Enclosure 1 to VPN-001-2019

RAI Responses

RESPONSE TO NUCLEAR REGULATORY COMMISSION (NRC) REQUEST FOR ADDITIONAL INFORMATION FOR THE TECHNICAL REVIEW OF THE APPLICATION FOR RENEWAL OF THE TROJAN INDEPENDENT SPENT FUEL STORAGE INSTALLATION LICENSE NO. SNM-2509

By letter dated April 23, 2018, the NRC issued to Portland General Electric Company (PGE) a "Request for Additional Information for the Technical Review of the Application for Renewal of the Trojan Independent Spent Fuel Storage Installation License No. SNM-2509 (CAC No. 001028)." The NRC's Requests for Additional Information (RAI) and PGE's response to each RAI are provided below.

CHAPTER 2 - SCOPING EVALUATION

RAI 2-1. Provide additional justification for excluding the independent spent fuel storage installation (ISFSI) storage and service pads from the scope of renewal. Alternatively, include the pads in the renewal scope, provide an aging management review (AMR), and describe the aging management activities used to manage the identified aging effects.

License Renewal Application (LRA) Table 2-1: Summary of Scoping Evaluation Results of the LRA states that the ISFSI storage and service pads are neither important-to-safety (ITS) nor could prevent the fulfillment of an ITS function as applied to scoping criteria 1 and 2 of the LRA.

Although the ISFSI pads are not listed as ITS in the safety analysis report (SAR) and drawings, it is not clear whether the failure of the pads (e.g., via cracking, settling) may affect the ability to retrieve the spent fuel with the transfer cask (scoping criterion 2).

This information is required to determine compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) 72.42(a).

<u>PGE Response to RAI 2-1</u>

Section 4.2.1 of the Trojan ISFSI Safety Analysis Report describes the functions of the ISFSI Storage and Service Pads:

> *4.2.1 STRUCTURAL SPECIFICATION*
>
> *The ISFSI Storage and Service Pads and Transfer Station Pad meet the requirements of ACI 318 and are capable of supporting the loads associated with the array of Concrete Casks and transfer equipment. The ISFSI Storage and Service Pads are classified as not important to safety. The concrete pads provide a supporting surface for the Concrete Casks and the HI-STAR 100 Transport Cask. They also provide a smooth level surface to allow operation of the air pad system.*

The air pad system provides the ability to remove a cask loaded with spent fuel assemblies from its storage location. The two characteristics of the Storage and Service Pads that affect air pad operation, as noted above, are smoothness and levelness of the concrete surface.

Potential aging effects affecting the smooth surface of the Storage and Service pads include cracking or loss of material (spalling or scaling) due to freeze-thaw degradation, chemical attack, cement aggregate reactions, loss of bond (due to corrosion of embedded steel), long-term settlement, or gamma and neutron irradiation. A further, potential aging effect is an increase in concrete porosity/permeability due to chemical leaching. Surface defects from cracking, loss of material, or porosity/permeability changes along the travel path may be spanned by use of sheet metal, a standard approach throughout industry which was at times used during initial fuel loading at Trojan. To improve the efficiency of the process, any defects could also be repaired using standard methods such as filling the defects with grout or epoxy prior to placement of steel plates. Only gross failure of the pad itself, resulting in significant vertical offset surfaces, could prevent use of sheet metal to provide a smooth surface for the air pads. Gross failure of the pad would require significant differential foundation settlement. The Trojan ISFSI SAR considers foundation settlement not credible as indicated in the following excerpts:

> *2.4.2.2 Flood Design Considerations*
>
> *There is no potential for flood induced erosion because the ISFSI reinforced concrete Storage Pad is founded on impervious rock.*
>
> *2.6.1 BASIC GEOLOGIC AND SEISMIC INFORMATION*
>
> *The ISFSI is located on the east side of the PGE property in a flat, yard area at an elevation of 45 feet MSL. The reinforced concrete slab on which Concrete Casks sit is located on competent rock.*
>
> *2.6.4 STABILITY OF SUBSURFACE MATERIALS AND FOUNDATIONS*
>
> *The existing gravel fill was removed during excavation for the ISFSI reinforced concrete Storage Pad and a nominal 2 ft. layer of graded and compacted gravel fill was placed under the concrete slab. No soluble or cavernous rocks underlie the site area, and no poorly consolidated or mineralogically unstable rocks occur at the site. No oil, gas, other mineral extraction, or subsurface mining occurs or has occurred in the vicinity of the site. It is therefore concluded that future subsurface subsidence is not a problem at the site.*
>
> *Because the ISFSI reinforced concrete Storage Pad is founded on the crest of a rock ridge which shows no evidence of deformation since Pliocene time, no unrelieved residual stresses should be expected to exist in the foundation rock. No evidence of unrelieved residual stress was observed during previous excavations for the nuclear plant foundations.*
>
> *3.2.3.1.7 Soil-Supported Structures*
>
> *The reinforced concrete Storage Pad on which the Concrete Casks rest and the adjacent concrete Service Pad and Transfer Station are the only at-grade ISFSI structures. The concrete pads are located on approximately 24 inches of engineered fill founded on competent rock. The foundation beneath the Transfer Station extends to competent rock.*

3.2.3.1.8 Soil-Structure Interaction

The foundation rock contains joints and fractures, as do essentially all rocks exposed to the earth's surface. However, none of these features should be expected to affect the stability of the foundation rock during vibratory motion. The foundation rock is confined by natural, in situ materials, and foundation loads are small in comparison to the foundation rock's ultimate bearing capacity. There will be no loss of strength or stability of the foundation rock during vibratory motions. Since the reinforced concrete pads are located on engineered fill founded on competent rock, soil-structure interaction is negligible.

