72-17(50-344)

PGE Portland General Electric Company

Stepnen M. Quennoz
Trojan Site Executive

January 16, 1997

VPN-003-97

Trojan Nuclear Plant
Docket 50-344
License NPF-1

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Dear Sirs:

License Change Application (LCA) 240 - Movement of Cask into Fuel Building

The purpose of this letter is to transmit LCA 240 which requests amendment of Facility Operating (Possession Only) License No. NPF-1. This LCA proposes to delete paragraph 2.(C)(7) to allow pre-operational testing and load handling of spent fuel transfer and storage casks in the Trojan Fuel Building.

LCA 240 contains the majority of the cask movement and heavy loads controls discussion that was submitted in LCA 237, "Spent Fuel Cask Loading in the Fuel Building" but does not request authorization to load spent fuel into the casks. The purpose for the separate submittal of the cask movement and heavy loads information is to permit the pre-operational testing of the casks in the Fuel Building, which can proceed independent of any fuel loading issues.

Attachment I provides the background and reason for the proposed change, a description of the proposed change, a description of the Independent Spent Fuel Storage Installation (ISFSI) components and equipment, a description of the cask pre-operational testing, a safety evaluation, and a no significant hazards consideration determination. PGE has determined that no new types of accidents are involved. Attachment II provides a copy of the affected License page with the proposed change annotated.

As described in the 10 CFR 72 license application submitted to the NRC in March 1996, PGE plans to begin loading spent fuel into casks and moving the casks to the ISFSI concrete storage pad in January 1998. Accordingly, PGE requests approval of this 10 CFR 50 license amendment by April 1, 1997.

A040 1/1

Also attached is one signed copy of a Certificate of Service for LCA 240 to the Chief Executive of the County in which the facility is located and to the Director of the Oregon Department of Energy.

Sincerely,

Stephen M. Quennoz

Stephen M. Quennoz
Trojan Site Executive

c: M. T. Masnik, NRC, NRR
D. G. Reid, NRC, NMSS
R. A. Scarano, NRC Region IV
David Stewart-Smith, ODOE
A. Bless, ODOE

STATE OF OREGON,)
)
)
COUNTY OF COLUMBIA)

I, S. M. Quennoz, being duly sworn, subscribe to and say that I am the Trojan Site Executive, for Portland General Electric Company, the licensee herein; that I have full authority to execute this oath; that I have reviewed the foregoing; and that to the best of my knowledge, information, and belief the statements made in it are true.

Date JANUARY 16, 1997

Stephen M Quennoz

S. M. Quennoz,
Trojan Site Executive
Portland General Electric Company

On this day personally appeared before me, S. M. Quennoz; to me known to be the individual who executed the foregoing instrument, and acknowledged that he signed the same as his free act.

GIVEN under my hand and seal this 16th day of January, 1997.

OFFICIAL SEAL
PAT SCHAFFRAN
NOTARY PUBLIC-OREGON
COMMISSION NO. 045755
MY COMMISSION EXPIRES JULY 27 1999

Pat Schaffran

Notary Public in and for the
State of Oregon

Residing at Clatskanie
My commission expires 7-27-99

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
PORTLAND GENERAL ELECTRIC COMPANY	)	Docket 50-344
THE CITY OF EUGENE, OREGON, AND	)	Operating License NPF-1
PACIFIC POWER & LIGHT COMPANY	)	
(TROJAN NUCLEAR PLANT)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of License Change Application 240 to the Operating License for the Trojan Nuclear Plant, dated January 16, 1997, have been served on the following by hand delivery or by deposit in the United States Mail, first class, this 16th day of January 1997:

State of Oregon
Attn: David Stewart-Smith
Department of Energy
625 Marion Street NE
Salem, Oregon 97310

Mr. Jack Peterson
Chairman of County Commissioners
Columbia County Courthouse
St. Helens, Oregon 97051

H. R. Pate
Manager, Licensing, Compliance,
and Commitment Management

On this day personally appeared before me H. R. Pate, to me known to be the individual who executed the foregoing instrument, and acknowledged that he signed the same as his free act.

GIVEN under my hand and seal this 16th day of January, 1997.

OFFICIAL SEAL
PAT SCHAFFRAN
NOTARY PUBLIC-OREGON
COMMISSION NO. 045755
MY COMMISSION EXPIRES JULY 27, 1999

Notary Public in and for the State of Oregon

Residing at Clatskanie
My commission expires 7-27-99

ATTACHMENT I

Portland General Electric

LCA 240 - Movement of Casks into the Fuel Building

Trojan Nuclear Plant

LICENSE CHANGE APPLICATION (LCA) 240
MOVEMENT OF CASKS INTO THE FUEL BUILDING

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1. BACKGROUND AND REASON FOR CHANGE

On October 31, 1983, PGE submitted Amendment 1 to License Change Application (LCA) 94, which requested an amendment to Operating License NPF-1 involving the installation of new spent fuel storage racks in the Spent Fuel Pool. The LCA also requested that Operating License NPF-1 be revised to include a prohibition on movement of a spent fuel assembly shipping cask into the Fuel Building.

The reason for requesting this prohibition was that PGE had evaluated the proposed Spent Fuel Pool rerack and concluded that no heavy load drops into the Spent Fuel Pool were credible with the possible exception of a spent fuel assembly shipping cask. This type of drop was an exception because, in 1983, the Department of Energy was only beginning to evaluate the types of spent fuel shipping casks that would be approved for use. PGE believed that the design of the casks that would be ultimately approved for use would be significantly different from the generation of casks that were current in 1983. Therefore, PGE was unable to conclusively determine that moving a spent fuel assembly shipping cask into the Fuel Building after the new racks were installed would not involve a significant hazard consideration. Accordingly, PGE requested the license amendment to prohibit bringing a spent fuel shipping cask into the Fuel Building until an evaluation of the consequences of a cask drop could be performed.

Following shutdown of the Trojan Nuclear Plant (TNP) reactor in November 1992, PGE decided to decommission TNP. PGE submitted a Decommissioning Plan dated January 26, 1995, that detailed prompt decontamination and dismantlement of contaminated structures, systems and components. In addition, PGE's Decommissioning Plan stated that relocating the contents of the Spent Fuel Pool to an Independent Spent Fuel Storage Installation (ISFSI) would be the most economical method for storing the TNP spent fuel until a permanent storage facility offsite would be available for offsite shipment of the spent fuel. Relocating the spent fuel and other high-level radioactive waste from the Spent Fuel Pool to the ISFSI also allows decontamination and dismantlement of structures, systems, and components at TNP to occur sooner than if the spent fuel were left in the Spent Fuel Pool until shipment to the offsite facility is possible.

PGE submitted a 10 CFR 72 license application to the NRC for construction and operation of an ISFSI in March 1996 and requested issuance of the 10 CFR 72 license prior to December 1997. As described in the safety evaluation below, an evaluation of cask drop events has been completed, as well as evaluation of a spectrum of postulated off-normal events and accidents. Because the evaluation of cask drops has been completed, the license condition that prohibits bringing casks into the Fuel Building may be removed from the license. This LCA is being submitted to remove the prohibition from the license such that spent fuel transfer and storage casks may be moved into the Fuel Building for pre-operational testing before any fuel is loaded into casks and moved to the ISFSI on the schedule stated in the 10 CFR 72 license application.

2. DESCRIPTION OF CHANGE

Facility Operating License No. NPF-1 was superseded in its entirety by Possession Only License No. NPF-1, which was issued as Amendment 190 to License No. NPF-1 on May 5, 1993. Paragraph 2.C(7) of NPF-1 specifically prohibits moving a spent fuel shipping cask into the Fuel Building. Amendments 191, 192, 193, 194 and 195 have been subsequently issued without revising paragraph 2.C.(7). Paragraph 2.C(7) of Possession Only License No. NPF-1 currently reads as follows:

"(7) Spent Fuel Assembly Shipping Cask

The licensee shall not move a spent fuel assembly shipping cask into the Fuel Building."

PGE proposes that paragraph 2.C(7) be deleted in its entirety from License No. NPF-1 to allow movement and handling of spent fuel transfer and storage casks in the Trojan Fuel Building as described in the 10 CFR 72 license application. Limiting Condition for Operation (LCO) 3.1.4, "Spent Fuel Pool Load Restrictions," remains in effect and precludes movement of casks over the Spent Fuel Pool.

A mark-up of the proposed change to Possession Only License No. NPF-1 (as provided by Amendment 190 to License No. NPF-1) is located in Attachment II of this LCA.

3. DESCRIPTION OF THE ISFSI COMPONENTS AND EQUIPMENT

3.1 GENERAL

PGE has selected Sierra Nuclear Corporation's TranStor™ Storage System for the Trojan ISFSI. The TranStor™ Storage System is a vertical dry storage system which utilizes a ventilated concrete cask and a seal-welded steel basket to safely store spent nuclear fuel assemblies, fuel debris, and Greater Than Class C (GTCC) waste material.

The Trojan ISFSI will consist of a reinforced concrete pad, supporting a maximum of 36 Sierra Nuclear Corporation's TranStor™ Storage Systems. It is anticipated that 36 storage baskets and Concrete Casks will be required. Thirty-four of the baskets will be pressurized water reactor (PWR) baskets, designed to safely store intact spent fuel assemblies, suspect/damaged fuel assemblies, and/or fuel debris. Two of the baskets will be GTCC baskets, designed to safely store GTCC waste.

The system is designed to permit transfer of the basket to a shipping cask once a permanent offsite repository or other offsite facility is available. The TranStor™ Storage System is also designed to accommodate recovery from postulated off-normal events without reliance on the Spent Fuel Pool.

