spent fuel pool, thus assuring that the bridge cannot travel near the spent fuel pool during dry cask handling operations in and near the cask load pool.

The planned electrical refurbishment of the FHB crane is scheduled to be installed and functionally tested in the first quarter of 2007.

4.3 Crane Structural Steel

An engineering review of the crane's past inspection and maintenance history was completed. As a result of this review and in preparation for the planned dry cask loading effort, critical structural areas were identified and inspected using ENO NDE procedures and the acceptance criteria of the applicable ASME, ANSI, and AWS codes and standards, referenced in ASME NOG-1, "Rules for Construction of Overhead Cranes." The NDE inspections (visual, UT and MT) confirmed that all of the selected critical welds were in acceptable condition. The inspection of certain bridge rail tie-down bolted connections raised concern with potential bolt cracking. All of the subject bolting has been replaced.

As a result of the seismic qualification effort (discussed in Section 4.5 below), the trolley-to-end truck bolting was replaced to assure the adequacy of the bolting material to resist the calculated seismic stresses.

4.4 Crane Inspections and Tests

The IP-1 FHB 75 ton crane receives pre-use inspections, quarterly exercise and operational inspections and an annual inspection by Whitey Services based upon 29CFR1910, Section 179, "Overhead and Gantry Cranes" and the original manufacturer's specifications. The use of the 75 Ton crane to move and prepare low level radioactive waste for shipment to off site disposal facilities drives the inspection and maintenance requirements. The most recent annual inspection was completed in August 2006 as part of efforts to evaluate and document the condition of the crane. The entire IP-1 dry storage loading effort is planned to be performed only once, using five casks. The ongoing inspections and the planned electrical refurbishments will ensure the ability of the crane to safely carry its 75 ton critical load.

Following the functional testing to be performed for the planned electrical refurbishments, a full load proof test will be performed prior to cask movement. A Non-Destructive Examination (NDE) inspection will be performed following the proof test to verify the condition of critical structural components.

4.5 Crane Seismic Qualification

The IP-1 FHB 75 ton Crane was designed and procured without any seismic considerations. As part of the Dry Cask Storage Project's assessment of the crane, an analysis was performed which confirmed that the crane system and its supporting structure, are qualified to hold the maximum critical load during a seismic event. Since there exist no specific IP-1 design seismic response spectra, the analysis utilized the 0.15g ground response spectra specified for the adjacent Unit 2. This approach is consistent with previous seismic analyses performed for various IP-1 structures in response to past specific inquiries from the NRC in conjunction with other regulatory actions (Ref. 5).

The crane was evaluated in accordance with guidelines in NUREG-0612 and the design acceptance criteria as applicable with IPEC Unit 2 FSAR Section 1.11 for Safe Shutdown Earthquake (SSE) loads. The crane and supporting structure were determined to remain below material yield when subject to the maximum load lift combined with the SSE, i.e. with a 75 ton load on the hook. Standards and guides which have been used for determining allowable stress limits and other acceptance criteria, are consistent with industry practice for similar applications. These include the American Institute of Steel Construction (AISC) Manual, 9th Edition, the American Concrete Institute (ACI) 318-02, Building Code Requirements for Reinforced Concrete and the American Society of Mechanical Engineers (ASME) NOG-1, "Rules for Construction of Overhead Cranes."

4.6 Tornado Wind and Missile Loads

The Unit 1 FHB 75 ton crane is totally contained within the FHB. The stack up of the transfer cask and MPC on the HI-STORM overpack will be accomplished using the Unit 2 gantry crane. This evolution is performed indoors inside the Unit 2 FHB.

ENO currently has administrative controls in place that prohibit Indian Point Unit 2 fuel handling and the FHB doors from being opened if severe weather is imminent. If fuel handling is in progress current procedures require fuel handling and radioactive material transport to cease except as required to move material to a safe location. IP-1 cask loading procedures will be verified to contain similar severe weather restrictions.

The IP-1 boiler stack which is the closest non-safety- related structure of significant size to the FHB has been analyzed for both wind and seismic events. The results of these evaluations are discussed in Section 1.11.6.3 of the Unit 2 Updated Final Safety Analysis Report.

4.7 Evaluations

4.7.1 Cask Loading Design Features

The design and operational features which limit the likelihood or mitigate the effects of postulated cask drop accidents are summarized as follows:

Only five Holtec MPC-32s are planned to be loaded and handled. The entire inventory of spent fuel, 160 fuel bundles, will be removed from the IP-1 FHB in one effort, limiting the possibility of a drop to these five cask handling evolutions.

The floor of the cask loading pool is concrete founded on bed rock (See Figure 3). The floor of the cask handling area at elevation 70'6" is either concrete founded on bed rock or concrete founded slightly above rock on engineered fill (Ref. 7).

There is no safety related equipment in the IP-1 FHB. The spent fuel pool cooling systems are no longer required to be operable since the minimal decay heat of the IP-1 fuel is dissipated into the atmosphere or into the floor and walls of the spent fuel pool. The NRC staff also concluded that the spent fuel has decayed such that the stainless steel clad fuel can be air cooled (Ref. 8).

The fuel-loaded transfer cask is not moved over the spent fuel in the spent fuel pool, nor near enough to the spent fuel pool to postulate a "tipping accident" which could propel the load to the pool. Refer to Figures 1, 2, and 3 for pool layout and cask travel path.

The "stack up" of the MPC and transfer cask over the concrete overpack will be performed in the Unit 2 FHB using the Unit 2 single failure proof gantry crane.

An impact limiter will be installed in the bottom of the cask load pool to reduce the g loads on the transfer cask, MPC, and the fuel loaded into the MPC should it be dropped back into the cask load pool. The design of the HI-TRAC 100D-Version IP1 transfer cask and the MPC precludes fuel damage if the loads are less than 64.8 g's. (Ref. 1)

The age and low burnup history of the IP-1 fuel precludes any significant threat to the health and safety of the public. The IP-1 FSAR and the Environmental Assessment by the NRC regarding the Order Authorizing Facility Decommissioning (Ref. 9) reports that, in 1996, a 100% clad failure of the entire 160 assemblies and a release of the gap activity would result in a total whole body dose of 0.027 Rads from Kr -85 at the site boundary. After another 10 years of decay, the dose would be even lower today.

4.7.2 Postulated Load Drops

Postulated load drops were performed through analyses using the commercially available computer codes Visual Nastran and LS-DYNA. These codes have been independently validated by Holtec in accordance with the requirements of its QA program, and have been reviewed by the NRC in support of other licensees' submittals. (Ref. 10 and Ref. 12).

A description of the load drops that have been analyzed and the corresponding results are provided in Items a) through f) below.

The general acceptance criteria for each drop analysis are (as applicable):

It has been demonstrated that the fuel assembly deceleration limit for a vertical drop is 64.8 g's as reported in the HI-STORM FSAR Section 3.5.

General Note: Relevant elevations of the cask handling area horizontal surfaces and dimensions of cask components are as follows:

Cask load pool floor:	30'0" (Note 1)
Truck bay/Cask handling area floor elev.	70'6" (Note 2)
Impact limiter height:	23.25"
Spent fuel pool water elevation	64'6" (Note 3)
HI-TRAC transfer cask pool lid thickness	4"
HI-TRAC transfer cask w/o top lid	161.87"
MPC-32 base plate thickness	2.5"
MPC-32 basket height	143.12"
HI-STORM 100S-185 overpack height without lid	166.12"
HI-STORM 100S-185 overpack base plate thickness	8"

Note 1: A leveling slab will be installed which will raise the final elevation to 31'-4".

Note 2: A leveling slab will be installed which will raise the actual elevation to 70'-8"

Note 3: Nominal elevation for cask loading activities

Key Input Data for Manufacturer's Analyses are:

Description of the HI-TRAC 100D-Version IP1 Transfer Cask (with loaded MPC-32)

The cask is represented as a homogeneous, rigid cylinder containing a loaded MPC. The data input required for the analysis is given below:

MPC lid weight = 9,650 lb.
Loaded MPC-32 weight (IP-1 Version) = 42,910 lb.
Weight of water in MPC and HI-TRAC annulus = 13,700 lb. (based on MPC-32)
HI-TRAC transfer cask weight (water jacket empty) = 72,114 lb.
HI-TRAC top lid = 1,243 lb.
HI-TRAC pool lid diameter = 89 in. (Area = 6,221 sq.in.)
HI-TRAC flange projected area = 7,178 sq.in.
HI-TRAC body diameter "d" = 86.75"
HI-TRAC length (L) = 162.875"
HI-TRAC Cask Body L/d = 1.878

Impact Limiter

The impact limiter is represented as a short cylinder or block. The input geometry is characterized by the impact limiter weight, diameter, and length in a manner similar to the cask. An initial estimate of the requirements for the impact limiter was performed as part of the evaluation. The impact limiter material evaluated has a weight density of 10 lb./cu.ft.

The force-crush behavior of the impact limiter is required either as an analytical formula, or as tabular data over the entire expected range of crush. For IP-1, the proposed impact limiter material is General Plastics Last-A-Foam FR-3700; dynamic pressure-deformation data on this material (10 lb./cu. ft. foam density) is obtained from the manufacturer's data sheets.

Lifting Yoke

Lifting Yoke weight plus hook = 9,200 lb. (estimated)
The typical weight of a Holtec lifting yoke of 4,500 lb. is used. The actual IP-1 lifting yoke weight could lead to an approximate 1% variation in the total lifted weight, which would not significantly impact the results.

For the vertical drop of the loaded transfer cask into the cask load pool, the weight of the Hook is neglected to ensure bounding g-loads. However, the 9,200 lb. total weight is considered in the inclined drop to increase the overall center of gravity (CG) to maximize cask rotation.

Cask Load Pool Target Surface

The target slab (beneath the impact limiter) is assumed rigid. This is conservative since higher g's are predicted. The remaining cask pit concrete compressive is assumed equal to 4,200 psi. Note that to account for concrete aging, and for dynamic effects, a 40% increase over the minimum specified strength of 3,000 psi is assumed. In the LS-DYNA models, concrete material is characterized using Material Model 16 with input parameters for the 4,200 psi concrete that has been benchmarked in the NRC approved Holtec report. Steel reinforcements are disregarded in the model because their contribution to the overall stiffness of the target is negligible.