Based on these references, significant differential settlement that could cause cracking that would affect the ability of air pads to be used to transfer Concrete Casks to the Transfer Pad is not considered credible. On the same basis, settlement resulting in loss of pad levelness that would affect the ability of air pads to be used to transfer Concrete Casks to the Transfer Pad is not considered credible.

Table 2-1 of the renewal application has conservatively been revised to state that the ISFSI Storage and Service Pads meet Scoping Criterion 2 (Not Important to Safety, but whose failure could prevent an ITS function from being fulfilled) in consideration of the pads' role in demonstrating ready retrieval. New LRA Table 2-7 has been added to list individual subcomponents of the pads and the associated Intended Function of Retrievability. New LRA Table 3-6 has also been added to list the appropriate Materials, Environments, Aging Effects Requiring Management, Aging Mechanisms, and Aging Management Activities. Since there are no aging effects requiring management, no AMP is proposed for the ISFSI Storage and Service Pads.

RAI 2-2. Resolve the discrepancies between the LRA and drawings regarding subcomponent safety functions, and revise the scoping and aging management review, if necessary.

Table RAI 2-2 below summarizes discrepancies between the LRA scoping Tables 2-2 through 2-6 and drawings.

If the resolution of these discrepancies causes a subcomponent to be added to the scope of renewal, an aging management review and aging management activities for these subcomponents should be provided.

This information is required to determine compliance with 10 CFR 72.42(a).

TABLE RAI 2-2: Safety Function Discrepancies of LRA vs Drawings

LRA TABLE	DISCREPANCY
Table 2-2 (MPC)	Item 17 (plugs): Identified as not important to safety (NITS) in drawing, but has a Shielding function in LRA table.
	Items 28, 29 (vent and drain tube and cap): Identified as ITS-C in drawing, but "N/A" in LRA table.
	Item 32 (set screw): Identified as NITS in drawing, but has a Confinement function in LRA table.
Table 2-4 (Transfer Cask)	Items 23, 28, 30, 33, 34, 35 (top lid and door items): Identified as ITS-B in drawing, but "N/A" in LRA table.
Table 2-6 (Transfer Station)	Items 8-10 and 12 of Drawing D-AI-200 (nuts, washers, threaded rod): Components do not appear in LRA table.

PGE Response to RAI 2-2

Item 17 (Plugs for Drilled Holes) is shown as Part No. 30 on Drawing 3663. Its safety classification is NITS and it does not have a shielding function. Consequently, LRA Table 2-2 has been revised to specify "N/A" in the Intended Function column for this item, consistent with the way other NITS subcomponents in Table 2-2 are described. In addition, LRA Table 3-1 has been corrected to specify "N/A" in the remaining columns for this item, consistent with the way other NITS subcomponents in Table 3-1 are described.

Items 28 (Vent and Drain Tube) and 29 (Vent and Drain Cap) are shown as Parts No. 11 and 12 on Drawing 3663. Both parts are classified as ITS Category C and were used during loading operations, with no need to use them in the future. Consequently, LRA Table 2-2 has been revised to add a reference to a new Note 2 in the Intended Function column for these items. The note states: "Used during loading operations. Not relied on for Intended Functions described in Section 2.1 during storage." Similarly, Table 3-1 has been revised to add a reference to a new Note 4 in the Intended Function column for these items.

Item 32 (Port Cover Plate Set Screw) is shown as Part No. 20 on Drawing 3663. Its safety classification is NITS and it does not have a confinement function. Consequently, Table 2-2 has been revised to specify "N/A" in the Intended Function column for this item, consistent with the way other NITS subcomponents in Table 2-2 are described. In addition, LRA Table 3-1 has been corrected to add Item 32, Port Cover Plate Set Screw and to specify "N/A" in the remaining columns for this item, consistent with the way other NITS subcomponents in Table 3-1 are described.

LRA Table 2-4 has been revised to provide the Intended Functions for Items 23, 28, 30, 33, 34, and 35. The items are classified as ITS Category B. LRA Table 3-2 has been revised to reflect this change. The items are in a sheltered environment and are included as part of the aging management activities for the Transfer Cask. LRA Table 2-4 has also been revised to correct the name of Item 3 so that it matches the item name on the referenced drawing.

LRA Table 2-6 has been revised to include all parts from drawings D-AI-100 (Transfer Station overall assembly), D-AI-200 (Transfer Station foundation), and C-3056 (Transfer Station Impact Limiter). This combination includes all parts associated with the Transfer Station. In some

cases, as shown in the table, Intended Functions are listed at the Assembly level rather than at the parts level, when all parts in the Assembly have the same Intended Function(s). LRA Table 3-5 has also been revised to match the initial parts screening in Table 2-6.