3.2 SYSTEM DESIGN

The TranStor™ Storage System consists of the baskets, concrete casks, a storage pad and associated transfer equipment necessary for safe placement of spent nuclear fuel assemblies, fuel debris, and GTCC waste into dry storage. The Trojan ISFSI storage system utilizes two types of baskets, the PWR basket and the GTCC basket. The baskets are metal containers that are seal welded closed. The baskets serve as the confinement boundary for the materials that are stored within the baskets.

The PWR basket is a fuel storage canister designed to provide safe storage of intact spent fuel, failed fuel, and fuel debris. The PWR basket consists of an internal sleeve assembly, an outer shell assembly, a shield lid, and a structural lid. The internal sleeve assembly is fabricated from high strength steel plates formed into an array of 24 square storage sleeves, each holding one PWR spent fuel assembly. The storage sleeves are sized to accommodate storage of control components within the fuel assembly. The shield lid contains penetrations for drying and filling the basket with helium. The shield lid and structural lid are welded to the basket shell using a semi-automatic electric arc welding system. The outer shell and lids form a confinement boundary for the spent fuel. The PWR basket relies only on geometry for subcriticality during storage.

Assemblies containing damaged fuel are stored in failed fuel cans in the PWR basket. The four peripheral cells in each PWR basket are oversized to accommodate failed fuel cans and will accommodate spent fuel assemblies as well.

The GTCC basket is designed to provide safe storage of GTCC waste. GTCC waste is placed in cans and then placed into the GTCC basket. The GTCC basket does not contain an internal sleeve assembly. The GTCC basket accommodates 28 individual cans designed for GTCC waste.

A skid-mounted vacuum drying system is used to remove the water from the PWR and GTCC baskets (following loading), dry the basket, and backfill the basket with helium. The vacuum drying system is designed to evacuate the basket in a stepwise fashion. During evacuation, the decay heat from the fuel further helps remove residual moisture from the basket.

The transfer cask is used to move the loaded basket from the Spent Fuel Pool to the concrete cask. The transfer cask is constructed with multiple layers of various shielding materials to reduce the radiation exposure to personnel during spent fuel loading and handling. The transfer cask has retractable doors at the bottom to permit lowering of the loaded basket from the transfer cask into the concrete cask in order to maintain radiation shielding during the transfer. The transfer cask is lifted and moved using a special lifting yoke and the Fuel Building overhead crane.

The concrete cask provides structural support, shielding, and natural circulation cooling for the basket. The basket is stored in the central steel lined cavity of the concrete cask. A steel lid is placed on the concrete cask to protect the basket from the environment. The concrete cask is ventilated by internal air flow paths which allows decay heat to be removed by natural circulation

around the metal basket wall. Air flow paths are formed by channels at the bottom (air entrance), the air inlets, the gap between the basket exterior and the concrete cask interior, and the air outlets. The air inlets and outlets are steel lined penetrations that take non-planar paths to minimize radiation streaming. Side surface radiation dose rates are limited by the thick steel and concrete walls of the concrete cask.

An air pad system is used to move a loaded concrete cask from the Fuel Building to the reinforced concrete storage pad. The air pad system consists of four air pads that are about 4' square, a standard air compressor, and associated air hoses. The air pad system lifts the concrete cask a few inches and floats the concrete cask on a cushion of air for movement.

The reinforced concrete storage pad is about 100' by 170' and is about 18" thick. The reinforced concrete pad will be located about 200' north of the Fuel Building at the general site grade elevation of about 45'.

Except for commercially available equipment such as the air pad system, the components and equipment described above will be fabricated/constructed in accordance with specifications and drawings prior to spent fuel loading and handling. The metal components, e.g., basket, transfer cask, and concrete cask liner, will be fabricated offsite and shipped to the site when completed. Final assembly and pouring of the concrete for the concrete cask, as well as construction of the reinforced concrete storage pad, will be accomplished onsite.

4. DESCRIPTION OF THE CASK PRE-OPERATIONAL TESTING

This description of testing provides a general overview of the pre-operational testing and load handling evolutions but is not intended to reflect the specific order or the actual testing location for the described tests.

The empty basket and transfer cask are brought into the Fuel Building through the crane bay. After examination and any needed cleaning, the transfer cask is moved along a safe load path by the Fuel Building overhead crane and transfer cask lifting yoke to the Cask Wash Pit. There, a protective bottom cover (e.g., plastic sheeting, plexiglas, plywood, etc.) is installed on the transfer cask lower hydraulic door carrier rails, which will prevent potential contamination on the Cask Loading Pit floor from being imbedded in the transfer cask. The basket is then moved by the same crane and placed into the transfer cask. After installation of radiation shielding shims in the gap between the transfer cask and basket, a cask lid assembly is bolted onto the top of the transfer cask. The cask lid assembly, which is a steel ring that has the center section removed to allow loading, ensures that the basket cannot be inadvertently lifted out of the transfer cask. The cask lid assembly also has shield lid retainers which are retracted to load the basket and are manually extended after the basket is loaded to prevent the shield lid from coming out of the basket in the unlikely event of a tipover. The basket is then filled with borated water from the Spent Fuel Pool. The water is filtered, if necessary, to reduce the potential for contamination on the exterior of the

basket. This filling may be done in the Cask Wash Pit or at the Cask Loading Pit before submergence.

The transfer cask (with empty basket) is then moved along a safe load path by the Fuel Building overhead crane and suspended over the Cask Loading Pit which is filled with borated water. A hose will be connected to a flushing system connection located near the bottom of the transfer cask designed to continuously flush borated water through the basket/transfer cask gap to minimize unnecessary contamination of the basket external surface while the transfer cask is submerged in the Cask Loading Pit. After the transfer cask is lowered onto the impact limiter at the bottom of the Cask Loading Pit, the lifting yoke will be removed.

The pre-operational testing and inspections include PWR Basket fit verification and the suitability of the basket lift rig. The basket shield lid retainers will be tested to ensure that the shield lid will stay on the basket during and after a crane mishandling event or a transfer cask tip over. A basket internal assembly will be loaded with a dummy fuel assembly and a failed fuel can to check the fit up and satisfactory operation of associated handling tools and equipment. A GTCC loading grate will be checked for fit up with the GTCC basket and ability to load a GTCC can into the GTCC basket. These pre-operational testing and load handling evolutions will provide mock-up and dry-run testing input to the finalization of the spent fuel loading and handling procedures.

Load testing will be performed consistent with ISFSI SAR section 9.2.3.1.2, "Transfer Cask and Associated Equipment." The crane(s) that lift the loaded transfer cask will be load tested. A test load equivalent to the heaviest fully loaded basket will be placed in the transfer cask to demonstrate the structural capability of the transfer cask bottom doors. The bottom doors will then be checked for proper operation after supporting the test load. The basket lift rig, slings, rings, and the crane used to lift the basket will be load tested to demonstrate the ability to safely lift a fully loaded basket.

The load travel path at the site will be checked to ensure that the transfer cask can be safely moved from the Fuel Building Bay to the Cask Wash pit. From the Cask Wash pit, the Transfer Cask will be moved to and lowered into the Cask Loading pit to verify the load travel path and clearances. The reverse from the Cask Loading pit to the Cask Wash pit to the Fuel Building bay will also be checked, if not identical.

Cask handling operations in the Fuel Building will be directly supervised by trained personnel in accordance with approved procedures. When the pre-operational testing in the Cask Loading Pit is completed the transfer cask is lifted from the Cask Loading Pit, the basket/transfer cask gap drained, the transfer cask is washed on the exterior to remove potential contamination, the shield lid retainers are extended into position, and the protective bottom cover is removed. The transfer cask is moved along a safe load path by the Fuel Building overhead crane to the Cask Wash Pit.

Decontamination of the transfer cask, if required, may begin as soon as the transfer cask is in the Cask Wash Pit. The radiation shielding shims are removed individually from the top of the basket

area to allow for completion of contamination surveys of the basket external surface. The exterior of the basket will be checked for loose surface contamination (to the extent possible because of its inaccessibility while in the transfer cask) to determine if decontamination of the basket is required. If loose surface contamination levels exceed 10^{-4} μCi/cm² β-γ or 10^{-5} μCi/cm² α, then an evaluation will be performed to determine if decontamination of the basket is required.

Draindown and evacuation of the basket is initiated by pumping the borated water in the basket back into the Spent Fuel Pool or a suitable holding tank. Residual moisture in the basket is removed by blowing dry service air through the basket via the basket drain line (maximum pressure will be controlled to 7.3 psig) and out the vent line for a minimum of 15 minutes and until no water is visible coming from the vent line. The outlet for the vent line will be connected to a suitable filtration system to minimize the possibility of gaseous or particulate airborne contamination.

The transfer cask containing the empty basket is moved along a safe load path in the Fuel Building by the Fuel Building overhead crane to Fuel Building hoistway. The loaded transfer cask is lowered through the hoistway to the Fuel Building bay where a concrete cask has been placed and prepared for acceptance of the basket. Ceramic tiles in the bottom of the concrete cask prevent the stainless steel basket from resting directly upon the carbon steel liner of the concrete cask.

Plastic sheeting is placed on top of the concrete cask walls to prevent contamination from spreading from the bottom of the transfer cask to the concrete cask. The transfer cask is placed on top of the concrete cask and correctly positioned by the use of 1" diameter alignment holes located on each side of the transfer cask. After removing the transfer cask lifting yoke and installing the transfer cask hydraulic door operating system and basket lifting rings and slings, the basket is lifted slightly by the Fuel Building overhead crane to remove the weight from the transfer cask bottom doors. The bottom doors are opened, and the basket is lowered into the concrete cask. When the basket is firmly resting on the ceramic tiles at the bottom of the concrete cask, the basket lifting rings and slings are removed with the aid of an extension device and the transfer cask bottom doors are closed. After removing the hydraulic system from the transfer cask, the lifting yoke is re-attached to the transfer cask and the transfer cask is lifted from the concrete cask and moved back to the Cask Wash Pit where the interior of the transfer cask is checked for loose surface contamination to provide a second check of the surface contamination levels on the exterior of the basket that was just removed from the transfer cask. If contamination levels exceed the limits previously stated (10^{-4} μCi/cm² β-γ or 10^{-5} μCi/cm² α,), then the need to decontaminate the basket previously placed in a concrete cask will be evaluated.