Wall and Floor Sections

Cask load pool east wall thickness = 3'
Cask load pool west wall thickness = 4'
Cask load pool width = 10'
Cask load pool length = 22'
Curb width = 6"
Curb height = 9"*
FHB floor thickness = 12"
Rail section thickness = 41"

* Field measurements indicate that the curb height is 6.75". This difference does not significantly affect the results.

Environmental Variables

Drop height – H (inches).

The drop height from the bottom of cask to the contact surface must be specified. If the drop occurs entirely in air, no further information is required. If the drop occurs first through air, and then through water down to the slab (or impact limiter), the following additional information is required:

Drop height from bottom of dropped body to surface of water – Ha (inches)

Fluid drag coefficient – C_d. This may be a function of Reynolds Number; however, a conservative simplification is to input a constant lower bound value for the entire range of velocity expected. For a cylinder with its axis parallel to the direction of flow, a conservative fluid drag coefficient value of 0.85 was used over the entire range of drop.

For the drop of the transfer cask into the cask load pool, H = 33.35' (water) after an initial drop through air, Ha = 90".

a) Loaded Vertical Transfer Cask Drop into the Cask Load Pool (Crane failure at upper limit of lift resulting in drop through air and a continued drop in water onto the impact limiter)

A HI-TRAC transfer cask containing a MPC loaded with 32 fuel assemblies is lifted from the floor of the cask loading pool (Elevation 31' 4") to above the cask handling elevation (Elevation 70'

6”). The cask is dropped vertically and lands upright on the impact limiter installed on the floor of the cask load pool.

Key assumptions for this analysis are:

- The cask and contents are modeled as rigid bodies with known geometry and weight. This is conservative because all energy loss from cask structural deformation is neglected.

- At the interface between the dropped load (the cask) and the target (the impact limiter resting on the cask load pool slab), a contact force-crush relationship is specified. This force-crush relationship represents the force-crush behavior of the impact limiter. This is a realistic assumption and permits actual test data to be used to represent impact limiter performance.

- For travel of the dropped cask through water, buoyancy effects, fluid virtual mass, and fluid hydrodynamic mass are included in the simulation after the cask breaks the surface of the pool water. This is a realistic assumption.

- For travel of the dropped cask through water, the effects of squeezing of the fluid trapped in the annulus between the falling cask and the target are neglected in the computation of the cask velocity just prior to impact. This is conservative since its neglect predicts higher impact velocity.

- The energy lost by “splashing” as the cask enters the water is neglected. This is conservative since it maximizes the energy.

- During the post-impact phase, all effects of the surrounding fluid (drag, added mass) are ignored. This is conservative since it maximizes velocity.

- The target slab in the cask load pool is assumed to be rigid. This is conservative as higher g’s are predicted.

- The minimum clear distance between the cask and the cask load pool south wall is assumed to be 5’. This is a realistic assumption.

- The Young’s modulus of the rock beneath the FHB floor is assumed to be 1.0E6 psi. This is a reasonable assumption and would predict lower g’s if the foundation is softer. Moreover, the rock foundation is modeled as pure elastic and thus any energy dissipation through plastic deformation is conservatively neglected.

Results:

The simulations were carried out for different impact limiter resistances. The 80% and 120% of nominal strength simulations provide bounding results for standard impact limiter material tolerances.

The analysis results demonstrate that the proposed impact limiter configuration successfully maintains an acceptable deceleration level in the transfer cask, MPC, and the contained fuel. The maximum calculated cask deceleration was 35.9 g's which is below the 64.8 g limit for the fuel. The maximum impact limiter "crush" was determined to be 13.8". The maximum impact force was used to check the bearing capacities of the cask load pool slab and its underlying rock. The minimum safety factor is calculated as 1.78 for the concrete slab.

No significant increase in pool leakage is anticipated to result from this drop event since the concrete base slab of the cask load pool remains well within code allowable stress levels. In addition, a permanent weir in each of the connecting gate slots extends to an elevation of 41' $3^{11}/_{16}$". This weir retains sufficient water shielding in the spent fuel pool to cover the active portion of the fuel while stored in the racks in the event make-up water needed to be added to restore level.

b) Inclined Loaded Vertical Transfer Cask Drop into the Cask Load Pool

A HI-TRAC transfer cask containing an MPC loaded with 32 fuel assemblies is lifted from the floor of the cask load pool (Elevation 31'4") to above the cask handling elevation (Elevation 70' 6"). The transfer cask is dropped and the edge of the transfer cask strikes the impact limiter installed on the floor of the cask load pool.

Key additional assumptions used in this analysis are:

- In the models for the inclined drop, the friction coefficient between the cask and the cask load pool walls is assumed to be 0.5. This is a typical value for steel on concrete. The cask/wall interface contact behavior is modeled using impulse and momentum method in Visual Nastran. The coefficient of restitution (COR) for this interface is assumed to be 40% pseudo-damping for impacts. This is a realistic assumption that appropriately models the expected interface behavior. In the LS-DYNA model, 20% contact damping is conservatively assumed. The above assumptions result in a realistic prediction of the dropping velocity of the cask just prior to impact on the impact limiter.

Key additional inputs used in this analysis:

None

Results:

The simulations were once again carried out for different impact limiter resistances. The 80% and 120% of nominal strength simulations provide bounding results for standard impact limiter material tolerances.

The analysis results demonstrate that the proposed impact limiter configuration successfully maintains an acceptable deceleration level in the transfer cask, MPC, and the contained fuel. The maximum calculated cask deceleration was 41.3 g's which is below the 64.8 g allowable limit for the fuel. The maximum impact limiter "crush" was determined to be 14.1". The maximum impact force was once again used to check the bearing capacities of the cask load pool slab and its underlying rock. The minimum safety factor is calculated as 1.69 for the concrete slab.

c) Loaded Transfer Cask Tips into the Cask Load Pool.

A HI-TRAC transfer cask containing an MPC loaded with 32 fuel assemblies is lifted out of the cask load pool and begins to traverse horizontally to the east with the cask bottom slightly above elevation 70'6". The cask drops just as it begins to travel over the cask load pool east wall and the bottom of the cask strikes the edge of the pool. The cask tilts to the west and rotates with its side contacting the west wall of the cask load pool.

The LS-DYNA model consists of the cask initially positioned 18" above the east wall curb. Two cases (denoted "Center" and "Edge") are considered with the only difference being the initial position of the cask relative to the edge of the east wall when the cask impacts. The "Center" case positions the cask pool lid center right over the curb edge to the load pool; while in the "Edge" case the cask has only 1" overlap with the east wall edge.

Key additional assumptions used in this analysis are:

- The impacted wall north and south edges are assumed to be fixed to produce maximum cask deceleration. An evaluation of the potential for gross collapse of the impacted wall is performed conservatively assuming the wall edges are simply supported. The bottom of the modeled 40' wall is assumed fixed, which is realistic because this boundary is far from the cask impact location at the top of the wall and its boundary has a negligible effect on the results.

Key additional inputs used in this analysis:

None

Results:

The results of drop simulations of the cask onto the cask load pool east wall top edge with a subsequent rotation of the cask and impact with the cask load pool west wall top edge results in acceptable cask decelerations and only local damage to the wall.

Table 1 summarizes the results from simulations of impact with the cask load pool walls.

The calculated decelerations are less than the 64.8 g limit for the fuel and are, therefore, acceptable. The 4' thick concrete wall only suffers local damage at the impacted region.

No significant increase in pool leakage is anticipated as a result of the localized structural damage which could occur as a result of this drop event. Normal pool make-up capability, which can be backed up by emergency make-up from the fire water and city water systems, ensure that no significant loss of shielding will occur for any spent fuel stored in the west spent fuel pool. The design of the interconnecting gates are such that the spent fuel being stored in the west storage pool cannot become uncovered due to a cask drop in the cask load pool. Due to the age of the spent fuel, water inventory is only required for shielding in the vicinity of the fuel pools.

d) MPC Lid Drop onto the MPC

After the spent fuel is loaded into the MPC, the MPC lid is installed using the FHB 75 ton crane. The rigging, attached to four symmetrically located lift points in the lid, ensures that the lid is held in the horizontal position during lowering to assure fit up onto the MPC. If the lid is dropped from a significant height, the column of water below the falling lid will eventually cause the lid to drift laterally and not physically be able to enter the open MPC. This analysis assumes the lid is 3' above the MPC and perfectly positioned for insertion when the postulated failure occurs, allowing the lid to drop straight down into the MPC fuel cavity in the horizontal orientation. The lid will accelerate as it falls and impart an impact load on the four lift lugs welded to the inside of the MPC shell. The lift lugs are designed to support the dead weight of the lid until the lid is welded to the canister shell. The analysis evaluates the ability of the lift lugs to withstand the impact load of the lid drop using manual structural mechanics computational techniques.
The acceptance criterion for this analysis is no damage to the spent fuel assemblies in the MPC.

Key additional assumptions used in this analysis are:

- The lid remains horizontal during the drop through the water and enters the MPC without obstruction. This is realistic, based on height assumed above the MPC.
- There is no loss of energy when the lid contacts the water surface. This is conservative because it maximizes the assumed energy.
- The lid is considered as a rigid mass. This is realistic for this application.
- The MPC shell is assumed to be instantaneously expanded out by the increased internal pressure from the piston effect, to the radius where it contracts the HI-TRAC inner shell. This is conservative as it provides the largest annular gap and therefore, a smaller resisting force is applied to the dropped mass.
- Fluid drag is included during the free fall to the top of the MPC shell. This is realistic.
- The water is considered approximately incompressible in that the change in density is assumed to be proportional to the lid velocity; the proportionality constant affords a simple way to account for the expected reduction in the water velocity escaping through the lid-to-shell gap as the water density increases. This is a simplifying assumption.

Key additional input data used in this analysis are:

- Water height from the base of the pool = 40' (assumed)

- Height of the lid above the top of the MPC shell is approximately 3'. This is conservative in that precise alignment is usually assured only when the lid is within a few inches of the top of the MPC.