CHAPTER 3: AGING MANAGEMENT REVIEW

RAI 3-1. Clarify the material of construction for the Lid Bolt and, if necessary, revise the aging management review.

LRA Table 3-2, Aging Management Review for Transfer Cask Subcomponents, identifies the Lid Bolt to be constructed of stainless steel. However, item 17 on Drawing 3555, sheet 2 is identified as Cr-Mo alloy (ferritic) steel (ASME SA-193 B7).

If the material designation as stainless steel is correct, provide a reference to the applicable design basis information. If the material designation is not correct, provide the AMR for the corrected material and revise the material designation in other areas of the application, as appropriate.

This information is required to determine compliance with 10 CFR 72.24(c) and 10 CFR 72.42(a).

PGE Response to RAI 3-1

The stainless steel Lid Bolt was only used at Trojan during fuel loading operations as part of the Transfer Cask retention system for the un-welded MPC Lid during moves from the Spent Fuel Pool area to the MPC lid welding area. This Lid Bolt will not be used with the Transfer Cask during future Trojan Transfer Station operations. The correct subcomponents for installing the Transfer Cask Lid at Trojan are Drawing 3555 Part Number 17 "Top Lid Stud (Top Lid Bolt)" and Part Number 56 "Top Lid Stud (Top Lid Washer)" fabricated from Cr-Mo alloy (ferritic) steel (ASME SA-193 B7) material.

LRA Table 2-4 has been revised to delete the information in the Item No. 17 row for the stainless steel "Lid Bolt" that was only used during initial loading and retain the unused row for continuity. In addition, Items 22 and 23 for Drawing 3555 Part Number 17 "Top Lid Stud (Top Lid Bolt)" and Part Number 56 "Top Lid Nut (Top Lid Washer)" the Intended Function was corrected to say "Structural Integrity."

LRA Table 3-2 has also been revised to delete the row for the stainless steel "Lid Bolt." In addition, for Drawing 3555 Part Number 17 "Top Lid Stud (Top Lid Bolt)" and Part Number 56 "Top Lid Nut (Top Lid Washer)", the Intended Function has been corrected to say "Structural Integrity" and the remaining columns have been corrected to say "Carbon Steel," "Sheltered," "Loss of Material," "Corrosion Pitting and Crevice Corrosion," and "Transfer Cask AMP."

RAI 3-2. Demonstrate why concrete degradation due to corrosion of the concrete cask reinforcement bar is not an aging effect that must be managed in the period of extended operation.

LRA Table 3-3: AMR for Concrete Cask Subcomponents, sheet 3-28 line item for reinforcement bar does not address corrosion. The staff notes that corrosion of reinforcing steel can be caused by the presence of chlorides, and that chloride attack has been well established in the technical literature (Cheung et al., 2009). The presence of corrosion products at the steel surface can generate internal stresses within the concrete matrix, causing cracks and spalling of the concrete cover with consequent structural damage.

Justify why the management of concrete degradation due to corrosion is not required or revise the AMR and aging management program (AMP) to address the corrosion of concrete cask reinforcement bar.

This information is required to determine compliance with 10 CFR 72.24(c) and 10 CFR 72.42(a).

Reference:
Cheung, M.M.S., J. Zhao, and Y.B. Chan. "Service Life Prediction of RC Bridge Structures Exposed to Chloride Environments," Journal of Bridge Engineering, Vol. 4, pp. 164-178, 2009.

PGE Response to RAI 3-2

The Trojan ISFSI site is located adjacent to the Columbia River, at river mile 72.5, well upstream of where measurable amounts of saltwater are found. As such, the ISFSI and its components are not exposed to brackish water or salt spray that would introduce chlorides to attack the reinforcing steel. Also, the Trojan ISFSI site is not exposed to significant concentrations of air pollutants. There is a cooling tower located in Longview, Washington, about 4.5 miles north of the ISFSI site. Roadways where de-icers may be used are U.S. Highway 30, about 0.6 miles away and Interstate Highway 5, about 1.3 miles away. The cooling tower and these roadways are sufficiently distant from the ISFSI that elevated chloride levels at the ISFSI from tower emissions and de-icer use are not expected.

Even though concrete degradation due to chloride corrosion of reinforcing steel is not expected, LRA Table 3-3 has been modified to include concrete shell degradation due to corrosion of the Concrete Cask reinforcement bar. The Concrete Cask AMP has also been revised to include inspection requirements for concrete surface cracking, spalling, or staining that may result from reinforcement bar corrosion.

RAI 3-3. Justify why cracking due to differential settlement is not included as an aging effect for the transfer station pad. Alternatively, revise the AMR and state how differential settlement is addressed with an AMP or time-limited aging analyses.