An air pad system, which floats the concrete cask on a cushion of air, is inserted under the concrete cask in the air inlet openings and inflated by a standard service air compressor. The cask is moved by forklift, tractor, or other vehicle to the reinforced concrete storage pad. Air is released from the pads once the concrete cask is in position on the concrete storage pad surface. The air pad system is removed from the air inlets and the air inlet screens are installed.

5. SAFETY EVALUATION

The safety evaluation first discusses normal operational considerations: criticality prevention, spent fuel cladding integrity, and radiation shielding and radiological controls. The second part of the safety evaluation addresses postulated off-normal events and accidents which are grouped into five categories: drops, tipovers, mishandling events, operational errors, and support system malfunctions. The last part of the safety evaluation summarizes operational controls that are implemented to ensure that the assumptions of the safety evaluation and supporting analyses are satisfied during the pre-operational testing and load handling process. It should be recognized that a number of the event descriptions use the bounding analyses for a loaded cask and are described for completeness. The pre-operational testing and load handling processes will not be performed with irradiated fuel.

5.1 NORMAL OPERATIONAL CONSIDERATIONS

5.1.1 Criticality Prevention

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. There is no need, therefore, to do a separate criticality analysis beyond the analyses presented in the Defueled Safety Analysis Report, Section 6.2.

5.1.2 Fuel Cladding Integrity

The fuel cladding serves as a fission product barrier, therefore, this barrier must be maintained during any fuel loading process to minimize the potential for radiological releases. No irradiated fuel handling/loading or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. There is no need, therefore, to do a separate assessment of fuel cladding beyond the analyses presented in the Defueled Safety Analysis Report, Sections 6.2 and 6.3.

5.1.3 Radiation Shielding and Radiological Controls

The exterior of the transfer cask will be washed down upon removal from the Cask Loading Pit to prevent the spread of contamination in the Fuel Building. Plastic sheeting or other material will be used on the bottom of the transfer cask to prevent spread of potential contamination from the bottom of the transfer cask to the top of the concrete cask. The basket, transfer cask, and concrete cask will be surveyed for contamination prior to moving the concrete cask out of the Fuel Building to ensure that contamination is not spread outside the building.

The pre-operational testing and load handling operations for the casks will be subject to the Trojan Radiation Protection Program. The doses received by occupational workers will be in

accordance with 10 CFR 20 and as low as reasonably achievable (ALARA) in accordance with the Trojan Radiation Protection Program.

5.2 POSTULATED OFF ORMAL EVENTS AND ACCIDENTS

The postulated off-norma events and accidents discussed below are grouped into five categories: drops, tipovers, mishandling, operational errors, and support system malfunctions. Within these categories, the discussion is provided in approximately the chronological order that these off-normal events or accidents could occur during the pre-operational testing process.

5.2.1 Drops

5.2.1.1 Fuel Assembly Drop into a Basket Loaded with Spent Fuel

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan. Cask Loading Pit liner damage from a dropped dummy fuel assembly is discussed in section 5.2.3.1 below.

5.2.1.2 Basket Shield Lid Drop onto a Basket Loaded with Fuel

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan. While a basket shield lid drop is not postulated to occur in LCA 237 during loading (while submerged in the Cask Loading Pit) and the shield lid is being lowered into the basket prior to lifting the transfer cask from the Cask Loading Pit, there are no radiological consequences for a drop during pre-operational testing and load handling operations because no fuel will be in the basket.

The guidance of NUREG-0612 is being used to minimize the possibility of this event to the degree that the event need not be considered credible. Consistent with the Trojan licensing basis (NRC SER dated July 18, 1983 for Phase I and Generic Letter 85-11, dated June 28, 1985 for Phase II), the Fuel Building Crane is not required to be a single failure proof crane. The Trojan facility is not required to have postulated load drops pursuant to the NUREG 0612, "Control of Heavy Loads at Nuclear Power Plants" Phase I program. The NUREG 0612 Phase II program, which may have required the evaluation of some load drops, was not implemented by the NRC as described in Generic Letter 85-11. Load drops during the pre-operational testing and load handling process are, however, discussed in various sections of this LCA.

The design safety factors for the shield lid lifting equipment will be consistent with NUREG-0612 criteria, paragraphs 5.1.6(b)(ii) and 5.1.1(5) which specify using twice the safety factors specified

in the guidelines of ANSI B30.9-1971, "Slings." Load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) will also be implemented. Implementing these design features and controls makes the possibility of a shield lid drop extremely unlikely.

5.2.1.3 Lifting Yoke Drop onto a Basket Loaded with Fuel

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan. In addition, since no fuel will be in the basket during pre-operational testing and load handling, there are no radiological consequences of a lifting yoke drop.

The lifting yoke drop is postulated to occur when the yoke is being lowered to lift the transfer cask out of the Cask Loading Pit. When the yoke is being lowered into the Cask Loading Pit, the shield lid is already inside the basket on the shield lid support ring. Therefore, the analysis of the lifting yoke drop considers the ability of the shield lid and support ring to withstand the yoke impact. The design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the load handling equipment minimize the possibility of a lifting yoke drop actually occurring. (Potential damage to the Cask Loading Pit liner from the lifting yoke is discussed in section 5.2.3.1 below.)

The analysis considered a drop of the 6600 lb yoke from 28' above the transfer cask, which would be the distance from the top of the basket to 1' above the top of the Cask Loading Pit where the yoke would be suspended prior to lowering into the Cask Loading Pit. The lifting yoke drop is conservatively assumed to be in air for the entire 28', which results in a velocity at impact of 42.5 feet/sec and an impact energy of about 180,000 ft-lb.

The analysis shows that the shield lid, which is composed of a 3" and a 5" plate on top of each other, would plastically deform less than 2" and the shield lid would not grossly fail. In addition, the shield lid support ring inside the basket would not fail and would prevent the shield lid from continuing further into the basket. If the lifting yoke impact is evaluated for perforation only, i.e., no deformation of the shield lid other than the penetration, the lifting yoke would penetrate less than 2" through the 8" shield lid. Therefore, the dummy fuel assembly would not be damaged and there would be, of course, no radiological release and no increase in the pool k_{eff}.

The lifting yoke entering the water could spill water from the Cask Loading Pit onto the Fuel Building floor at the 93' elevation. The water would cause minimal exposure to workers because the water would be only slightly contaminated. Most of the water would be captured by floor drains. Clean up of the remaining spilled water would be relatively straightforward and not hazardous.

5.2.1.4 Structural Failure of Transfer Cask Lifting Devices

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

Consistent with the Trojan licensing basis (NRC SER dated July 18, 1983 for Phase I and Generic Letter 85-11, dated June 28, 1985 for Phase II), the Fuel Building Crane is not required to be a single failure proof crane. The Trojan facility is not required to have postulated load drops pursuant to the NUREG 0612, "Control of Heavy Loads at Nuclear Power Plants" Phase I program. The NUREG 0612 Phase II program, which may have required the evaluation of some load drops, was not implemented by the NRC as described in Generic Letter 85-11. Load drops during the pre-operational testing and load handling process are, however, discussed in various sections of this LCA.

Structural failure of the lifting yoke, a transfer cask trunnion, or other transfer cask lifting device (e.g., sling, ring, or hook) is postulated to occur. The result of one of these failures would be a transfer cask drop.

The transfer cask drop analysis considers the spectrum of drops that could occur. The design safety factors and load testing requirements for the lifting yoke, trunnions, other transfer cask lifting devices, and load handling equipment minimize the possibility of structural failure actually occurring. In addition, the maximum handling height of the transfer cask is procedurally limited and impact limiters are used to ensure that the results of the analysis are bounding for any potential transfer cask drop. (Potential damage to Cask Loading Pit liner from the dropped transfer cask is discussed in section 5.2.3.1 below.)

The transfer cask drop analysis did not postulate a transfer cask drop into the Spent Fuel Pool. The safe load path is sufficiently far from the Spent Fuel Pool, including lowering and lifting the transfer cask into and out of the Cask Wash Pit and Cask Loading Pit. Mechanical stops and electrical interlocks on the crane used to lift the transfer cask will ensure that sufficient distance from the Spent Fuel Pool is maintained. The floor over which the transfer cask is carried, with impact limiters and steel plates at some locations, has sufficient capacity to absorb the impact of the transfer cask in the unlikely event of a drop. The transfer cask will be not be able to tipover and roll into the Spent Fuel Pool because the transfer cask will only be carried at heights above Fuel Building 93' elevation floor that are well below the height at which the transfer cask would need to be carried for a tipover to occur

A radiological release will not occur as a result of a transfer cask drop due to no fuel being present in the basket.

The postulated drops into the Cask Loading Pit, Cask Wash Pit, and Fuel Building hoistway and onto the floor in the Fuel Building are summarized in the paragraphs that follow.

5.2.1.4.1 Transfer Cask Drop into the Cask Loading Pit

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask drop due to no fuel being present in the basket.

A transfer cask drop into the Cask Loading Pit was assumed to occur from elevation 93' 8", which is about 6" above the curb elevation at the top of the Cask Loading Pit, to the top of an impact limiter at the bottom of the Cask Loading Pit (bottom is elevation 49' 4"). Only an upright drop was considered because the transfer cask will not fit sideways in the Cask Loading Pit. (Note that liner tears are addressed in section 5.2.3.1 below and a sideways tipover where the transfer cask impacts the opposite side of Cask Loading Pit is addressed in section 5.2.2.1.1 below.)