- Dry weight of the MPC lid = 10,000 lb.

- Distance from the top of the MPC to the top of the lift lugs = 9.125"

- MPC lid diameter = 66.75"

- MPC maximum inside diameter= 67.75"

- Thickness of the MPC lid = 9.5"

Results

The results of the analysis show that the lift lugs will withstand the impact force and prevent the lid from coming into contact with the fuel basket or the fuel.

e) MPC Lid Drop onto the Transfer Cask Flange

A second lid drop event was analyzed where the MPC lid is assumed to drop vertically from the elevation of 90" above the cask loading pool water surface. The lid is slightly offset from the center of the MPC cavity so that the first impact will occur on the top flange of the HI-TRAC transfer cask. Subsequent to the initial impact, the lid may hit the MPC shell, the fuel basket and the stored fuel assemblies before it eventually rests in the MPC cavity.

The objective of the analysis performed, using the LS-DYNA finite element code, is to determine whether the postulated offset drop scenario would significantly damage the fuel basket in the MPC resulting in an unacceptable criticality configuration for the stored fuel assemblies.

Key additional assumptions used in this analysis are:

- The MPC and HI-TRAC transfer cask components are assumed to behave as bilinear elastic-plastic materials characterized by five material parameters, i.e. Young's modulus, yield strength, ultimate strength, failure strain, and Poisson's ratio. This is consistent with engineering practices.

- Material damping and water resistance during impact are neglected in the analysis. This is conservative because it maximizes velocity.

- The offset between the centers of the MPC lid and the shell is assumed to be 2" in the drop event. This is a reasonably representative small offset that allows the MPC lid to impact the transfer cask top flange first with the minimum amount of kinetic energy dissipated before falling into the MPC cavity above the fuel basket. This analyzed small offset bounds other drop scenarios on the basis of available impact energy to be imparted in the impact involving the basket.

- The effect of the Damaged Fuel Cans either structurally or as a containment for fuel debris is not credited. (All IP-1 fuel will be inserted in Damaged Fuel Cans with individual lids installed before the MPC lid is lifted into position.)

Key additional input data used in this analysis are:

- ID of the transfer cask inner shell=68.75"

- OD of the transfer cask outer shell=81.25"

- OD of the MPC shell=68.375"

- Height of the transfer cask flange to flange=191.25"

- Height of the MPC=156.94"

- Height of the fuel basket=142.125"

- Thickness of the MPC lid= 9.5"

Results:

The results of the analysis conclude that the MPC lid hits the transfer cask top flange at a velocity of 220.0 in/sec. and that a dropped MPC 32 IP-1 lid could damage up to 4 MPC-32 IP1 basket cells. The total of 4 basket cells suffer plastic deformation extending down as much as 6.3 inches below the basket top, which is inside the region covered by the neutron absorber (3.75 inches below the basket top). The cell deformation is limited to an area more than 12" above the active fuel region of the stored fuel. Major relocation of fuel material is not expected.

The analysis did not credit the IP-1 fuel loading arrangement which places all fuel assemblies in damaged fuel containers. These containers provide additional assurance that relocation of fuel material leading to criticality is precluded.

f) Loaded Transfer Cask and Vertical Drop onto the Elevation 70'6" Concrete Floor.

This event would occur after the loaded transfer cask is lifted out of the cask load pool and is traversing to the east to the cask preparation area for canister welding and other activities. This analysis fixes the allowable height above the floor to which the loaded transfer cask can be lifted while being moved. This also bounds placement of the loaded transfer cask on the air transporter pads.

Key additional assumptions used in this analysis are:

- To determine the maximum carry height of the cask when it is entirely above the spent fuel building floor level and transiting horizontally to the East , the floor edges are conservatively assumed fixed except for the east side grade embedded beam. The rock foundation is modeled to 40' below the free surface.

- Concrete compressive strength of 5,500 psi is assumed instead of using the 28 day test results of 4,950 psi for the 2" grout layer. This is a reasonable assumption accounting for concrete aging effect and resulting in a stiffer impact target.

Key additional inputs:

None

Results:

By administratively limiting the carrying height, when the cask is above the spent fuel building floor level, the cask would experience a maximum deceleration below the 64.8 g allowable limit for the fuel.

4.7.3 Radiological Evaluation

The potential radiological consequences of an MPC lid drop onto the irradiated fuel in the canister and subsequent damage to the fuel were determined using the data in Tables 2.1-1 and 2.1-2 of NUREG-0612. The MPC lid drop analysis shows that fuel assemblies may potentially be damaged as a result of the event. A conservative radiological evaluation has been performed to bound damage to all fuel in the cask from a lid drop. In addition, damage of up to two fuel assemblies due to a drop of a fuel assembly into the cask has also been evaluated. It is important to note that the fuel in the spent fuel storage canister will have decayed at least 32 years at the time of first cask loading because the final shutdown of IP-1 occurred in October 1974. The radiological dose evaluation is described below.

Whole body doses at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) in NUREG-0612 Table 2.1-1 are zero at 54 days and 40 days subcritical, respectively. Pool water filtration, which only applies to iodine, is not a factor in estimating whole body dose. Therefore, because the IP-1 fuel is aged over 32 years, whole body dose at all locations is considered to be zero. This conclusion is consistent with SECY 96-01 (Ref. 5) which reports a dose of 0.027 Rad from Kr-85 based on an earlier calculation which assumed a 100% gap release from all 160 assemblies stored in the pool. With a half life of approximately 11 years, the Kr-85 concentration has further decayed since that calculation was performed.

The evaluation performed focuses solely on thyroid dose in order to provide a non-zero estimate of the dose due to a damaged fuel event, even though the thyroid dose also decreases to zero well within one year after shutdown as shown in NUREG-0612, Table 2.1-1.

The generic thyroid doses estimated for the longest decay time with non-zero results in NUREG-0612, Table 2.1-1 are used as the baseline in this evaluation and are very conservative due to the short fuel decay times assumed compared to the actual IP-1 fuel. The longest decay time with non-zero, unfiltered thyroid doses calculated for the EAB and LPZ from NUREG-0612, Table 2.1-1 is 90 days.

The doses for a single damaged PWR fuel assembly from NUREG-0612, Table 2.1-1 are multiplied by the following factors to account for the IP-1 site specific differences:

- The ratio of IP-1 reactor thermal power to the generic thermal power
- The ratio of the Indian Point site-specific X/Q values for the EAB, LPZ, and control room to the generic values.

This approach is consistent with that suggested in the "Applicability" portion of NUREG-0612, Section 2.1.

The resulting doses are multiplied by an additional factor reflecting the reduced pool depth at IP-1 (and consequently the decontamination factor) that is assumed in NUREG-0612. The single assembly doses are adjusted for the number of assemblies assumed to be damaged in the two cases being studied.

Case 1: Single assembly doses are multiplied by 32 to provide a conservative maximum value for damaging all of the fuel in the spent fuel canister due to a single MPC lid load drop.

Case 2: Single assembly doses are multiplied by two, representing the two damaged fuel assemblies, and adjusted for a high fuel peaking factor of 1.65 as suggested by Note 2 to NUREG-0612, Table 2.1-2, when only one damaged fuel assembly is involved. (This factor does not apply to doses calculated for the Case 1 evaluations because all 32 assemblies are evaluated for those cases.)

Doses were evaluated for the following scenarios:

EAB Case 1- 32 Assemblies Damaged under 18.8 feet of water
EAB-Case 2-Two Assemblies Damaged under 5.9 feet of water
LPZ-Case 1-32 Assemblies Damaged under 18.8 feet of water
LPZ-Case 2-Two Assemblies Damaged under 5.9 feet of water
Control Room-Case 1-32 Assemblies Damaged under 18.8 feet of water
Control Room-Case 2-Two Assemblies Damaged under 5.9 feet of water

Note: The doses were evaluated for the Unit 2 control room, which provides bounding results for the Unit 3 control room.

Results

The NRC offsite exposure limits for dose due to a heavy load drop accident are set at "well within 10 CFR Part 100 guidelines". The NRC has interpreted "well within" to mean "less than or equal to 25% of the 10 CFR Part 100 values". The control room dose limit, which is not addressed in 10 CFR 100 or NUREG-0612, is taken from 10 CFR 50, Appendix A, General Design Criterion (GDC) 19 and NUREG-0800, Standard Review Plan, Section 6.4. The GDC limit for control room dose is "5 REM whole body or its equivalent to any part of the body." The thyroid equivalent is 30 REM per SRP 6.4, Section II.6. Table 2 shows the comparison of the estimated doses for IP-1 fuel damage events and the regulatory limits. All the calculated doses are much less than the regulatory limit and therefore are acceptable as shown in Table 2.

4.7.4 Criticality Evaluation

The analyses of the loaded transfer cask drops into the cask load pool and in the handling area, the lid drops in the cask loading pool, and the fuel drop in the cask load pool confirm that no damage to the fuel basket occurs to the extent that the neutron absorber panels would be prevented from performing their criticality safety function. In addition, there would be no relocation of fuel material to create a critical geometry. The maximum allowable g load is not exceeded in any of the drop scenarios. Therefore the existing generic cask vendor licensing basis criticality analysis remains applicable and bounding and no additional analysis is necessary.

4.8 Summary

The IP-1 FHB 75 ton crane is adequately designed and will be appropriately maintained, inspected, and tested to provide reasonable assurance that the cask handling loads can be safely handled with a load drop being a highly unlikely event. Evaluations of hypothetical drop events during spent fuel storage component lifting and handling resulted in no unacceptable consequences for the public or the plant, including the MPC, the transfer cask and the loaded fuel.

5.0 REGULATORY ANALYSIS

The IP-1 10 CFR 50 licensing basis assumes the use of a shipping cask, the GE IF-200, which is designed for severe g loads from drops and impacts without damage to the contained fuel. The impact of a load drop on systems, structures, and components in the vicinity of the load path was evaluated. The load path has been established and, in accordance with the technical specifications, casks are not lifted over or near the spent fuel pool.