LRA Table 3-5, Aging Management Review for Transfer Station Subcomponents, states that loss of strength, spalling, cracking, and scaling are aging effects requiring management for the transfer station pad. The associated aging mechanisms are identified as alkali silica reaction, CaOH leaching, and freeze/thaw. Differential settlement is a result of the uneven deformation of

the supporting foundation soil (Das, 1999; NAVFAC, 1986). Differential settlement, which causes distortion (loss of form) and damage (cracking) to concrete structures, is a function of the uniformity of the soil, stiffness of the structure, stiffness of the soil, and distribution of loads within the structure (U.S. Department of the Army, 1990; NAVFAC, 1996).

The staff notes that, while cracking due to concrete degradation mechanisms (e.g., alkali silica reaction, leaching) is managed by the Transfer Station AMP, it is not clear that the AMP activities are also appropriate for managing cracking due to settlement.

This information is required to determine compliance with 10 CFR 72.24(c) and 10 CFR 72.42(a).

PGE Response to RAI 3-3

Cracking due to differential settlement is not included as an aging effect for the Transfer Station pad because this aging effect is not considered credible given the foundation conditions for the pad, as noted in the Trojan ISFSI SAR:

> *2.6.4 STABILITY OF SUBSURFACE MATERIALS AND FOUNDATIONS*
>
> *The existing gravel fill was removed during excavation for the ISFSI reinforced concrete Storage Pad and a nominal 2 ft. layer of graded and compacted gravel fill was placed under the concrete slab. No soluble or cavernous rocks underlie the site area, and no poorly consolidated or mineralogically unstable rocks occur at the site. No oil, gas, other mineral extraction, or subsurface mining occurs or has occurred in the vicinity of the site. It is therefore concluded that future subsurface subsidence is not a problem at the site.*

The Transfer Station pad has the same foundation conditions except that the pad is founded directly on competent rock without an intermediate layer of engineered fill, as noted in the Trojan ISFSI SAR:

> *3.2.3.1.7 Soil-Supported Structures*
>
> *The reinforced concrete Storage Pad on which the Concrete Casks rest and the adjacent concrete Service Pad and Transfer Station are the only at-grade ISFSI structures. The concrete pads are located on approximately 24 inches of engineered fill founded on competent rock. The foundation beneath the Transfer Station extends to competent rock.*

Based on these references, significant differential settlement that could cause cracking of the Transfer Station pad is not considered credible.

RAI 3-4. Justify why the impact limiter foam has no aging effects that require management. Otherwise, describe the foam material and identify any aging effects that could impact an important-to-safety function. For those aging effects, TLAAs or AMPs should be provided to ensure that safety functions are maintained.

LRA Table 3-5, Aging Management Review for Transfer Station Subcomponents, states that the transfer station impact limiter foam has no aging effects requiring management. The table also

states that the current licensing basis requirements for periodic impact limiter foam coupon testing will be maintained. The LRA does not describe, or provide the technical justification for, the aging effects that the coupon testing is intended to address, nor does it provide justification for the effectiveness of that testing in the period of extended operation.

This information is required to determine compliance with 10 CFR 72.24(c) and 10 CFR 72.42(a).

PGE Response to RAI 3-4

The aging effect of concern for the Impact Limiter polyurethane foam material is a change to its dynamic crush strength. This aging effect will be monitored by periodic testing. Element 4 of the Transfer Station AMP includes this requirement with analysis of coupon test results required by Element 6.

Table 3-5 and the Transfer Station AMP have been revised to clarify these requirements and provide additional details. A subsection of Table 3-5 lists subcomponents for the Impact Limiter including its top plate, sheet metal enclosure, angle iron shapes, foam material, and threaded plug. Element 4 of the Transfer Station AMP includes a subsection for the Impact Limiter that provides a testing schedule for representative foam samples. Element 6 of the AMP includes a subsection with acceptance criteria for static crush strength tests (and equivalent dynamic crush strength values) of representative foam samples. The dynamic crush strength values were taken from the MPC drop analysis at the Transfer Station. Element 6 also includes acceptance criteria for visual inspection of the Impact Limiter top plate. The aging mechanism of concern is loss of material.

RAI 3-5. Clarify the interior environment of the transfer cask neutron shield and, if necessary, revise the AMR and associated aging management activities.

LRA Table 3-2, Aging Management Review for Transfer Cask Subcomponents, identifies the environment of the components exposed to the neutron shield water as being sheltered; however, the staff is unable to identify documentation that shows that the shield is drained when not in use. If the stated environment is not correct (the neutron shield has remained filled), revise the AMR for all subcomponents that are exposed to water and correct the environment designation in other areas of the application, as appropriate.

In addition, the staff is unable to identify documentation that shows whether or not the neutron shield water is borated. The staff notes that Chapter 7 of the SAR, Operating Procedures, does not define what water is to be used to fill the water jacket, i.e., borated or fresh/demineralized water. Clarify the type of water used.

This information is required for the staff to determine compliance with 10 CFR 72.42(a), 10 CFR 72.104, and 10 CFR 20.1301(a) and (b).