The analysis shows that the transfer cask would drop through air, enter the water and fall through the water to the impact limiter at the bottom of the Cask Loading Pit. The bearing strength and punching shear strength calculated for the concrete at the bottom of the Cask Loading Pit were less than the force that would be created by the transfer cask decelerating at 82g (the fuel limit), hence, the concrete at the bottom of the Cask Loading Pit was determined to be the limiting component on which the height of the impact limiter is based. The deceleration force on the contents of the basket as a result of the impact would be less than the fuel limit. If the transfer cask is dropped into the Cask Loading Pit, any resultant spill of water caused by the transfer cask entering the Cask Loading Pit would cause minimal exposure to workers because the water would be only slightly contaminated and would not be unduly difficult to clean up.

5.2.1.4.2 Transfer Cask Drop into the Cask Wash Pit

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask drop due to no fuel being present in the basket.

A transfer cask drop into the Cask Wash Pit was assumed to occur from 93' 6", which is about 6" above the top of the Cask Wash Pit, to the top of an impact limiter at the bottom of the Cask Wash Pit (bottom is 72'). Only an upright drop was considered because the transfer cask will not fit sideways in the Cask Wash Pit. (Note that a sideways tipover where the transfer cask impacts the opposite side of Cask Wash Pit is addressed in section 5.2.2.1.2 below.)

The analysis shows that the transfer cask would be moving at about 26.6 feet/second upon initial contact with the impact limiter. The shear strength calculated for the 30" concrete slab at the bottom of the Cask Wash Pit, including the bending stress that would be imparted to two steel beams imbedded in the slab, was less than the force that would be created by the transfer cask decelerating at 82g (the fuel limit), hence, the concrete slab at the bottom of the Cask Wash Pit was determined to be the limiting component on which the height of the impact limiter is based. The deceleration force on the contents of the basket would be about 3g.

5.2.1.4.3 Transfer Cask Drop into the Fuel Building Hoistway

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask drop due to no fuel being present in the basket.

A transfer cask drop into the Fuel Building bay was assumed to occur from 93' 6", which is about 6" above the top of the Fuel Building hoistway, to the top of an impact limiter at the bottom of the Fuel Building bay (bay floor elevation is 45'). Both upright and side drops were considered because the Fuel Building hoistway is large enough for the transfer cask to drop through sideways. (Note that a sideways tipover where the transfer cask impacts the opposite side of the Fuel Building hoistway is addressed in section 5.2.2.1.3 below.)

The transfer cask would be moving at about 53 feet/sec upon initial contact with the impact limiter. The structural integrity of the concrete slab in the Fuel Building bay was not considered

because the slab is at ground level. The deceleration force for this drop would be about 17g for an upright drop and 40g for a side drop.

5.2.1.4.4 Transfer Cask Drop onto the Fuel Building Floor (93' Elevation)

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Sections 6.2 and 6.3 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask drop due to no fuel being present in the basket.

A transfer cask drop onto the Fuel Building floor slab (elevation 93') was assumed to occur while moving the transfer cask along the safe load path. Only vertical drops were considered because the transfer cask will not be lifted high enough off the floor to tip over into a horizontal position. The maximum lift height will be from 5" to 6" above the floor depending on the location along the safe load path. The maximum lift height will be procedurally controlled and bounded by the analysis.

Along the safe load path, the transfer cask will be moved over floor slabs supported by a combination of rigid shear walls and steel beams. Multiple cases, which bound the floors structural configurations along the safe load path, were analyzed. The floors along the safe load path were shown to have sufficient strength to withstand a transfer cask drop with two exceptions: 1) a location along the safe load path near the Cask Wash Pit and 2) the floor slab adjacent to the Fuel Building hoistway. The analysis shows that the location on the safe load path between the Cask Loading Pit and Cask Wash Pit may need to be protected by an impact limiter. Alternately, a second safe load path may be used which circumvents the location if use of an impact limiter is not desired. The analysis also shows that the floor slab adjacent to the Fuel Building hoistway may be protected by placing a steel plate on the floor.

The range of forces experienced by the transfer cask as a result of these drops is about 1 to 20g depending on the drop location. These forces are considerably less than the maximum allowed force of 82g for intact fuel.

The safe load path on the 93' elevation of the Fuel Building has been selected to minimize the possibility of an adverse effect of a dropped load on safety related equipment. The safety related equipment that could potentially be adversely affected by a load drop is the Spent Fuel Pool, including the spent fuel racks. The safe load path is sufficiently far from the Spent Fuel Pool to prevent a heavy load from dropping into the Spent Fuel Pool. Mechanical stops and electrical interlocks prevent the Fuel Building overhead crane from moving over the Spent Fuel Pool. As stated above, loads are not lifted sufficiently far above the floor to allow a cask to tipover and roll into the Spent Fuel Pool. (Tipover events are discussed in section 5.2.2 below, but their

occurrence is only postulated in locations where the cask could fall back into the pit or hoistway from, or into, which they are being lifted, or lowered). While it is no longer safety related, the safe load path crosses directly over the Service Water System Spent Fuel Pool makeup flow piping located on the 45 foot elevation. As described above, the floors at the 93' elevation have sufficient strength to withstand the postulated load drops. In addition, various other sources of water are available for makeup to the Spent Fuel Pool. Therefore, the safe load path ensures that the Spent Fuel Pool and the Service Water System piping that provide makeup water for the Spent Fuel Pool are not adversely affected by a load drop.

5.2.1.5 Transfer Cask Lid Assembly Drop onto a Basket Loaded with Fuel

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask lid assembly drop due to no fuel being present in the basket.

A transfer cask lid assembly drop is postulated to occur when the transfer cask is located in the Cask Wash Pit and the cask lid assembly is being removed. The design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the load handling equipment minimize the possibility of a cask lid assembly drop actually occurring. The consequences of dropping the cask lid assembly on the basket loaded with fuel are bounded by the lifting yoke drop onto the basket (section 5.2.1.3). A major difference would be that for this event, the cask lid assembly weighs about 600 lbs as compared to 6600 lbs for the lifting yoke. Also, the drop height would be less than 28'.

5.2.1.6 Basket Structural Lid Drop onto Basket Loaded with Fuel

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a structural lid drop due to no fuel being present in the basket.

A basket structural lid drop is postulated to occur when the transfer cask is located in the Cask Wash Pit. The design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the load handling equipment minimize the possibility of a structural lid drop actually occurring.

The consequences of dropping the structural lid on the basket loaded with fuel are bounded by the lifting yoke drop onto the basket (section 5.2.1.3). A major difference would be that for this event, the structural lid weighs 2700 lbs as compared to 6600 lbs for the lifting yoke. Also, the drop height would be less than 28'. In addition, for a structural lid drop, the shield lid would typically be welded to the basket when the drop would occur. The shield lid would add considerable protection for the fuel.

5.2.1.7 Basket Lift Ring Drop onto Basket Loaded with Fuel

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a basket lift ring drop due to no fuel being present in the basket.

The basket lift ring drop is postulated to occur when the basket is being prepared for lowering from the transfer cask into the concrete cask in the Fuel Building bay. A basket lift ring drop would occur after the shield and structural lids have been welded to the basket. The design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the load handling equipment minimize the possibility of a basket lift ring drop actually occurring.

The consequences of a basket lift ring drop are bounded by the lifting yoke drop onto the basket shield lid (section 5.2.1.3). The basket lift ring weighs about 20 lbs and would be dropped about 3' as compared to the yoke which weighs about 6600 lbs and is postulated to be dropped 28'. In addition, the shield lid would typically be welded in place and structural lid would be welded in place on top of the shield lid at the time that the basket lift ring drop is postulated to occur. The structural lid provides an additional 3" of steel for protection of the basket contents in addition to both lids being welded in place, neither of which were considered in the lifting yoke drop.

5.2.1.8 Basket Drop into Concrete Cask

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a basket drop due to no fuel being present in the basket.

The basket drop into the concrete cask is postulated to occur as the basket loaded with fuel is being lowered from the transfer cask into the concrete cask in the Fuel Building bay. The basket drop would typically occur after the shield and structural lids have been welded to the basket. The design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the load handling equipment minimize the possibility of a basket drop actually occurring.

The basket drop analysis considered a drop of the basket from the top of the transfer cask bottom doors to the bottom of the concrete cask. The methodology of EPRI Report NP-7551, "Structural Design of Concrete Storage Pads for Spent Fuel Casks," was used to determine the resulting acceleration. The equivalent weight used to calculate the basket impact included the weight of the basket, the weight of the concrete cask steel liner, and the weight of the concrete in a spherical cone directly beneath where the basket would impact the concrete cask. The hardness of the Fuel Building bay floor slab was calculated as 6.24 E4 (dimensionless) and the basket deceleration as 39g. This deceleration is considerably less than the maximum allowable for the basket (124g).

5.2.1.9 Concrete Cask Shield Ring or Lid Drop onto a Basket Loaded with Fuel

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a concrete cask shield ring or lid drop due to no fuel being present in the basket.

The concrete cask shield ring or lid drop are postulated to occur after the basket has been lowered from the transfer cask into concrete cask in the Fuel Building bay and the transfer cask has been removed from the concrete cask. The drop is postulated to occur after the shield and structural lids have been welded to the basket. The design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the load handling equipment minimize the possibility of this drop actually occurring.

The consequences of a concrete cask shield ring or lid drop are bounded by the lifting yoke drop onto the basket shield lid (section 5.2.1.3). The concrete cask shield ring and lid each weigh about 1230 lbs and would be dropped about 3' as compared to the yoke which weighs about 6600 lbs and is postulated to be dropped 28'. In addition, the shield lid would typically be welded in the basket and the structural lid would also typically be welded in place on top of the shield lid at the time that the concrete cask shield ring or lid drop is postulated to occur. The structural lid provides an additional 3" of steel for protection of the basket contents in addition to both lids being welded in place, none of which were considered in the lifting yoke drop.