However the HI-TRAC transfer cask is not a 10CFR71 certified shipping cask. Therefore, because the 75-ton crane has not been upgraded to single failure proof, the spent fuel storage canister (MPC-32), the fuel inside, and the transfer cask require evaluation for hypothetical drops.

The Holtec HI-STORM 100 system has design limits regarding the acceptable g loading on the cask structures and contained fuel. To ensure the g loading on the fuel, MPC and cask due to a drop event remain within the applicable design limit, an impact limiter will be installed in the cask load pool and maximum allowable drop heights will be established in the cask loading procedures.

The original plant licensing basis also did not address the possibility of a lid drop into a loaded canister due to the physical configuration of the IF-200 cask and lid which precluded damage to the fuel. The Holtec HI-STORM 100 system has been analyzed for this postulated event at IP-1.

In addition, Indian Point Unit 1 and 2's response to Bulletin 96-02 included a statement that a license amendment request would be submitted in advance if an activity involves the lifting of a heavy load over the spent fuel pool or in a manner which is outside the licensing basis (Ref 11).

Consequently NRC approval of this amendment is requested to support implementation of dry cask loading activities using the HI-STORM system inside the IP-1 Part 50 facility.

5.1 Applicable Regulatory Requirements / Criteria

ENO has determined that the proposed amendment does not require any exemptions or relief from applicable regulatory requirements. A FSAR change request has been submitted to reflect the change in Attachment Two.

Applicable NRC guidance issued since IP-1 last transferred spent fuel includes NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants”, associated Generic Letters 80-113, 81-07, 83-42, and 85-11; ANSI N14.6, American National Standard for Radioactive Material-Lifting Devices for Shipping Containers weighing 10,000 lbs (4500kg) or More”; and NRC Regulatory Issue Summary 2005-25; “Clarification of NRC Guidelines for Control of Heavy Loads.”

NRC Bulletin 96-02 was issued in April 1996 in response to a heavy load handling issue that arose in the industry pertaining to spent fuel cask handling. This bulletin reiterated NRC’s expectations regarding heavy load control established in NUREG-0612.

Bulletin 96-02 states, in part: “For licensees planning to perform activities involving the handling of heavy loads over spent fuel, fuel in the reactor core, or safety related equipment while the reactor is at power…and that involve a potential load drop accident that has not been previously evaluated in the FSAR, submit a license amendment request in advance.”

IP-1 is in the SAFESTOR mode. The HI-TRAC/MPC will not be lifted over spent fuel and the reactor core has been defueled since the 1970’s. There is no safety related equipment, including spent fuel pool cooling, in the IP-1 FHB. However, the current licensing basis assumed the use of a shipping cask which inherently, due to the requirements of 10 CFR 71, protected the spent fuel contained therein in the case of a hypothetical drop.

The HI-TRAC transfer cask and MPC to be used for dry cask storage operations have different design criteria than a shipping cask. The 10 CFR 72 CoC and FSAR for the HI-STORM 100 System provide the design criteria for verifying the protection of the cask components and fuel, which have been previously approved by the NRC. Absent applicable acceptance criteria in 10 CFR 50 for these components and fuel, the acceptance criteria and analytical methods developed under 10 CFR 72 during cask licensing were chosen in evaluating the consequences of postulated load drops related to cask handling in the FHB.

The NRC has accepted this approach, and the analytical methods applied to the drop evaluations, in License Amendment Requests by other licensees. (Ref.10 and Ref. 12)

The analyses presented in this request conclude that the fuel loaded into the HI-TRAC transfer cask/MPC does not exceed the allowable g loads for the fuel or basket assemblies in the event of a load drop event.

The radiological consequences of a cask drop or heavy load drop into a fuel-filled cask during loading operations have been evaluated and found to be well within regulatory limits.

5.2 No Significant Hazard Consideration

The Amendment approval and subsequent cask loading operations will result in a FSAR change allowing the removal of all spent fuel from the IP-1 spent fuel pool to the Indian Point ISFSI, using a planned total of five HI-STORM 100S, Version B, Type 185 storage systems, in a short term one time effort. The IP-1 FSAR and Technical Specifications will be revised in a separate submittal subsequent to the removal of fuel from the facility.

No conflict exists between the existing technical specifications or license conditions and the dry cask storage evolutions proposed in this request.

This proposed amendment has been evaluated in accordance with 10 CFR 50.92(c). The amendment is deemed to involve no significant hazards based on the following:

i. Will operation of the facility in accordance with this proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated.

   Response: No.

   The proposed amendment introduces no new mode of plant operations and does not affect Structures, Systems, and Components (SSCs) associated with power production, accident mitigation, or safe plant shutdown. The SSCs affected by this proposed amendment are the IP-1 FHB 75-ton crane, the FHB concrete structure, the spent fuel storage canister, the spent fuel transfer cask, and the spent fuel inside the storage canister. A hypothetical drop of a 30 ton spent fuel shipping cask has been previously evaluated by the NRC and found to be acceptable based on the physical arrangement of plant equipment and the fact that the load path is entirely over concrete floors founded on bedrock or engineered fill over bedrock. The increased mass of the HI-TRAC transfer cask containing a fuel-loaded MPC consequently results in no change to the basis for the original cask handling approval.

   With this amendment, fewer HI-TRAC casks will be required to be loaded, lifted, and handled, a planned total of five, than the previous cask handling effort which involved loading and handling 120 casks. The HI-TRAC cask is within the design capability of the IP-1 FHB 75 ton crane, therefore the probability of an accident is not increased.

   The new analyses of hypothetical drops of a loaded transfer cask confirm that there is no release of radioactive material from the storage canister and no unacceptable damage to the fuel, MPC, or transfer cask.

   The hypothetical drop of a spent fuel canister lid into an open, fuel-filled-canister in the cask loading pool during fuel loading has been evaluated. The radiological consequences of this event, as well as the drop of a single spent fuel assembly into an open fuel-filled canister in the cask loading pool, due to the potential damage of spent fuel assemblies in the canister have been evaluated. The consequences of the fuel drop events are less than 2% of regulatory requirements and are bounded by the licensing basis of IP-1.

   Since the hypothetical drops result in lesser g loads on the fuel than design, there is no rearrangement of the fuel or deformation of the fuel basket in the canister such that a critical geometry is created.

ii. Will operation of the facility in accordance with this proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The proposed amendment introduces no new mode of plant operations and does not affect SSCs associated with power production, accident mitigation, fuel pool cooling, or SAFESTOR configuration. The SSCs affected by this proposed amendment are the non-single-failure proof 75 ton crane, structural portions of the FHB, the spent fuel canister, the spent fuel transfer cask, and the spent fuel inside the canister.

The design function of the IP-1 FHB 75 ton crane is not changed. The HI-STORM System load drops create the possibility of a new initiator of an accident previously evaluated (failure of fuel cladding) caused by the postulated non-mechanistic single failure of a component in the FHB 75 ton crane.

The current licensing basis includes evaluations of the consequences of a spent fuel cask drop into the cask load pool. The new initiators include the drop of a fuel transfer cask and a drop of a spent fuel canister lid into the open, fuel filled canister in the cask loading pool and a drop of individual assemblies into the MPC. These new initiators create hypothetical accidents that are comparable in consequences to and bounded by those previously evaluated. For the drop of a spent fuel transfer cask, the consequences of cask impact on facility SSCs are bounded by the current licensing scenario of a shipping cask drop. That is, there is no significant damage to the FHB structure or on any SSCs used for safe storage of spent fuel, and there is no release of radioactive material. These new analyses of the drop of a loaded transfer cask confirm that there is no release of radioactive material from the storage container and no unacceptable damage to the fuel, MPC, or transfer cask.

For the drop of the spent fuel canister lid, with the maximum number of assemblies in the canister at 32, or the drop of a single spent fuel assembly into a fuel-filled canister, doses are calculated to be less than 2% of regulatory limits. Further the previously analyzed 100 percent cladding failure of 160 assemblies bounds the event. There is no rearrangement of the fuel in the canister such that a critical geometry is created as a result of an MPC lid drop.

iii. Will operation of the facility in accordance with this proposed amendment involve a significant reduction in a margin of safety?

Response: No.

The proposed amendment introduces no new mode of plant operations and does not affect SSC's associated with spent fuel storage, spent fuel pool cooling, or the integrity of SSCs in the SAFESTOR mode. The SSCs affected by this proposed amendment are the non-single-failure proof FHB 75 ton crane, structural portions of the FHB, the spent fuel storage canister, the spent fuel transfer cask, and the spent fuel inside the canister. This amendment does not affect the fuel stored in the spent fuel pool or any SSC associated with safe store of the fuel. The design function of the 75 ton crane is not changed. The proposed changes to plant procedures needed to implement dry cask storage do not exceed or alter a design basis or safety limit associated with accident mitigation, SAFESTOR, or fuel clad integrity.

This proposed amendment results in a net benefit based upon the larger capacity cask being used to move and store the fuel (32 assemblies per canister versus two assemblies). All the fuel can be removed from the spent fuel pool with far fewer cask lifts, welding evolutions, and storage placement. Because the maximum weight of the cask loaded with spent fuel is the same as the original design and tested capacity of the crane, design safety margins for use of the 75 ton crane remain unchanged.

Based on the above review, it is determined that: (1) the proposed amendment does not constitute a significant hazards consideration as defined by 10 CFR 50.92; (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed amendment; and (3) this action will not result in a condition which significantly alters the impact on the environment as described in the NRC Environmental Assessment Regarding Order Authorizing Facility Decommissioning (Ref. 5)

5.3 Environmental Considerations

The proposed amendment does not involve (i) a significant hazard consideration, (ii) a significant change in the types or a significant increase in the amounts of any effluents that may be released off site, or (iii) a significant or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 50.51(c)(9). Therefore pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. Letter S. Anton, Holtec to USNRC: “Submittal of Amendment Request # 5 to HI-STORM 100 CoC”; Docket 72-1014-5, Accession Nos. ML061800234, ML062630291; dated June 23, 2006.

2. R. Reid, USNRC to W. Cahill, Con Edison: “Amendment 16 to Provisional Operating License No. DPR-5, Safety Evaluation by the Office of Nuclear Reactor Regulation”; Docket 50-3; Dated April 14, 1977.