PGE Response to RAI 3-5

The Transfer Cask neutron shield (water jacket) was filled with potable (non-borated) water while in use during MPC transfers from the Trojan Spent Fuel Pool to the ISFSI Pad. After the

Transfer Cask handled each loaded MPC, the water jacket was drained to a storage tank for re-use with the next MPC. After the final MPC was loaded and transferred to Concrete Cask storage, the Trojan procedure "Transfer Cask Water Jacket Dry Layup" was followed. The Transfer Cask water jacket was drained, any residual water was vacuumed out, forced air was used to completely dry the water jacket, and a final visual inspection was made to confirm the water jacket was dry and free of water. The water jacket was slowly purged using argon gas, to avoid mixing with air, until at least two volume changes occurred. The water jacket was then sealed for long-term dry layup storage.

The Transfer Cask is now stored in the Trojan ISFSI Utility Building located on the ISFSI Pad. The Utility Building provides a Sheltered environment for the Transfer Cask and its subcomponents. Consequently, during storage, most subcomponents that form the water jacket have a Sheltered environment on external surfaces and an Inert Gas environment on internal surfaces. LRA Table 3-2 has been revised to reflect these storage environments for the water jacket subcomponents.

No changes to AMR activities are necessary since, during dry layup storage, the Inert Gas environment of the water jacket cavity protects metallic components from degradation. The Transfer Cask AMP specifies appropriate AMR activities (visual inspection) for external surfaces during dry layup storage and additional AMR activities (checking the water jacket for leaks) during future periods of Transfer Cask use.

APPENDIX A - Aging Management Program:

Transfer Cask AMP:

RAI A-1. Clarify if the Transfer Cask AMP specifically addresses the aging management activities associated with the loss of material of the Holtite shield or justify why not.

LRA Table 3-2, Aging Management Review for Transfer Cask Subcomponents, states that loss of material due to corrosion of the Holtite shielding will be managed by the Transfer Cask AMP. However, it does not appear that any activities in the AMP specifically address this aging effect, as the Holtite shielding is not accessible for the proposed visual inspections.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-1

LRA Table 3-2, Aging Management Review for Transfer Cask Subcomponents, erroneously listed loss of material as the aging effect requiring management and corrosion as the aging mechanism for the Holtite shielding material contained in the Top Lid Shielding, as well as listing the long-term extended storage environment for the Holtite as sheltered. Loss of material is not a concern for the Holtite shield. It is made of a corrosion resistant polymer material and is embedded within the plates and rings that form the transfer cask top lid. Holtite is therefore not subject to any aging mechanisms. No aging management activities associated with the loss of Holtite material are necessary. In addition, the Transfer Cask AMP appropriately manages the condition of the Transfer Cask Lid, thereby assuring the continued presence of the Holtite shielding material.

LRA Table 3-2 was revised to change the environment to Embedded, aging effects to None Identified, aging mechanism to None Identified, and aging management activities to N/A for the Top Lid Shielding.

RAI A-2. Clarify the extent of coverage for the inspections of accessible surfaces in LRA Appendix A: Transfer Cask AMP element 4, Detection of Aging Effects.

Transfer Cask AMP element 4 states that accessible painted surfaces will be inspected for corrosion and chipped, cracked, or blistered paint.

It is unclear whether the proposed inspections include the transfer cask internal (cavity) components, such as the inner shell. The AMP should clearly state whether the internal components are considered to be accessible and will be included within the scope of the inspections. If the internal surfaces are not considered to be accessible, the AMP should address how the aging of the internal components will be managed.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-2

The intent of Element 4 in the Transfer Cask AMP is to include accessible internal surfaces of the cask, which includes the cylindrical MPC storage cavity, but does not include the inner surfaces of the water jacket. The inner cask surfaces will typically be inspected from above, by looking down into the cask interior, rather than by personnel entering the cavity.

The wording in Element 4 of the Transfer Cask AMP has been clarified to note that internal surfaces are part of the visual inspection.

RAI A-3. Demonstrate that the Trojan Quality Assurance (QA) program includes provisions to ensure that the proposed visual inspections of the transfer cask and transfer station will be capable of detecting degradation.

The LRA states that visual inspections of the transfer cask and transfer station will be performed using a QA validated procedure.

It is unclear to the staff whether the proposed visual inspections will be capable of identifying corrosion, paint degradation, or other surface damage. As recommended in NUREG-1927, Revision 1, AMPs should define a visual inspection methodology that has been demonstrated to be capable of identifying the inspected parameters, using consensus codes and standards (e.g., ASME Section XI VT-3 with controls for distance and lighting), as applicable. If the Transfer Cask and Transfer Station AMPs will not use a consensus code to define the visual inspection method, the staff requires additional information (QA program documents or summaries thereof) regarding how the Trojan QA program will establish visual examination requirements to ensure that degradation will be detected, taking into account the need for inspection parameters for lighting, distance, offset, and assessment of base metal when coating degradation is present.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-3

Trojan Certified ISFSI Specialists have performed annual visual inspections of the Transfer Station since 1999, and the Holtec Transfer Cask since 2003, in accordance with the Structural Inspection Program described in Section 9.7.6 of the Trojan ISFSI SAR. These inspections will continue until the new Aging Management Program is implemented in 2022. The inspections are performed in accordance with Trojan's quality-related procedure TIP-09, Structural Inspection Program. Trojan's procedure control program requires a qualified Independent Safety Reviewer to conduct a technical review of all new quality-related procedures and all revisions to quality-related procedures (reference ISFSI SAR 9.6.1). Procedure TIP-09 contains a description of what is to be inspected and the inspection criteria used to determine if a defect or irregularity exists.