5.2.2 Tipovers

5.2.2.1 Transfer Cask Tipover with Basket Loaded with Fuel

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask tipover due to no fuel being present in the basket.

This transfer cask tipover is postulated to occur at the top of the Cask Loading Pit while being withdrawn, at the top of the Cask Wash Pit either while being lowered prior to lid welding or while being raised after the lids have been welded onto the basket, and at the top of the Fuel Building hoistway prior to being lowered to the storage cask at the 45' elevation. The tipover would be the result of a transfer cask drop while the transfer cask is partially over the Pit/hoistway and partially over the Fuel Building floor. The design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the load handling equipment minimize the possibility of a transfer cask tipover actually occurring.

5.2.2.1.1 Transfer Cask Tipover at the Cask Loading Pit

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask tipover due to no fuel being present in the basket.

A transfer cask tipover at the Cask Loading Pit was assumed to occur at the east wall of the Cask Loading Pit where the transfer cask would be located after being withdrawn from the Cask Loading Pit.

The transfer cask is assumed to tip sideways from the east wall and impact the top of an impact limiter located on the west wall of the Cask Loading Pit. (The transfer cask is about 16' high and the Cask Loading Pit is about 12' across in the east-west direction.) For a worst case side impact, the transfer cask is assumed to tip such that its base remains at the top of the east wall and does not slide into the Cask Loading Pit which would create a glancing blow instead of a solid impact. (However, if the transfer cask slipped into the Cask Loading Pit, the results would be bounded by the drop into the Cask Loading pit discussed in section 5.2.1.4.1 above.) The analysis shows that

the deceleration force would be about 7g. The analysis also shows that the bearing strength of the concrete west wall of the Cask Loading Pit is sufficient to withstand the transfer cask impact.

When the transfer cask is lifted from the Cask Loading Pit, there may be about 40 to 50 gallons of Spent Fuel Pool water on top of the shield lid (3" between the shield lid and the top of the basket) that could spill on to the Fuel Building floor if the transfer cask tipped over. (The water in the transfer cask/basket annulus would drain into the Cask Loading Pit through the transfer cask bottom doors.) This amount of water would cause minimal exposure to workers because the water would be only slightly contaminated. Most of the spilled water would be captured in floor drains. Clean up of the remaining spilled water would be relatively straightforward. Further water leakage from the basket would be minimal because the shield lid is kept in place in the basket by the shield lid retainers.

5.2.2.1.2 Transfer Cask Tipover at the Cask Wash Pit

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask tipover due to no fuel being present in the basket.

A transfer cask tipover at the Cask Wash Pit was assumed to occur at the north wall of the Cask Wash Pit where the transfer cask would be located prior to being lowered into and after being withdrawn from the Cask Wash Pit. The transfer cask is assumed to tip sideways from the north wall and impact the top of an impact limiter located on the south wall of the Cask Loading Pit. (The transfer cask is about 16' high and the Cask Wash Pit is about 14' across in the north-south direction.) For a worst case side impact, the transfer cask is assumed to tip such that its base remains at the top of the north wall and does not slide into the Cask Wash Pit which would create a glancing blow instead of a solid impact. (However, if the transfer cask slipped into the Cask Wash Pit the results would be bounded by the drop into the Cask Wash Pit discussed in section 5.2.1.4.2 above.)

The analysis shows that the deceleration force would be about 3g which is considerably less than the maximum allowed horizontal load of 44g for intact fuel.

The analysis also shows that the south wall, which is supported by a 33" steel beam, 76.5" steel girder, and block wall between the beam and girder, has sufficient strength to withstand the transfer cask impact. If the transfer cask tipover occurs prior to the lids being welded in place in the Cask Wash Pit, then the shield lid is kept in place on the basket by the shield lid retainers and any spill of water from the basket would be minimal.

5.2.2.1.3 Transfer Cask Tipover at the Fuel Building Hoistway

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask tipover due to no fuel being present in the basket.

A transfer cask tipover at the Fuel Building hoistway was assumed to occur at the top of the south wall of the Fuel Building hoistway where the transfer cask would be located prior to being lowered into the hoistway. The transfer cask is assumed to tip sideways from the south wall and impact the top of the north wall of the Fuel Building hoistway. The transfer cask is about 16' high and the Fuel Building hoistway is about 12' across in the south-north direction. If the transfer cask slips into the Fuel Building hoistway, the results would be bounded by the drop into the Fuel Building hoistway discussed in section 5.2.1.4.3 above.

The analysis shows that the deceleration force would be about 6g which is considerably less than the maximum allowed horizontal load of 44g for intact fuel.

The analysis also shows that the north wall, which is supported by a complex arrangement of concrete walls and steel beams, would not have sufficient strength to withstand the transfer cask impact. Therefore, an impact limiter will be used on the top of the north wall of the Fuel Building hoistway to protect the wall from impact.

5.2.2.2 Transfer Cask Tipover during Concrete Cask Transfer Operations

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask tipover due to no fuel being present in the basket.

This transfer cask tipover is postulated to occur when the transfer cask is being placed on the concrete cask in the Fuel Building bay. After the transfer cask has been lowered until it is just a few inches higher than the top of the concrete cask, the transfer cask is moved sideways or the concrete cask will be moved underneath the transfer cask, and the transfer cask will be lowered the last few inches onto the top of the concrete cask. If a vertical drop occurred while a portion of the transfer cask was over the concrete cask, but the transfer cask center of gravity was not over the concrete cask, the transfer cask could slide off the concrete cask and could tipover. The

design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the load handling equipment minimize the possibility of a transfer cask tipover actually occurring.

The consequences of a transfer cask tipover during concrete cask transfer operations are bounded by the transfer cask side drop in the Fuel Building hoistway (5.2.1.4.3). The transfer cask will be over the impact limiter placed at the bottom of the Fuel Building hoistway. If the transfer cask is mispositioned on top of the concrete cask such that tipover were possible, its center of gravity would be over the impact limiter and if the transfer cask fell off the concrete cask, it would fall onto the impact limiter. The distance that the transfer cask could fall from the top of the concrete cask (about 17.5' high) to the top of the impact limiter is considerably less than the 43' drop used in the transfer cask drop.

5.2.3 Mishandling Events

5.2.3.1 Cask Loading Pit or Spent Fuel Pool Liner Tear/Breach during Handling Operations

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

The Cask Loading Pit or Spent Fuel Pool liner tear/breach is postulated to occur by the drop of a dummy fuel assembly or heavy load such as the transfer cask. The design safety factors, load testing requirements, and administrative controls (i.e., procedures, training, maintenance, inspections) for the fuel and load handling equipment minimize the possibility of a liner tear/breach actually occurring. As described below, a liner tear/breach will not cause increased radiation levels in the Fuel Building as a result of water loss from the Cask Loading Pit or water loss from the Spent Fuel Pool.

The water level in the Cask Loading Pit will be at the same level as the Spent Fuel Pool because the Spent Fuel Pool gate, which separates the Cask Loading Pit and Spent Fuel Pool, will be open for moving spent fuel from the Spent Fuel Pool to the Cask Loading Pit. The Spent Fuel Pool water level is maintained 23' or more above the spent fuel stored in the Spent Fuel Pool per the Trojan Technical Specifications. The Trojan Technical Specification Bases state that 10' of water over the spent fuel provides an adequate heat sink for the fuel and shielding for personnel working in the area.

If the Cask Loading Pit liner is torn or breached, the leakage from the tear or breach will be collected by tell-tale drains. The size of the drain lines from the Cask Loading Pit will restrict the leakage to 44 gpm. If the Spent Fuel Pool gate is closed and is not damaged by the event, the Cask Loading Pit would drain to the minimum acceptable height of water over the Transfer Cask, which is 10', in approximately 4 hours. This would be ample time to stop the leak by shutting the

valves on the Cask Loading Pit tell-tale drain lines, or patch/repair the liner. In addition, water may be supplied from the various sources to makeup the water loss if more time is needed to stop the leakage. If the Spent Fuel Pool gate was also damaged such that water from the Spent Fuel Pool could flow into the Cask Loading Pit, the leak rate would be the same 44 gpm, but the level decrease would be much slower due to the increased volume to be drained (i.e., the combined volume of the Cask Loading Pit and Spent Fuel Pool). Once again, there would be ample time to secure the leak by shutting the valves on the Cask Loading Pit tell-tale drain lines. Water may be supplied from the various sources to makeup the water loss if more time is needed to stop the leakage.

If the Spent Fuel Pool liner is torn or breached, the leakage from the tear or breach will be collected by tell-tale drains. The size of the drain lines from the Spent Fuel Pool will restrict the leakage from a tear or breach of the Spent Fuel Pool liner to 42 gpm. This leakage is less than leakage from a Cask Loading Pit liner tear/breach and the Spent Fuel Pool is considerably larger than the Cask Loading Pit. Therefore, there will be more than 4 hours to stop the leak by shutting the valves on the Spent Fuel Pool drain lines (with or without the gate closed between the Cask Loading Pit and Spent Fuel Pool). As previously stated, water may be supplied from the various sources to makeup the water loss if more time is needed to stop the leakage.

The Trojan DSAR, Section 6.3.3, evaluates the effects of the loss of forced spent fuel cooling with concurrent spent fuel pool inventory loss. The evaluation credits only 10 feet of water being present over the fuel (due to seismic failure of the gates and spent fuel cooling system piping). This evaluation demonstrates that there is ample time for operator action to provide make up water, from a variety of sources, to the spent fuel pool before level decreases below 5 feet above the top of the fuel.

5.2.3.2 Crane Mishandling Operation with Transfer Cask/Basket Resulting in Horizontal Impacts

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a transfer cask/basket horizontal impacts due to no fuel being present in the basket.