3. 45 FR 30614, May 9, 1980

4. J. Minns, USNRC to M Kansler, Entergy; “Indian Point Nuclear Generating Station, Unit 1-Issuance of Amendment RE: Changes to Effectively Coordinate Indian Point Nuclear Generating Station, Units 1 and *2,* Programs (TAC. No MB5259)”, Docket 50-003; Accession No. ML 032240282; August 11, 2003; Safety Evaluation Report, Section 4.0.

5. SECY 96-01; “Environmental Assessment-Order to Authorize Decommissioning and Amendment No. 45 to License No. DPR-5 for Indian Point No. 1 (TAC No. M59664)”; Docket No. 50-003; Accession No. ML992950095; dated Jan. 2, 1996.

6. Letter: J. Boska, USNRC to M. Kansler, ENO; “Indian Point Nuclear Generating Unit No. 2-Issuance of Amendment RE: Approving the Use of a new Gantry Crane in the Fuel Storage Building (TAC No MC5036)”; Amendment No. 244, Accession No. ML053000051; dated November 21, 2005.

7. Response to Directorate of Licensing Questions in Letter of March 6, 1974, dated May 15, 1974 (Attachment to “Amendment No. 11 to Petition for Full Term Operating License” W. Cahill, Con Edison; AEC Docket No. 50-3, May 15, 1974).

8. A. Schwencer, USNRC to W. Cahill, Con Edison; “ NRC Order to Show Cause”, Docket Nos. 50-3, 50-247; February 11, 1980.

9. P. Erickson, NRC to S. Bram, Con Ed; “Order to Authorize Decommissioning and Amendment No. 45 to License No. DPR-5 for Indian Point Unit 1 (TAC No. M59664)”; Docket 50-3; January 31, 1996.

10. B. Vaidya, USNRC to P. Hinnenkamp, Entergy; “River Bend Station Unit 1-Issuance of Amendment RE: Use of Fuel Building Cask Handling Crane for Dry Spent Fuel Cask Loading Operations, (TAC No. MC6327)”; Docket 50-458; Accession No. ML053410490; December 1, 2005.

11. S. Quinn, Consolidated Edison to USNRC; “Response to NRC Bulletin 96-02, ‘Movement of Heavy Loads Over Spent Fuel Pool, Over Fuel in the Reactor Core, of Over Safety Related Equipment’; “Docket Nos. 50-003 & 50-247, July 12, 1996.

12. N. Kalyanam, USNRC to V. Bilovsky, Holtec: “ Holtec International-Request for Withholding Information from Public Disclosure for River Bend Station, Unit 1 (TAC NO. MC6327)”; Accession No. ML052280428; August 2, 2005.

Table 1
Results of Loaded Transfer Cask Tips Into the Cask Load Pool

18 in. Drop to East Cask Pit Wall	Maximum Cask Deceleration (g's)
Center	41.6
Edge	33.1

Table 2
COMPARISON OF IP-1 CALCULATED DOSES AGAINST ACCEPTANCE LIMITS

Location and Case	Dose Type	IP-1 Calculated Value (REM)	Regulatory Limit (REM)	Regulatory Basis
EAB-Case 1	Thyroid	0.824	75	25% of Part 100
EAB-Case 1	Whole Body	0	6.25	25% of Part 100
EAB-Case 2	Thyroid	0.226	75	25% of Part 100
EAB-Case 2	Whole Body	0	6.25	25% of Part 100
LPZ-Case 1	Thyroid	0.304	75	25% of Part 100
LPZ-Case 1	Whole Body	0	6.25	25% of Part 100
LPZ-Case 2	Thyroid	0.084	75	25% of Part 100
LPZ-Case 2	Whole Body	0	6.25	25% of Part 100
CR-Case 1	Thyroid	0.515	30	GDC 19/SRP 6.4
CR-Case 1	Whole Body	0	5	GDC 19/SRP 6.4
CR-Case 2	Thyroid	0.142	30	GDC 19/SRP 6.4
CR-Case 2	Whole Body	0	5	GDC 19/SRP 6.4

Table 3
CASK HANDLING OPERATIONAL SEQUENCE

Note: Refer to Section 4.7 of this attachment and Figures 1 through 10 for cask locations and component dimensions and elevations. This sequence is intended to describe only the major heavy loads movements and is not a detailed description of all operational steps required for cask loading.

1. Load an empty MPC into the HI TRAC transfer cask using either the Unit 2 single-failure-proof gantry crane or a mobile crane located away from all safety-related SSCs. (Refer to Figure 5)
2. With the use of the Vertical Cask Transporter (VCT), move the transfer cask to the Indian Point 1 (IP-1) Fuel Handling Building (FHB) north rolling steel door area and place the transfer cask on the pre-arranged air caster pads.
3. Using the air casters and a secure mover, slide the transfer cask south into the IP-1 FHB to its designated location east of the cask load pool.
4. Move the FHB 75-ton crane over the pre-staged HI TRAC transfer cask.
5. Lift the transfer cask and move the transfer cask west until it is centered over the cask load pool and impact limiter. (Refer to Figure 6)
6. Lower the transfer cask into the cask load pool onto the impact limiter.
7. Disengage the 75-ton crane bridge movement safety control so that the crane can be used for fuel movements.
8. Move 32 pre-designated fuel assemblies from the racks in the west spent fuel pool, through the gate opening in the disassembly pool, through the gate opening in the cask load pool and load them individually into the MPC. (Refer to Figure 7)
9. Re-engage the 75 ton crane bridge movement safety control.
10. Attach the transfer cask lifting yoke to the 75-ton crane main hook.
11. Lift and move the MPC lid over the MPC with the 75-ton crane.
12. Lower the lid, install it on the MPC and disengage the MPC lid from the lifting yoke. (Refer to Figure 8)
13. Lift and move the transfer cask east and set down on the truck bay floor. (Refer to Figures 2 & 3)
14. Complete MPC welding, draining and drying activities.
15. Lift the transfer cask and MPC above operating deck floor and slide the air casters under the transfer cask.
16. Move the transfer cask north out of the building on the air casters.
17. Use the VCT to move the transfer cask from IP-1 to the entrance of the Unit 2 Fuel Building and place it on the Unit 2 Low Profile Transporter (LPT).
18. Move the transfer cask into the Unit 2 Fuel Building with the LPT.
19. With the Unit 2 single-failure-proof gantry crane lift the transfer cask off the LPT onto the truck bay floor.
20. Move the LPT out of the Fuel Building and, using the VCT, place an empty HI-STORM overpack on the LPT.
21. Move the overpack into the Unit 2 Fuel Building using the LPT.
22. Using the gantry crane, lift and place the transfer cask on top of the mating device located on top of the overpack. (See “stack-up” configuration shown on Figure 10)
23. Remove the Pool Lid Cover.
24. Using the gantry crane, lower the MPC into the overpack.
25. Remove the empty transfer cask and mating device with the gantry crane and place in the designated storage location.
26. Move the loaded overpack out of the Unit 2 Fuel Building using the LPT.

27. Place the overpack lid on the overpack.
28. Using the VCT move the loaded overpack to the ISFSI pad and place the overpack in it’s designated location.

Table 4
<u>NUREG-0612 SECTION 5.1.1 - COMPARISON MATRIX</u>

Document and Section	Guidance	Evaluation
NUREG-0612 Section 5.1.1 (1)	<u>Safe Load Paths</u> should be defined for the movement of heavy loads to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and in the spent fuel pool, or to impact safe shutdown equipment. The path should follow, to the extent practical, structural floor members, beams, etc. such that if the load is dropped, the structure is more likely to withstand impact. These load paths should be defined in procedures, shown on equipment layout drawings, and clearly marked on the floor in the area where the load is to be handled. Deviations from defined load paths should require written alternative procedures approved by the plant safety review committee.	The lift of the spent fuel transfer cask is performed from the Cask Load Pool, a separate pool from the West Pool containing the spent fuel. The Safe Load Path does not result in lifting of the spent fuel transfer cask above irradiated fuel in the spent fuel pool, or above or with any potential impact to safe shutdown equipment. The Safe Load Path will be defined within a specific cask lifting procedure and the Safe Load Path will be clearly marked on the floor. (See Figures 1, 2, and 3 of this attachment.)
NUREG-0612 Section 5.1.1 (2)	Procedures should be developed to cover load-handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. These procedures should include: identification of required equipment; inspection and acceptance criteria required before movement of load; the steps and proper sequence to be followed in handling the load; defining the safe load path; and other special precautions.	Specific crane operating procedures utilized for transfer cask and cask component lifts will be prepared to include: identification of required equipment; inspections and acceptance criteria required before load movement; the steps and proper sequence to be followed in handling the load; defining the safe load path; and other precautions. A specific cask loading and handling procedure will provide additional details for controlling movement during transfer cask handling operations, including requirements for limiting clearance between the bottom of the cask and the floor surface.
NUREG-0612 Section 5.1.1 (3)	<u>Crane Operators</u> should be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, “Overhead and Gantry Cranes”.	Crane operators receive initial and continued training on material handling and hoisting and equipment control in accordance with Entergy’s systematic approach to training process that includes the provisions of Chapter 2-3 of ANSI B30.2.0-1976.