PGE plans to continue this program for visual inspections of the Transfer Station and Transfer Cask. The respective AMPs have been revised to reflect this approach. PGE will prepare new Aging Management Program implementing procedures for the Transfer Station and Transfer Cask that conform to the requirements in their respective AMPs, including the definitions of defects and irregularities (Element 3) and acceptance criteria (Element 6).

Since the function of the Transfer Station and Transfer Cask coatings is to protect the base metal from corrosion, visual inspections of coated components will verify that no base metal or corrosion products are showing through the coating. These inspections will be conducted during daylight hours, and supplemental lighting will be used as necessary to ensure that coating defects exposing base metal or corrosion products can be detected. The Transfer Station is fully accessible to inspectors using means such as scaffolding, bucket trucks, scissor lift, ladders, and existing platforms. Enhanced observation methods such as binoculars may also be used. These means will ensure that inspectors are able to approach surfaces of interest as close as needed to observe coating defects that expose base metal or corrosion products.

If a coating defect is found, the depth of any metal loss will be determined. Tools available for this purpose include depth gauges, feeler gauges, tape measures, rulers, and go-no go gauges. In accordance with Element 6 in the Transfer Cask and Transfer Station AMPs, if this depth exceeds 1/8 inch the issue will be entered into the Trojan Corrective Action Program for evaluation. If the depth of the defect is 1/8 inch or less, its location and size will be documented.

Trojan staff individuals have performed visual inspections in accordance with TIP 09 during the current licensing period. Pursuant to the second paragraph in your Request for Additional Information, PGE believes that these activities should be credited towards aging management in the renewed period. Trojan's history of using Certified ISFSI Specialists to successfully perform these inspection activities demonstrates that the inspections are capable of identifying defects and conditions that exceed the acceptance criteria. Certified ISFSI Specialists are subject to annual physical exams that include measurement of visual acuity, measurement of field of vision (peripheral vision), and confirmation of color vision ability. Trojan Certified ISFSI Specialists meet or exceed the minimum qualifications of ANSI N18.1-1971 for a comparable position.

Certified ISFSI Specialists will be trained and qualified on implementation of the AMPs through both self-guided study and on-the-job practical training on the new quality-related AMPIPs to ensure the visual inspections described in the AMP can effectively manage the effects of aging for these components.

Wording in Element 6 of the Transfer Station Pad AMP has been revised to remove the reference to ACI 349.3R 02 for acceptance criteria. During preparation of this RAI response, it was determined that Trojan does not use the term "QA validated procedure" in existing procedures or the procedure control program. Consequently, this term has been removed from Element 4 of the Transfer Cask and Transfer Station AMPs for clarity.

RAI A-4. Describe the criteria for entering an issue into the Corrective Acton Program (CAP) in LRA Appendix A, Transfer Cask AMP element 6, Acceptance Criteria.

Transfer Cask AMP element 6, Acceptance Criteria, states that, if degradation of material is detected on any of the identified subcomponents within the transfer cask, the issue would be entered into Trojan's CAP and an engineering evaluation would be performed to determine the impact on intended functions. However, AMP element 7, Corrective Actions, states that, if the engineering evaluation shows that the transfer cask has indications that exceed acceptable limits, the issue will be entered in the CAP.

It is unclear to the staff what specific criteria will be used to determine if degradation is present and the issue is entered into the CAP. Also, the AMP appears to have conflicting information regarding whether the engineering evaluation is part of the CAP or whether it is used to determine entrance in to the CAP. If the intent of the AMP is to enter into the CAP <u>any</u> indication of the parameters monitored (e.g., chipped or cracked paint, signs of corrosion, leaks, scratches), then the AMP should clearly state so. If the intent of the AMP is to enter into the CAP some other threshold that is determined through evaluation, then the AMP should identify that threshold.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

<u>**PGE Response to RAI A-4**</u>

Elements 6 (Acceptance Criteria) and 7 (Corrective Actions) of the Transfer Cask AMP in LRA Appendix A have been revised to specify the acceptance criteria and the decision process used to enter an issue into the Trojan Corrective Acton Program (CAP).

The Transfer Cask AMP detailed inspection results are documented by the qualified individuals (Certified ISFSI Specialists), and reviewed by the ISFSI Manager, who decides whether the acceptance criteria are met. If a condition is identified that does not meet one or more of the Transfer Cask's specified AMP Acceptance Criteria, the issue will be entered into the Trojan CAP. When necessary, performance of an engineering evaluation is part of the CAP. In addition, the ISFSI Manager may have an engineering evaluation of a questionable condition performed as a part of his decision on whether to enter the condition into the CAP.