A crane mishandling operation is postulated to occur while moving the transfer cask along the safe load path or when lowering the basket from the transfer cask into the concrete cask. A crane mishandling operation is unlikely because of the administrative controls (procedures, inspections, maintenance, and testing) that are implemented.

The analysis of a crane mishandling operation assumed a horizontal impact of 2' per second. (Vertical impacts are bounded by the spectrum of drops addressed in sections 5.2.1.1 through

5.2.1.9.) The impact deflection was calculated as 0.0055" which corresponds to a deceleration of 17.5g. This deceleration is considerably less than the maximum allowable horizontal load of 44g for the intact fuel.

If the crane mishandling operation occurred prior to the shield lid being welded in place, then the shield lid retainers will keep the shield lid in place on the basket and prevent any significant quantity of potentially contaminated water from spilling out of the basket.

The Spent Fuel Pool is the only safety related equipment that could be potentially impacted by inadvertent horizontal movement of the transfer cask. However, this type of impact is not credible because the Fuel Building overhead crane's mechanical stops and electrical interlocks would prevent movement of the load over/into the Spent Fuel Pool. Therefore, safety-related equipment would not be adversely affected by a crane mishandling event.

5.2.3.3 Interference while Lowering Basket during Transfer Operations

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a interferences while lowering the basket during transfer operations due to no fuel being present in the basket.

Interference while lowering the basket is postulated to occur while transferring the basket from the transfer cask to the concrete cask in the Fuel Building bay. The interference would result from the basket catching on the top edge of the concrete cask while being lowered which could be caused by misalignment of the transfer cask on top of the concrete cask or some sort of misalignment of the basket lifting rig. The potential for interference is minimized because the concrete cask internal cavity is about 8" larger in diameter than the basket which allows additional horizontal clearance as the basket is being lowered into the concrete cask. In addition, alignment holes are used to accurately position the transfer cask on top of the concrete cask prior to the basket lowering operation.

The only force acting on the basket during lowering is gravity (1g). Therefore, the worst case condition would be a load of 1g on the basket bottom or side if it were to be completely supported by the interference. The stresses applied to the basket by the interference are bounded by those analyzed for the basket drop in the concrete cask described in section 5.2.1.8 above, which concluded that the basket accelerations were considerably less than the maximum allowed.

5.2.3.4 Misalignment of Transfer Cask Lifting Yoke

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a misalignment of a transfer cask lifting yoke due to no fuel being present in the basket.

Misalignment of the transfer cask lifting yoke (i.e., less than full engagement of both transfer cask trunnions) is postulated to occur when the yoke is being placed on the transfer cask. The yoke is placed on the transfer cask, while the transfer cask is in the Cask Loading Pit, in preparation for lifting the transfer cask out of the Cask Loading Pit and in the Cask Wash Pit after the shield and structural lids would have been welded into the basket and the transfer cask is ready to be moved to the concrete cask for transfer of the basket. As described below, misaligning the transfer cask lifting yoke will not cause a drop of the transfer cask.

Misalignment of the transfer cask lifting yoke is highly unlikely because the design of the yoke ensures simultaneous full engagement of both transfer cask trunnions. The designed difference in diameter between the trunnion and cutout in the yoke arm into which the trunnion is placed will be a maximum of about 0.2", which ensures that the yoke fits tightly on the trunnions with little chance for misalignment. The transfer cask diameter will be about 0.5" less than the distance between the yoke arms, therefore, there is very little play between the yoke arms and the transfer cask which ensures that the yoke is not placed on the transfer cask in a misaligned position. Once the yoke is placed on the transfer cask trunnions, the yoke will not be able to spread apart and slip off the ends of the trunnions to a misaligned position because the trunnions are fitted with endcaps that are larger in diameter than the cutout in the yoke into which the trunnions are placed. In addition, the yoke, trunnions, and transfer cask are checked for fit-up after fabrication.

5.2.4 Operational Errors

5.2.4.1 Opening the Transfer Cask Bottom Doors Prior to Attaching the Basket Lifting Rig

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of operational errors due to no fuel being present in the basket.

Opening the transfer cask bottom doors is postulated to occur when the transfer cask has been placed on top of the concrete cask in the Fuel Building bay in preparation for transfer of the basket from the transfer cask to the concrete cask. Opening the transfer cask bottom doors without first attaching the basket lifting rig to the basket will result in a drop of the basket into the concrete cask. Opening the transfer cask bottom doors prior to attaching the basket lifting rig is unlikely because procedural controls will minimize the possibility of occurrence of both of the two independent actions that are required for opening the transfer cask bottom doors. As described below, this event is not considered credible.

Opening the transfer cask bottom doors will not occur because two separate and independent procedural errors are required to cause the bottom doors to be opened. The bottom doors are moved by hydraulic actuators that are attached to the sides of the transfer cask once the transfer cask is in position on top of the concrete cask in the Fuel Building bay. Operators must take deliberate action to actuate the hydraulics to open the bottom doors. This action would not be procedurally allowed until the basket lifting rig is attached to the basket. In addition, the transfer cask bottom doors are prevented from being inadvertently withdrawn from their closed position by locking bolts (2 per door, 1 on either side). Operators must take deliberate action to remove the locking bolts to open the bottom doors. This action also would not be procedurally allowed until the basket lifting rig is attached to the basket. Therefore, opening the transfer cask bottom doors before the basket lifting rig is attached is not considered a credible event. Even if a basket drop were to occur, as described in section 5.2.1.8 above, the accelerations are less than the maximum allowable.

5.2.4.2 Closing the Transfer Cask Bottom Doors while Lowering the Basket

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of closing the transfer cask bottom doors due to no fuel being present in the basket.

Closing the transfer cask bottom doors on the basket is postulated to occur when the transfer cask has been placed on top of the concrete cask in the Fuel Building bay and the basket is being lowered from the transfer cask into the concrete cask. Closing the transfer cask bottom doors could damage the basket. As described below, closing the transfer cask bottom doors on the basket is not considered a credible event.

Closing the transfer cask bottom doors on the basket is highly unlikely because two separate and independent operator actions or spurious actuations are required to cause the bottom doors to be closed while the basket is being lowered into the concrete cask. After the bottom doors are opened by the hydraulic actuators, the hydraulic pump (source of hydraulic motive force) will be stopped, and the hydraulic pump will be isolated from the hydraulic actuators by repositioning three way valves. Operators would need to reposition or misposition a three way valve and inadvertently start the hydraulic pump to close the bottom doors. Neither of these actions will be procedurally allowed until the basket is lowered completely into the concrete cask. Alternately, a spurious actuation of the hydraulic pump concurrent with the three way valve being physically repositioned or mispositioned is also unlikely. Therefore, closing the transfer cask bottoms doors while the basket is being lowered into the concrete cask is not considered a credible event.

5.2.4.3 Brittle Fracture of the Transfer Cask

Brittle fracture of the transfer cask will not occur because a service temperature of -3°F has been established for the load bearing components of the transfer cask and procedures will not allow handling the transfer cask when ambient temperatures are below -3°F.

Charpy V-notch energies have been determined for the transfer cask inner and outer shells, cask trunnions, lifting yoke, and lift yoke pins using a service temperature of -3°F, which is the lowest recorded temperature for Portland, Oregon. The fabrication specifications require that the results of Charpy V-notch tests for these components are equal to or greater than the specified energies. Although temperatures below -3°F are unlikely at the ISFSI site, procedures will require that the ambient temperature be measured prior to handling the transfer cask when it is loaded with fuel to ensure that the ambient temperature is more than -3°F to minimize the possibility of brittle fracture.

5.2.4.4 Boron Dilution of Cask Loading Pit, Basket, or Spent Fuel Pool

A boron dilution event is not likely because borated water will be used for operations involving the Cask Loading Pit and/or Spent Fuel Pool. The water may be filtered to reduce radioactivity/contamination levels or to improve water clarity, but the filtration equipment will be designed and operated to not reduce the boron concentration of the water being used to flush the basket/transfer cask annulus, wash down the outside of the transfer cask, etc.

As described above in section 5.2.3.1 above, a tear/breach of the Cask Loading Pit or Spent Fuel Pool although unlikely, could occur as the result of a load drop. One of the actions in response to a large leak would be addition of water to the Cask Loading Pit or Spent Fuel Pool from various non-borated water sources. Addition of non-borated water would result in dilution of the Cask Loading Pit or Spent Fuel Pool. The Trojan Technical Specification Bases (B 3.1.2) state that the k_{eff} in the Spent Fuel Pool racks will be less than 0.95 even in non-borated water. Therefore, if a boron dilution did occur as a result of adding non-borated makeup water to the Cask Loading Pit or Spent Fuel Pool, the spent fuel in the basket and Spent Fuel Pool racks would remain subcritical.

5.2.4.5 Spread of Transfer Cask and/or Basket Contamination

Spread of contamination is not likely because the surface contamination levels of the basket and concrete cask will be controlled and measured. The need for decontamination will be evaluated if loose surface contamination levels are above 10^{-4} μCi/cm² β-γ or 10^{-5} μCi/cm² α. This control ensures that even if the small amount of contamination that could be affixed to the basket became loose and was released, the resulting dose would be negligible (0.0024 rem at 100 meters). The loose surface contamination level is determined by taking swipes on the exterior of the basket, the internal surface of the transfer cask (which is representative of the contamination level of the inaccessible basket external surface), and the concrete cask external surface.

In addition, the NRC's Dry Storage Action Plan identifies weeping as a potential source of contamination from casks with bare metals, especially stainless steels, and states that weeping may be alleviated by coating the metal surfaces of the cask. Normally, contamination caused by weeping would occur only if the transfer cask and basket were submerged in the Cask Loading Pit over a period of days. Since the loading operation will normally only require the transfer cask and basket to be submerged in the Cask Loading Pit for a short period of time, and the water in the Cask Loading Pit will not contain significant quantities of loose contamination, absorption of contamination by the transfer cask and basket is not expected. However, as a precaution, the inner surfaces of the transfer cask metal liner and the external surface of the basket will be coated with a hard, smooth epoxy to prevent absorption of contamination by the transfer cask and basket which should further preclude the potential for weeping.