Document and Section	Guidance	Evaluation
NUREG-0612 Section 5.1.1 (4)	Special Lifting Devices should satisfy the guidelines of ANSI N14.6-1978, "Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4,500 kg) or More for Nuclear Materials". This standard should apply to all special lifting devices, which carry heavy loads in areas as defined above. For operating plants certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used*. This is in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6, which bases the stress design factor on only the weight (static load) of the load and of the intervening components of the special handling device. * For purposes of selecting the proper sling, loads imposed by the SSE need not be included in the dynamic loads imposed on the sling or lifting device.	The Holtec HI-TRAC lifting yoke is the only special lifting device that is required to meet the guidelines of ANSI-N14.6. It complies with ANSI-N14.6-1993 and the additional guidelines of NUREG-0612, Section 5.1.6(1)(a). The lifting trunnions of the HI-TRAC transfer cask have a design safety factor greater than 10 times the maximum combined static and dynamic load. A dynamic load factor of 1.15 is applied to the mass of the lifted load.
NUREG-0612 Section 5.1.1 (5)	Lifting Devices that are not specifically designed should be installed and used in accordance with the guidelines of ANSI B30.9-1971, "Slings. However, in selecting the proper sling the load used should be the sum of static and maximum dynamic load*. The rating identified on the sling should be in terms of the "static load" which produces the maximum static and dynamic load. Where this restricts to use on only specific cranes, the slings should be clearly marked as to the cranes with which they may be used. * For purposes of selecting the proper sling, loads imposed by the SSE need not be included in the dynamic loads imposed on the sling or lifting device.	The transfer cask lift and transfer of the cask to the EL. 70'-6" loading floor, together with removal of the cask from the Fuel Handling Building does not utilize any lifting devices that are not specifically designed. Other lifts will be performed as part of the cask handling procedures; any associated heavy load lifts will be in accordance with plant procedures.
NUREG-0612 Section 5.1.1 (6)	Crane Inspection and Maintenance. The crane should be inspected, tested, and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976, "Overhead and Gantry Cranes", with the exception that tests and inspections should be performed prior to	The FHB bridge crane is considered operated in an environment and frequency of normal service. The crane is inspected, tested and maintained in accordance with

Document and Section	Guidance	Evaluation
	use where it is not practical to meet the frequencies of ANSI B30.2 for periodic inspection and test, or where frequency of crane use is less than the specified inspection and test frequency (e.g., the polar crane inside a PWR containment may only be used every 12 to 18 months during refueling operations, and is generally not accessible during power operation. ANSI B30.2, however, calls for certain inspections to be performed weekly or monthly. For such cranes having limited usage, the inspections, tests, and maintenance should be performed prior to their use).	Chapter 2-2 of ANSI B30.2-1976 and the additional guidance contained in NUREG-0612, Section 5.1.1(6) regarding frequency of inspections and test. A full load proof test will be performed on the crane prior to first lift of the transfer cask with fuel.
NUREG-0612 Section 5.1.1 (7)	<u>Crane Design.</u> The crane should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, "Overhead and Gantry Cranes" and of CMAA-70, "Specifications of Electric Overhead Traveling Cranes". An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specification compliance if the intent of the specification is satisfied.	The IP-1 FHB bridge crane was fabricated in 1958, in accordance with specification requirements. This specification required the crane to be designed in accordance with safety standards of New York State or any other codes applying to this type of equipment with New York codes governing. Codes in effect at that time included ANSI B30.2-1943 and CMAA standards (in effect in 1955). The crane has been evaluated to the requirements of ASME NOG-1 which utilizes similar design requirements to that of Chapter 2-2 of ANSI B30.2 and CMAA-70. Supplemental testing and inspections will be performed to offset the material design requirements of ANSI B30.2 and CMAA-70, including a full load proof test at minimum operating temperature and NDE inspection of critical welds post proof test.
NUREG-0612 Section 5.1.2 (1)	The overhead crane and associated lifting devices used for handling heavy loads in the spent fuel pool area should satisfy the single failure proof guidelines of Section 5.1.5 of NUREG-0612	The IP-1 FHB bridge crane does not satisfy the single failure proof guidelines of Section 5.1.6 of NUREG-0612.
	<u>OR</u>	

Document and Section	Guidance	Evaluation
NUREG-0612 Section 5.1.2 (2)	Each of the following is provided:	
NUREG-0612 Section 5.1.2 (2)	a). Mechanical stops or electrical interlocks should be provided that prevent movement of the overhead crane load block over or within 15 feet horizontal of the spent fuel pool. These mechanical stops or electrical interlocks should not be bypassed when the pool contains "hot" spent fuel, and should not be bypassed without approval of the shift supervisor (or other designated plant management personnel). The mechanical stops or electrical interlocks should be verified to be in-place and operational prior to placing "hot" spent fuel in the pool.	Mechanical stops or electrical interlocks will be provided that prevent movement of the overhead crane load block over or within 15 feet horizontal of the spent fuel pool. Administrative controls will be in place to govern the use of the mechanical stops or electrical interlocks.
NUREG-0612 Section 5.1.2 (2)	b). The mechanical stops or electrical interlocks of 5.1.2(20(a) above should also not be bypassed unless an analysis has demonstrated that damage due to postulated load drops would not result in criticality or cause leakage that could uncover the fuel.	For the IP-1 FHB, an electrical interlock will be provided to prevent the bridge from traveling toward the Fuel Pool when moving the transfer cask or its components. Additionally a load drop analysis of the cask demonstrated criticality of the contained spent fuel would not occur. Consequences of a dropped cask, impacting the Cask Load Pool walls and floor, demonstrate that the cask would not impact the spent fuel pool, and would not result in leakage from the spent fuel pool that could uncover the fuel.
NUREG-0612 Section 5.1.2 (2)	c). To preclude rolling if dropped, the cask should not be carried at a height greater than necessary and in no case more than six (6) inches above the operating floor level of the refueling building or other components or structures along the path of travel.	The transfer cask will not be carried more than six (6) inches above the EL. 70'-6" FHB operating floor along its path of travel
NUREG-0612 Section 5.1.2 (2)	d). Mechanical stops or electrical interlocks should be provided to preclude crane travel from areas where a postulated load drop could damage equipment from redundant or alternate safe shutdown paths.	Mechanical stops or electrical interlocks will be provided to preclude movement of the transfer cask over the fuel pool. There are no safety related or

Document and Section	Guidance	Evaluation
		safe shutdown equipment in the vicinity.
NUREG-0612 Section 5.1.2 (2)	e). Analysis should conform to the guidelines of Appendix A.	Cask drop consequence analysis have been performed conforming to the requirements of Appendix A of NUREG-0612.
	OR	
NUREG-0612 Section 5.1.2 (3)	Each of the following are provided (Note: this alternative is similar to a) above, except it allows movement of heavy loads, such as a cask, into the pool while it contains hot spent fuel if the pool is large enough to maintain wide separation between the load and the hot spent fuel.)	The cask will not be loaded into the spent fuel pool.
	OR	
NUREG-0612 Section 5.1.2 (4)	The effects of drops of heavy loads should be analyzed and shown to satisfy the evaluation criteria of Section 5.1 of this report. These analyses should conform to the guidelines of Appendix A.	Cask drop consequence analyses have been performed conforming to the requirements of Appendix A of NUREG-0612.