A new technical basis document[1] has been developed for Transfer Cask subcomponent base metal acceptance criteria for corrosion, dents, cracks, scratches, and gouges. The technical

[1] Response to Request for Technical Information (RRTI) 2536-002R2 provides the technical basis for the following acceptance criteria stated in Element 6 of the Aging Management Plan (AMP) for the Transfer Cask, Concrete Cask and Transfer Station: "No corrosion, dents, cracks, scratches, or gouges in base metal that exceeds 1/8" in depth."

basis document was added as a footnote to the Transfer Cask AMP in Appendix A and was used to revise Element 6 (Acceptance Criteria) to state:

"The acceptance criteria for Transfer Cask subcomponents are:

- No corrosion, dents, cracks, scratches, or gouges in base metal that exceeds 1/8" in depth (defects in the protective coating are acceptable provided the underlying base metal meets the above criteria)
- No leakage of water from the water jacket"

Element 6 was also revised to delete the confusing "engineering evaluation" wording and clearly state that "The inspection results are evaluated by the Trojan ISFSI Manager and if water jacket leakage or degradation of material is detected on any of the identified subcomponents within the Transfer Cask that exceeds the above acceptance criteria, the issue will be entered into Trojan's CAP."

In addition, Element 7 (Corrective Actions) of the Transfer Cask AMP has been revised to delete the confusing "engineering evaluation" wording and, for consistency with the Concrete Cask and Transfer Station AMPs, replace it with the following wording: "In addition, this process may result in an engineering evaluation to determine the extent and impact of the condition on the ability of the Transfer Cask to perform its Intended Function or in supplemental inspections, such as non-destructive examinations (NDE)."

Based on the above technical basis document, no acceptance criteria are required for the Transfer Cask metal protective coatings. However, PGE plans to repair accessible degraded coatings to maintain the protective barrier.

RAI A-5. Describe what inspections have been performed on the transfer cask and whether any indications of degradation were identified for LRA Appendix A: Transfer Cask AMP element 10, Operating Experience.

The LRA states that the transfer cask was used during the initial loading of the Trojan ISFSI and the transfer cask was inspected before use in accordance with existing operating procedures.

NUREG-1927, Rev. 1, Section 3.6.1.10, Operating Experience, recommends that the operating experience element of the program support a determination that the effects of aging will be adequately managed. Operating experience is useful in providing justification for the effectiveness of each AMP program element and critical feedback for enhancement.

It is unclear to the staff what inspections have been performed on the transfer cask and whether those inspections identified any indications of degradation. The LRA should provide any available inspection details (e.g., scope, methodology, results) that support the adequacy of the proposed aging management activities.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-5

The Transfer Cask was received at Trojan in July 2002. At that time, PGE personnel performed a receipt inspection in accordance with the following Holtec and PGE procedures:

- Final Inspection (Holtec procedure)
- Receiving Inspection (Holtec procedure)
- Transfer Cask Receiving and Offloading Operations (Holtec procedure)
- Receipt Inspection (PGE procedure)
- Quality Inspection (PGE procedure)

The scope of these inspections included the following:

- Cleanliness
- Workmanship
- Dimensions
- Coating Integrity
- Weld Preparation Condition
- Lack of Shipping Damage

Receipt inspection documentation demonstrates that no shipping damage or material degradation was present.

The cask was used in fuel loading operations from January through September 2003. No repair documentation for the transfer cask was found.

Following completion of the fuel loading campaign in September 2003, the cask was prepared for dry layup and placed in long-term storage per Trojan ISFSI procedure. As part of this process, the cask was inspected for damage, surface coating defects, weld irregularities, and corrosion. By Trojan procedure, a surface coating defect was defined as any defect that exposes bare metal or shows evidence of rusting below the coating. The Maintenance Request package for preparing the Transfer Cask for long-term storage did not specifically note any irregularities, defects, or damage.

Following this inspection, the cask was placed in a sheltered environment inside a storage building on the ISFSI pad, with the intent that it remains there until it is used to transfer fuel for shipment offsite. The cask has undergone annual inspections since that time in accordance with the Trojan Structural Inspection Program. The scope consists of inspection of accessible surfaces for excessive corrosion, pitting, or loss of paint. Any findings are documented and categorized as irregularities or defects depending on the severity. No irregularities or defects have been found or noted in the 15 annual inspections conducted.

Based on the lack of degradation observed during these cask inspections, no changes are deemed necessary to Element 10 of the Transfer Cask AMP.

Concrete Cask AMP:

RAI A-6. Provide the specific parameters that will be inspected to identify concrete degradation before a loss of intended function for LRA Appendix A: Concrete Cask AMP, element 3, Parameters Monitored/Inspected.

The LRA states that exposed exterior concrete surfaces will be examined for indications of surface deterioration.

The AMP does not provide sufficient detail for the staff to evaluate whether the proposed inspection methods are capable of identifying conditions and quantifying their severity. If all parameters associated with the ACI 349.3R acceptance criteria will be monitored (e.g., popouts, spalling, cracks, leaching), then the AMP should clearly state those parameters.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-6

Exposed steel and concrete surfaces of the Concrete Cask will be visually examined for indications of deterioration that could affect their ability to provide support to the MPCs, to provide radiation shielding, to provide missile shielding, or to provide a path for heat transfer. The exposed concrete surfaces include the complete vertical and top surfaces of the cylindrical casks. The exposed steel surfaces include the top of the Concrete Cask Lid.