5.2.5 Support System Malfunctions

5.2.5.1 Loss of Electrical Power or Component Failures

No irradiated fuel handling or heavy load handling directly over the spent fuel pool is authorized or proposed by this amendment to the license. LCO 3.1.4, "Spent Fuel Pool Load Restrictions," remains in affect. The analyses presented in the Defueled Safety Analysis Report, Section 6.2 remain the bounding discussion relative to fuel handling at Trojan.

A radiological release will not occur as a result of a loss of electrical power or component failures due to no fuel being present in the basket.

The Fuel Building and Spent Fuel Pool Bridge cranes are designed to not release their load on the loss of electrical power. There are no consequences for the loss of electrical power during pre-operational testing. Component failures are addressed by the previous load drop and tip-over event discussions.

5.2.5.2 Air Pad System Failures

Air pad system failures are postulated to occur after the concrete cask has been lifted by the air pad system for movement to the concrete storage pad. Air pad system failures would be malfunctions of the compressor, the air hoses that feed the air pads, or the air pads themselves that result in the loss of air pressure to the air pads.

Failure of the air compressor, the air hoses that feed the air pads, or the air pads themselves will cause loss of air pressure that will result in the concrete cask being lowered to the concrete pad or surface over which the concrete cask is being moved. If a catastrophic failure of one of the four air pads underneath the concrete cask occurs, then the concrete cask would be lowered rapidly on the corner being supported by the failed air pad. The air manifold would automatically feed more air to the failed pad which would partially cushion the impact. If the failure is in the compressor or the air hoses that feed the airs pads, then air pressure loss in the air pads would be slower and the concrete cask would be lowered to the concrete pad slower than in the case of the catastrophic failure of one of the air pads. In any event, the concrete cask will be lowered to the concrete pad or surface over which the concrete cask is being moved from the lift height of the air pads, which is about 3". An analysis of a drop of the concrete cask onto the concrete reinforced pad shows that the concrete cask may be dropped from 53" and not result in damage to the basket (dropping the basket into the concrete cask in the Fuel Building bay results in less deceleration force). The drop analysis is from a considerably higher distance with no credit for air cushioning by the air pads.

5.2.6 Natural Phenomena

5.2.6.1 Natural Phenomena

The spectrum of natural phenomena include tornados, floods, tsunami, and earthquakes.

5.2.6.1.1 Tornadoes

Procedures will be in place to preclude pre-operational testing and load handling during high winds and unstable atmospheric conditions that could lead to a tornado threat.

5.2.6.1.2 Floods and Tsunami

Pre-operational testing and load handling will take place inside the Fuel Building at elevations above credible external flood (internal flooding is not postulated due to the limited sources of water) and tsunami levels.

5.2.6.1.1 Earthquakes

A radiological release will not occur as a result of an earthquake due to no fuel being present in the basket during pre-operational testing and load handling.

Earthquakes will have a negligible effect on the transfer cask, basket, and concrete cask individually because of their rigid design. Therefore, an earthquake was only postulated to occur and cause toppling of the transfer cask when the transfer cask is stacked on top of the concrete cask in the Fuel Building bay while preparing to lower the basket from the transfer cask to the concrete cask. For the transfer cask to topple, the earthquake would need to occur during the few minutes that the lifting yoke is detached from the transfer cask and the basket lifting rig has not been attached to the basket. Toppling would not occur while the basket or transfer cask were attached to the lifting equipment because the design safety factors would support the load. Toppling while the basket and transfer cask are both not attached to lifting equipment is highly unlikely because the probability is extremely small that an earthquake will occur during the short period of time that is required to shift the lifting equipment from the transfer cask to the basket.

An analysis was performed assuming that a Seismic Margin Earthquake occurred while the transfer cask is stacked on top of a concrete cask in the Fuel Building bay, the lifting yoke is detached from the transfer cask, and the basket lifting rig has not been attached to the basket. The total effect of the earthquake is calculated by assuming kinetic energy input to the transfer cask corresponding to the square-root-of-the-sum-of-the squares combination of the peak horizontal and peak vertical ground velocities. Using this kinetic energy and assuming that the earthquake's periodic motion is only in one direction, the transfer cask would slide only about 6" across the top of the concrete cask, which would not be sufficient for the transfer cask center of gravity to move to the edge of the concrete cask. If the sliding motion described above is

neglected and only the rocking motion imparted by the earthquake is considered, the transfer cask by itself and the transfer cask coupled with the concrete cask would only be tipped less than 1° from the vertical, which is much less than would be needed to tip the transfer cask or transfer cask/concrete cask combination (about 24°). Therefore, the transfer cask would remain on top of the concrete cask during a Seismic Margin Earthquake, and no basket damage would occur because the Seismic Margin Earthquake accelerations are well below the maximum allowable accelerations for the basket (124g vertical, 44 horizontal)

5.3 OPERATIONAL CONTROLS

The operational controls that are implemented to ensure that the assumptions of the safety evaluation and supporting analyses are satisfied are summarized below.

5.3.1 Handling Height for the Transfer Cask

The handling height of the transfer cask (the height at which the transfer cask will be lifted above the floor) during movement along the designated safe load path will be limited to 5"- 6", depending on the location along the safe load path, to ensure that the floor over which the transfer cask is moved has sufficient strength to withstand a transfer cask drop in the unlikely event that a drop occurs. The handling height used in (or derived by) the transfer drop analysis is a minimum of 6", except at the top of the Cask Loading Pit, where the analysis used a height of 5" above the floor and over an impact limiter near the Cask Wash Pit, where the analysis derived a range of heights depending on the impact limiter thickness. Impact limiters will also be placed in the Cask Loading Pit, Cask Wash Pit, and Fuel Building hoistway, where the handling heights will be greater than the maximum allowed handling height, and at the top of the Cask Loading Pit, Cask Wash Pit, and Fuel Building hoistway where tipover of the transfer cask was analyzed, to ensure the structural integrity of the floors and the transfer cask in the unlikely event of a drop or tipover.

5.3.2 Handling Temperature of the Transfer Cask

The transfer cask will not be handled/lifted when ambient air temperatures in the transfer cask handling area are less than -3°F or the transfer cask has been stored at temperatures less than -3°F, unless direct temperature measurement of the transfer cask handling/lifting components shows that they are at temperatures higher than -3°F. This temperature limit minimizes the possibility that the transfer cask components will experience a brittle fracture during handling/lifting operations.

5.3.3 Auxiliary/Fuel Building Ventilation

Auxiliary/Fuel Building ventilation will be in operation during pre-operational testing and load handling inside the Fuel Building to minimize the amounts of airborne particulate radioactivity released from the Fuel Building to the environment. Procedures will specify alternate ventilation

and/or equipment needed to be available in the event that the Auxiliary/Fuel Building Ventilation becomes inoperable during these operations.

5.3.4 Recovery from Off-Normal Events and Accidents

Procedures will be written that specify appropriate methods and equipment that will be needed to recover from credible off-normal events and accidents. As a minimum, procedures will address recovery from a 1) transfer cask/basket drops, 2) transfer cask tipovers, and 3) spent fuel pool/pit liner tears/cracks.

6. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

In accordance with the requirements of 10 CFR 50.92(c), implementation of the requested license amendment, spent fuel loading and handling in the Fuel Building, is analyzed using the following standards and found: 1) not to involve a significant increase in the probability of an accident previously evaluated; 2) not to involve a significant increase in the consequences of an accident previously evaluated; 3) not to create the possibility of a new or different kind of accident from any accident previously evaluated; and 4) not to involve a significant reduction in a margin of safety.

1. The requested license amendment does not involve a significant increase in the probability of an accident previously evaluated.

   With the issuance of a Possession Only License, the number of potential accidents was reduced to those types of accidents associated with the storage of irradiated fuel and radioactive waste storage and handling. Additional events were postulated for decommissioning activities due to the difference in the types of activities that were to be performed. The postulated accidents described in the Defueled Safety Analysis Report (DSAR) are generally classified as: 1) radioactive release from a subsystem or component, 2) fuel handling accident, and 3) loss of spent fuel decay heat removal capability. The postulated events described in the Decommissioning Plan are grouped as: 1) decontamination, dismantlement, and materials handling events, 2) loss of support systems (offsite power, cooling water, and compressed air), 3) fire and explosions, and 4) external events (earthquake, external flooding, tornadoes, extreme winds, volcanoes, lightning, toxic chemical release). These types of accidents are discussed below.

   Radioactive release from a subsystem or component involves failure of a radioactive waste gas decay tank (WGDT) or failure of a chemical and volume control system holdup tank (HUT). For the failure of a WGDT, the radioactive contents were assumed to be principally noble gases krypton and xenon, the particulate daughters of some of the krypton and xenon isotopes, and trace quantities of halogens. For the failure of a HUT, the assumptions were full power operation with 1-percent failed fuel, 40 weeks since power operation, and 60,000

gallons of 120°F liquid released over a 2 hour period. However, the WGDTs and HUTs are no longer active and have been drained. Therefore, pre-operational testing and load handling activities cannot increase the probability of occurrence of a failure of a WGDT or HUT.

The fuel handling accident involves a stuck or dropped fuel assembly which results in breaking the cladding of the fuel rods in one assembly and releasing the gaseous fission products. Pre-operational testing and load handling do not involve the movement of irradiated fuel. A dummy assembly will be used for fit-up testing. The fuel handling equipment will be the same as previously analyzed with the exception of special tools that may be used to manipulate the dummy fuel assembly. These special tools will be similar in size and weight to other tools used for underwater manipulation, and therefore, would not present a new hazard. In addition, the same administrative controls and physical limitations imposed on any fuel handling operation will be used for pre-operational testing and load handling. Thus, there is no increase in the probability of occurrence of a fuel handling accident over what would be expected for any routine fuel handling operation.