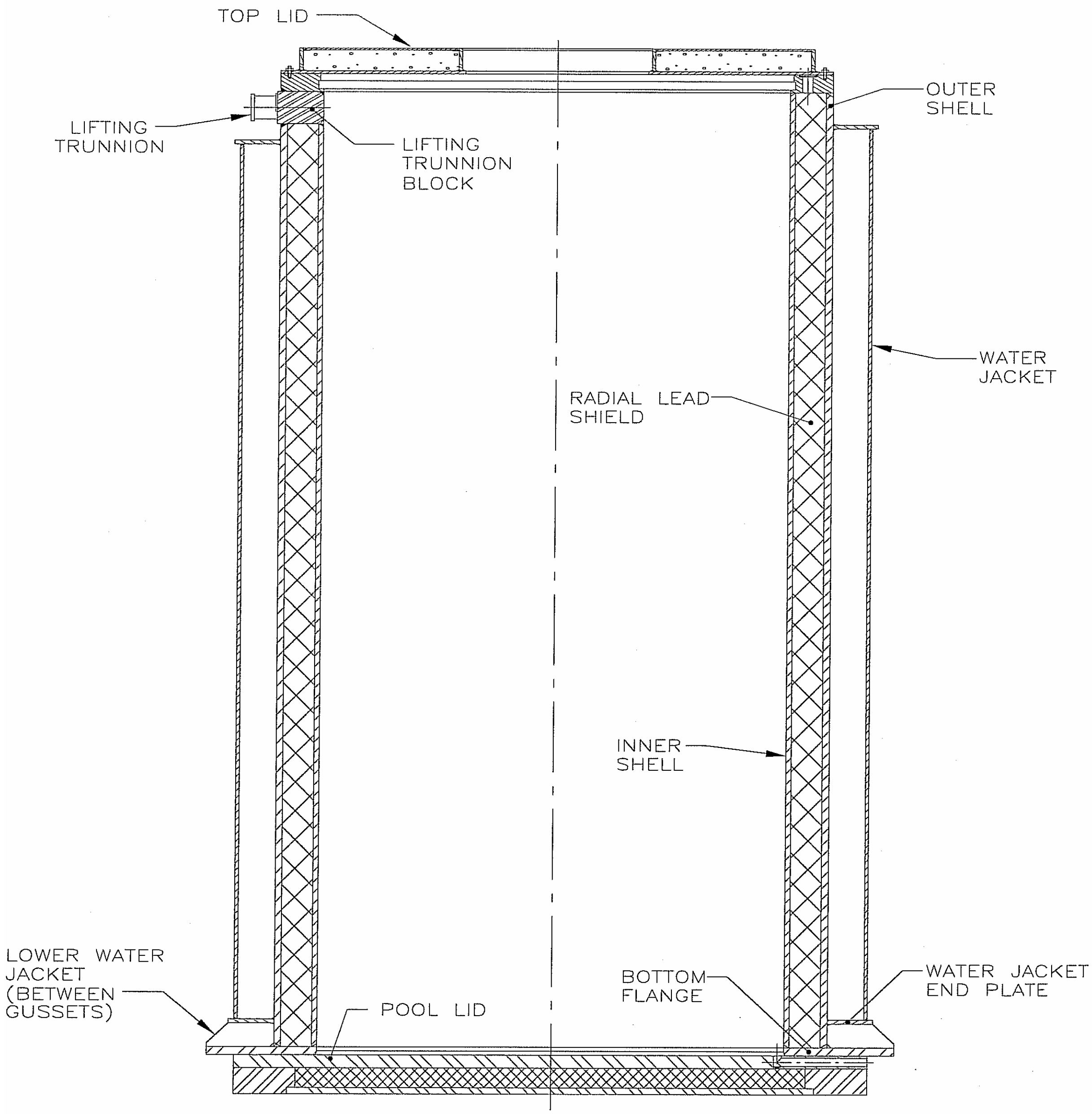

FIGURE 4
HI-TRAC TRANSFER CASK CROSS SECTIONAL VIEW

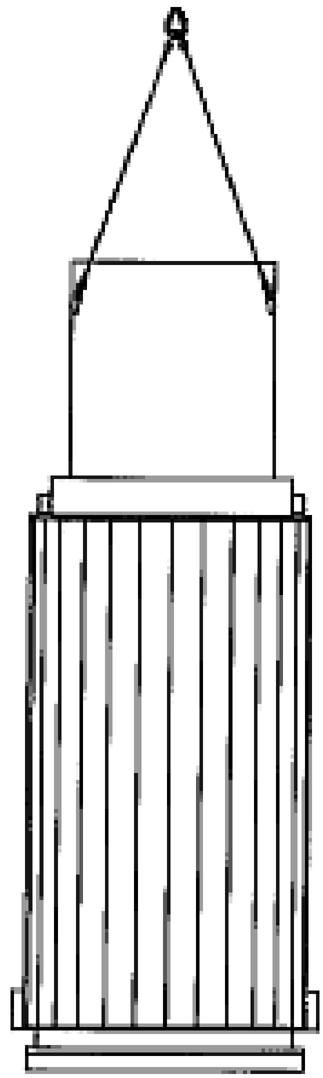

FIGURE 5

MPC INSTALLATION INTO TRANSFER CASK

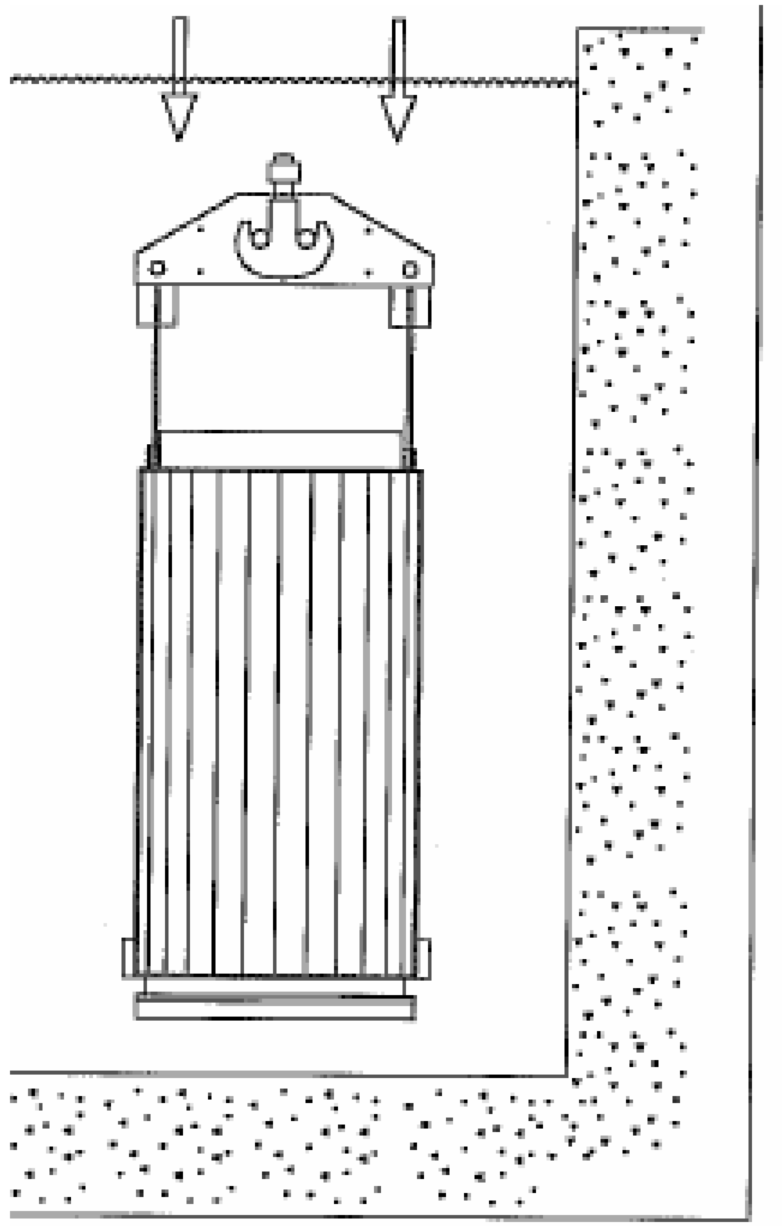

FIGURE 6
PLACEMENT OF TRANSFER CASK AND MPC IN CASK LOAD POOL

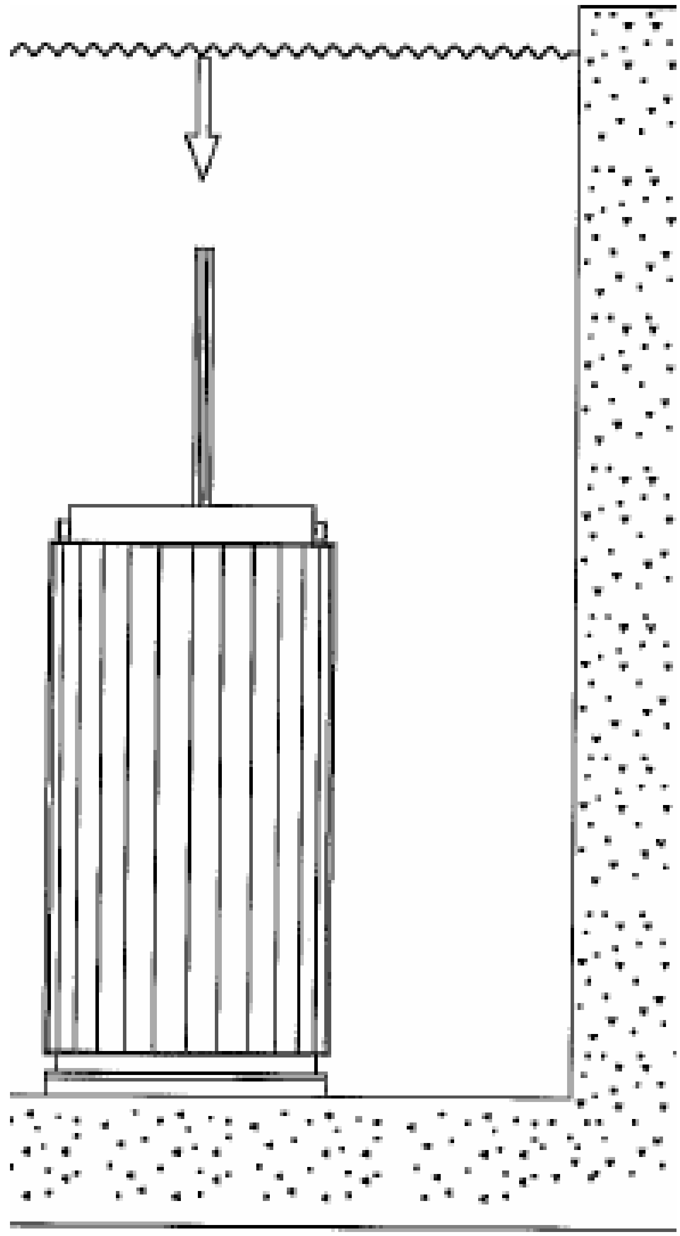

FIGURE 7
FUEL LOADING IN THE CASK LOAD POOL

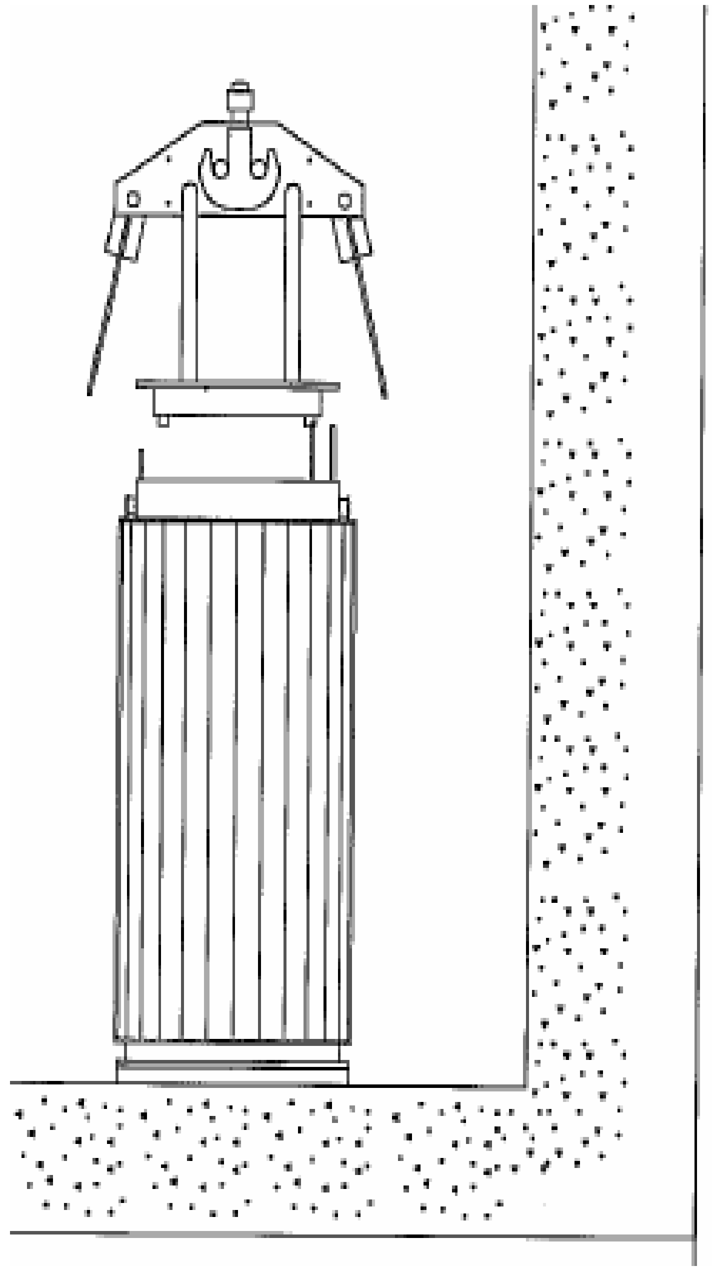

FIGURE 8

MPC LID INSTALLATION IN THE CASK LOAD POOL

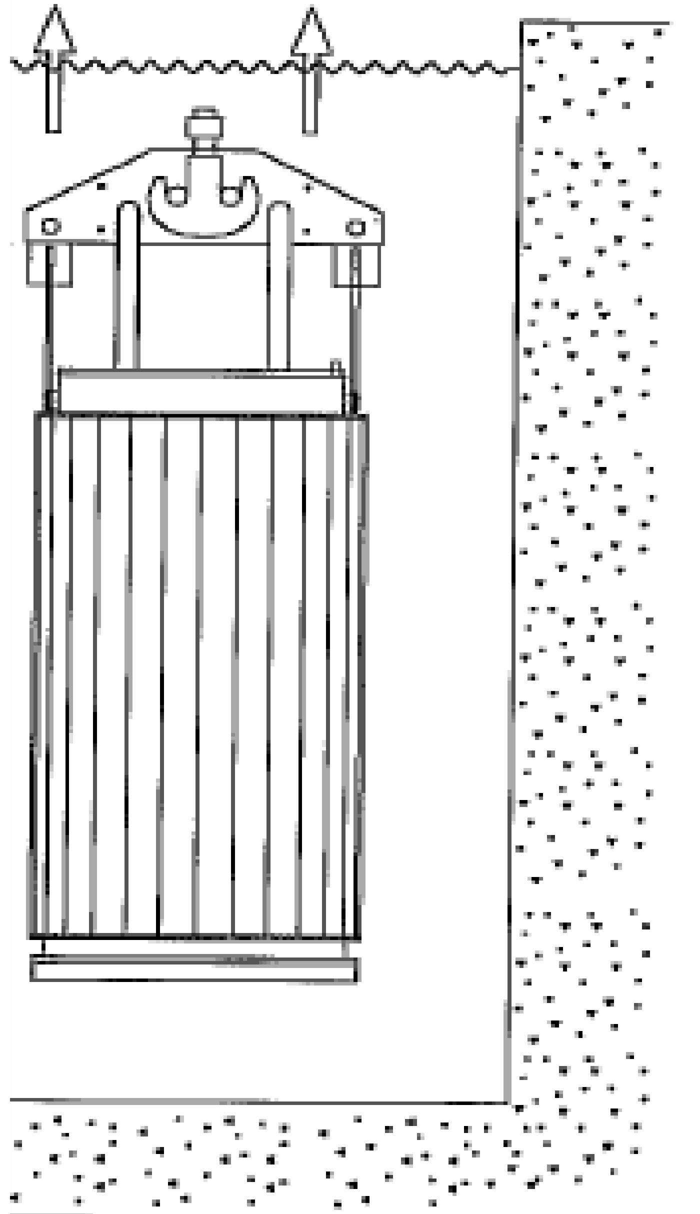

FIGURE 9
CASK REMOVAL FROM CASK LOAD POOL

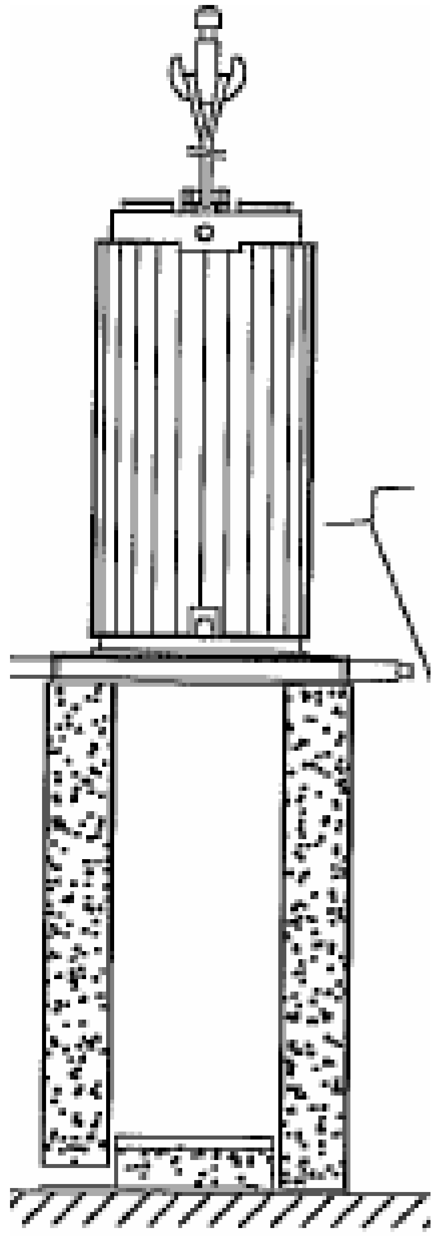

FIGURE 10

TRANSFER CASK STACKED UP OVER OVERPACK
FOR INSERTION OF THE MPC
(LIFT PERFORMED BY THE UNIT 2 GANTRY CRANE)

ATTACHMENT TWO TO NL-07-033

MARKED UP UNIT 1 FSAR PAGES FOR LICENSE AMENDMENT REQUEST - UNIT 1 FUEL HANDLING BUILDING CRANE

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT ENERGY CENTER, UNIT 1
DOCKET 50-003

Unit 1 FSAR Change

ENO requests Section 3.5.1 be revised from:

> "All spent fuel will continue to be stored in the spent fuel pools of Unit 1 fuel handling building until it is shipped to an appropriate permanent off-site facility."

To:

> "All spent fuel will continue to be stored in the spent fuel pools of Unit 1 fuel handling building until it is shipped to an appropriate permanent off-site facility or temporary storage."

ENO requests Section 6.0 be revised from:

> "The spent fuel stored in the Unit 1 fuel building has decayed sufficiently such that, even in the unlikely event of a loss of water in the pool, this fuel can be adequately cooled by ambient air.[1]"

To:

> "The spent fuel stored in the Unit 1 fuel building has decayed sufficiently such that, even in the unlikely event of a loss of water in the pool, this fuel can be adequately cooled by ambient air.[1] Fuel is to be moved out of the spent fuel pool to defuel it. Based on additional analysis, inspections, and load testing, the 75 ton HI-TRAC 100D-Version IP1™ transfer cask loaded with spent fuel can be handled by the 75 ton crane main hoist with a load drop being a highly unlikely event that would meet regulatory criteria for such an event. Five transfers of the cask with fuel are planned to remove all fuel to the Independent Spent Fuel Storage Installation (ISFSI). Hypothetical drops of heavy loads associated with cask loading have been analyzed to ensure their consequences were acceptable. When handling spent fuel transfer casks, mechanical stops or electrical interlocks will be provided that prevent movement of the overhead crane load block and cask over or within 15 feet horizontal of the spent fuel pool and all heavy loads movement will be administratively controlled. Postulated drops are the loaded vertical transfer cask drop into the Cask Load pool, inclined loaded vertical transfer cask drop into the Cask Load pool, and loaded transfer cask tips into the Cask Load pool. In all cases the calculated cask deceleration is below the allowable g force for the fuel in the cask so there is no fuel damage. The Cask Load pool floor slab is acceptable and the west concrete wall suffers only minor damage, provided the left height is limited to the analyzed value. Dropping the loaded transfer cask vertically onto the concrete floor at elevation 70' 6" results in the most significant g force but is below the allowable g force for the fuel in the cask therefore there is no fuel damage, provided lift height is limited to the analyzed values. Dropping of the MPC lid into the MPC and onto the transfer cask flange were also evaluated and may damage some fuel but not cause criticality. For bounding purposes 32 assemblies were assumed damaged. Similarly, two fuel assemblies may be damaged by dropping fuel into the cask. Radiological analyses were performed and the damage to 32 assemblies was bounding in all cases. A regulatory limit of 25 percent of Part 100 was used for the exclusion area boundary (EAB) and low population zone (LPZ) and GDC 19 limits were used for the control room. The doses were zero whole body and less than one REM thyroid (less than 2 percent of regulatory limits) in all cases. Reference ENO letter to NRC, "License Amendment Request (LAR) – Unit 1 Fuel Handling Building Crane," February 2007 (NL-07-033).

ATTACHMENT THREE TO NL-07-033

COMMITMENTS

ENTERGY NUCLEAR OPERATIONS, INC.
INDAIN POINT ENERGY CENTER, UNIT 1
DOCKET 50-003

Commitment Number	Commitment	Scheduled Completion Date
NL-07-033-01	The Safe Load Path will be defined in specific cask loading procedures and will be clearly marked on the floor.	Prior to first lift of the Transfer cask with fuel.
NL-07-033-02	A specific cask loading and handling procedure will provide additional details for controlling movement during cask handling operations, including requirements for limiting the clearance between the bottom of the cask and the floor surface to values less than or equal to the values used in the drop analysis.	Prior to first lift of the Transfer cask with fuel.
NL-07-033-03	Crane Operators will be trained and qualified in accordance with Entergy's training process and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, "Overhead and Gantry Cranes".	Prior to first lift of the Transfer cask with fuel.
NL-07-033-04	A full load proof test will be performed on the crane prior to cask lifting, including the full load proof test at minimum operating temperature and NDE inspection of critical welds post proof test.	Prior to first lift of the Transfer cask with fuel.
NL-07-033-05	Mechanical stops or electrical interlocks will be provided that prevent movement of the overhead crane load block over or within 15 feet horizontal of the spent fuel pool, when moving the transfer cask or its components.	Prior to first lift of the Transfer cask into the cask load pool.
NL-07-033-06	The appropriately designed impact limiter will be installed in the cask loading pool.	Prior to first lift of the Transfer cask with fuel.
NL-07-033-07	Cask loading procedures will include instructions to check for severe weather prior to commencing outdoor transfer cask or HI-STORM overpack movements.	Prior to first lift of the Transfer cask with fuel.