The loss of spent fuel decay heat removal capability involves the loss of forced spent fuel cooling with and without concurrent Spent Fuel Pool inventory loss. The only requirement to assure adequate decay heat removal capability for the spent fuel is to maintain the water level in the Spent Fuel Pool so that the spent fuel assemblies remain covered (i.e., the capability to makeup water to the Spent Fuel Pool must be available when required). The potential events which could result in a loss of spent fuel decay heat removal capability include external events (explosions, toxic chemicals, fires, ship collision with intake structure, oil or corrosive liquid spills in the river, cooling tower collapse, seismic events, severe meteorological events), and internal events including Spent Fuel Pool makeup water system malfunctions (Service Water System, electrical power, instrument air). Pre-operational testing and load handling will not require the use of explosive materials, toxic chemicals, or flammable materials (routine use of plastic sheeting or absorbent materials for contamination control is not considered significantly hazardous). The probability of other external events (e.g., cooling tower collapse) would be unaffected by the pre-operational testing and load handling activities inside the Fuel Building. Pre-operational testing and load handling activities will not directly interface with the Spent Fuel Pool makeup water systems, therefore, could not affect their probability of failure. (The Cask Loading Pit will be filled with borated water from the Spent Fuel Pool that will be cooled by the Spent Fuel Pool Cooling System, but use of this water in the Cask Loading Pit would not increase the failure probability of the Spent Fuel Pool or makeup water systems.) As described in the safety evaluation above, the safe load path and handling height limitations will ensure that a load drop does not adversely affect the Spent Fuel Pool or the makeup water systems. Therefore, there is no significant increase in the probability of a loss of spent fuel decay heat removal capability.

The events postulated in the Decommissioning Plan are similar to the DSAR with the exception of the decontamination, dismantlement, and materials handling events. Decontamination events involve gross liquid leakage from in-situ decontamination equipment

(e.g., tanks), or accidental spraying of liquids containing concentrated contamination. Dismantlement events involve segmentation of components and structures, or removal of concrete by rock splitting, explosives, or electric and/or pneumatic hammers. Dismantlement events potentially result in airborne contamination. Material handling events involve the dropping of contaminated components, concrete rubble, or filters or packages of particulate materials. Pre-operational testing and load handling activities are material handling activities and, therefore, are within the bounds of the existing analysis. Therefore, the probability of decontamination, dismantlement, and materials handling events would not be significantly increased.

Based on the above, the pre-operational testing and load handling activities would not significantly increase the probability of any accident previously evaluated.

2. The requested license amendment <u>does not involve</u> a significant increase in the consequences of an accident previously evaluated.

The accidents described in the DSAR are generally classified as: 1) radioactive release from a subsystem or component, 2) fuel handling accident, and 3) loss of spent fuel decay heat removal capability. The events described in the Decommissioning Plan are grouped as: 1) decontamination, dismantlement, and materials handling events, 2) loss of support systems (offsite power, cooling water, and compressed air), 3) fire and explosions, and 4) external events (earthquake, external flooding, tornadoes, extreme winds, volcanoes, lightning, toxic chemical release).

As described above, the failure of a WGDT and HUT are no longer credible since these tanks have been deactivated. Therefore, the consequences of a failure of a WGDT or HUT cannot significantly increase as a result of pre-operational testing and load handling.

As discussed in the safety evaluation, if a dummy fuel assembly was dropped in the spent fuel pool then only 1 fuel assembly could be damaged. The previous analysis described in the DSAR postulated the same results. Therefore, the consequences of a dummy fuel assembly drop would be the same as the consequences of the analysis described in the DSAR. Therefore, the consequences of a dummy fuel assembly drop are not significantly increased as a result of pre-operational testing and load handling.

A radiological release will not occur as a result of pre-operational testing and load handling due to no fuel being present in the basket.

There are no credible adverse consequences of the loss of spent fuel decay heat removal because the DSAR demonstrates that adequate time is available to establish a source of makeup water to the Spent Fuel Pool such that uncovering the fuel and an actual loss of spent fuel cooling is not credible. As described by the safety evaluation above, the postulated events that could affect the Spent Fuel Pool (liner tear/breach and heavy load drop) do not have a

significant adverse effect. In addition, establishment of the makeup water path and recovery of spent fuel cooling would not be affected because postulated off-normal events and accidents would not affect the capability to provide makeup water to the Spent Fuel Pool by various water sources. Therefore, pre-operational testing and load handling cannot significantly increase the consequences of the loss of spent fuel decay heat removal.

The events postulated in the Decommissioning Plan that are different from the DSAR are decontamination, dismantlement, and materials handling events. Pre-operational testing and load handling are materials handling events and are, therefore addressed within the bounds of the existing analyses. Therefore, the consequences of decontamination, dismantlement, and materials handling events will not be significantly increased.

Based on the above, the pre-operational testing and load handling activities do not involve a significant increase in the consequences of an accident previously evaluated.

3. The requested license amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated.

The accidents described in the DSAR are generally classified as: 1) radioactive release from a subsystem or component, 2) fuel handling accident, and 3) loss of spent fuel decay heat removal capability. The events described in the Decommissioning Plan are grouped as: 1) decontamination, dismantlement, and materials handling events, 2) loss of support systems (offsite power, cooling water, and compressed air), 3) fire and explosions, and 4) external events (earthquake, external flooding, tornadoes, extreme winds, volcanoes, lightning, toxic chemical release).

As described in the safety evaluation of the proposed pre-operational testing and load handling activities, no types of off-normal events/accidents were determined to have radiological consequences greater than currently evaluated in the DSAR and Decommissioning Plan.

The postulated dummy fuel assembly drop is considered the same type or kind of event as the previously analyzed fuel handling accident, mainly because the initiator for this postulated event is the same, i.e., a (non-specified) failure of the fuel handling equipment or the Fuel Handling Bridge Crane. During pre-operational testing and load handling, a dummy fuel assembly may be dropped in the Spent Fuel Pool or the Cask Loading Pit. As the Cask Loading Pit is similar in construction to the Spent Fuel Pool and the Cask Loading Pit will be flooded with borated water of the same concentration as the Spent Fuel Pool, the differences between the two events are negligible and the two events may be considered the same type or kind of event. Therefore, the dummy fuel assembly drop is not a new or different type or kind of accident.

The postulated transfer cask drop or mishandling event is similar a materials handling event. Therefore, the consequences of a transfer cask drop or mishandling event would not represent a new or different type or kind of accident.

Based on the above, pre-operational testing and load handling activities do not create new types of accidents.

4. The requested license amendment <u>does not involve</u> a significant reduction in the margin of safety.

The Trojan Permanently Defueled Technical Specifications contain four limiting conditions of operation that address: 1) Spent Fuel Pool Water level, 2) Spent Fuel Pool Boron Concentration, 3) Spent Fuel Pool Temperature, and 4) Spent Fuel Pool Load Restrictions. These Technical Specifications will remain in effect as long as spent fuel is stored in the Spent Fuel Pool, which is in accordance with their applicability statements. The pre-operational testing and load handling activities will not affect these Technical Specifications nor their bases.

The Cask Loading Pit, is immediately adjacent to the Spent Fuel Pool. The gate between the Cask Loading Pit and Spent Fuel Pool may be opened to allow a dummy fuel assembly(s) to be moved from the spent fuel storage racks in the Spent Fuel Pool to the basket in the Cask Loading Pit. Opening the gate will allow free exchange of the water between the Cask Loading Pit and the Spent Fuel Pool. The water in the Cask Loading Pit must be at essentially the same level, boron concentration, and temperature as the Spent Fuel Pool prior to the first opening of the gate to ensure that the limiting conditions of operation are continuously satisfied for the Spent Fuel Pool. Therefore, the Cask Loading Pit will be initially filled, to about the same level as the Spent Fuel Pool, with water that is about the same boron concentration and temperature as the Spent Fuel Pool. With these precautions, the limiting conditions of operation pertaining to Spent Fuel Pool level, boron concentration, and temperature will be continuously maintained for the Spent Fuel Pool and the margin of safety will be unaffected.

Pre-operational testing and load handling activities will involve lifting and moving heavy loads (e.g., transfer cask). Loads that will be carried over fuel in the Spent Fuel Pool racks and the heights at which they may be carried will be limited in such a way as to preclude impact energies over 240,000 in-lbs if the loads are dropped in accordance with LCO 3.1.4, "Spent Fuel Pool Load Restrictions." With this precaution, the limiting condition of operation pertaining to load restrictions over the Spent Fuel Pool will be satisfied for fuel stored in the Spent Fuel Pool racks and the margin of safety will be unaffected. The safe load path for heavy loads being lifted and moved outside the Spent Fuel Pool will be located sufficiently far from the Spent Fuel Pool as to not have an adverse effect on the Spent Fuel Pool in the unlikely event of a load drop. In addition, the mechanical stops and electrical interlocks on

the Fuel Building overhead crane will provide additional assurance that heavy loads are not carried over the fuel in the Spent Fuel Pool racks.

Based on the above, the pre-operational testing and load handling activities will not reduce the margin of safety.

7. SCHEDULE CONSIDERATION

As described in the 10 CFR 72 license application submitted to the NRC in March 1996, PGE plans to begin loading spent fuel into casks and moving the casks to the ISFSI concrete storage pad in January 1998. Accordingly, PGE requests approval of this 10 CFR 50 license amendment by April 1, 1997, to allow adequate time for mock-up and dry run testing as described in Chapter 9 of the ISFSI Safety Analysis Report, finalization of spent fuel loading and handling procedures as a result of mock-up and dry run testing, and NRC review of pre-operational test results which will be submitted 30 days prior to the beginning of spent fuel loading.