Deterioration of the exposed steel and concrete surfaces will be detected by identification of defects and/or irregularities in or on each inspected item.

Defects associated with the concrete surface are defined as damage or degradation (scabbing, spalling, cracking, etc.) larger than ½ inch in diameter or width and with a depth of greater than ¼ inch. Defects also include evidence of leachate deposits, staining, or stalactite growth on the concrete surface. The inspections will identify defects or irregularities of any form that meet or exceed the above criteria regardless of their cause or origin. An irregularity is defined as damage or degradation to a component that is noted, but is less severe, and does not meet the definition of a defect.

Contact radiation dose rate measurements will be taken at the location of any identified defect in the concrete surface and at an unaffected location adjacent to the defect. The results of these measurements will be compared to each other to assess whether the defect has compromised the radiation shielding function of the concrete.

Defects associated with the steel cask lid are chipped, cracked, blistered, or missing coating that exposes base metal, and corrosion products showing through the coating.

Defects associated with the Inlet and Outlet Air Assemblies are visible signs of blockage in the air flow path.

All noted defects and irregularities will be documented on an inspection data sheet and recorded in a Defect Log. Previously reported defects and irregularities will be reviewed against the Defect Log and evaluated to determine whether their condition has visibly changed. Areas

where new defects are found, or previously identified irregularities or defects have changed, will be closely examined to determine whether any reinforcing steel is exposed. If the concrete in the area is spalled or cracked, it will be checked for soundness by tapping with a hammer. Rust stains which may indicate rebar degradation will also be identified.

This inspection program provides the means to detect and address the aging effects and mechanisms identified in Section 3.4.5, including:

- Loss of material (steel) due to corrosion
- Cracking or loss of material (concrete) due to freeze-thaw degradation
- Cracking or loss of material (concrete) due to alkali-silica reactions
- Cracking or loss of material (concrete) due to corrosion of embedded reinforcing steel
- Calcium hydroxide leaching that could cause loss of strength

Inspecting to this level of detail for defects and irregularities ensures that degradation will be detected and addressed before it impairs the ability of the Concrete Cask to perform its Intended Functions.

Defects that exceed acceptance criteria will be entered in the Corrective Action Program to provide assurance that the ability of the casks to perform their Intended Functions is maintained.

Acceptance criteria for the concrete shell of the Concrete Cask include:

- No exposed reinforcing steel on the surface of the Concrete Cask
- No defects in the Concrete Cask surface that result in a contact radiation dose rate of 150% or more of the contact radiation dose rate of adjacent unaffected areas of the Concrete Cask
- No leachate deposits, staining, or stalactite growth on the concrete surface
- No areas of unsound concrete

Acceptance criteria for Concrete Cask Lid:

- No corrosion, dents, cracks, scratches, or gouges in base metal that exceeds 1/8-inch in depth

Acceptance criteria for the Inlet and Outlet Air Assemblies:

- No more than 28 in^2 (cross sectional area) of visible foreign material blockage on any Inlet Air Assembly vent screen or within the flow channel
- No more than 14 in^2 (cross sectional area) of visible foreign material blockage on any Outlet Air Assembly vent screen or within the flow channel

The Concrete Cask AMP in LRA Appendix A has been updated to incorporate the details of this inspection program and these acceptance criteria.

RAI A-7. Provide details on the concrete inspection method, inspection coverage, and the qualification of the inspector and the individual that reviews inspection results for LRA Appendix A, Concrete Cask AMP element 4, Detection of Aging Effects.

The LRA states that a qualified individual will perform the concrete inspections and a qualified individual will review inspection results for possible entry into the CAP. The LRA also states that these inspections will be performed in accordance with the Trojan ISFSI Structural Inspection Program, which is described in the Trojan ISFSI safety analysis report.

The staff notes that the description of the Structural Inspection Program in the Trojan ISFSI SAR does not provide any detail on the inspection methods, inspection coverage, or inspector qualifications. The LRA should include sufficient information to demonstrate that the inspections are capable of identifying and evaluating the concrete degradation parameters, citing relevant standards (e.g., ACI), as applicable. The LRA should provide details on the visual inspection method (e.g., distance, lighting requirements, use of gauges), coverage (extent of concrete areas inspected), and to which standard(s) inspectors and those reviewing inspection results are qualified.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

<u>PGE Response to RAI A-7</u>

The entire vertical and top exposed concrete surfaces of the cylindrical Concrete Casks will be visually inspected by qualified individuals in in accordance with the Concrete Cask AMP which is based on the current Trojan ISFSI Structural Inspection Program.

The inspections will be performed by Certified ISFSI Specialists and the inspection results will be reviewed by the ISFSI Manager. The Certified ISFSI Specialists will be trained on implementation of the Trojan ISFSI Concrete Cask AMP through both self-guided study and on-the-job practical training. The self-guided study will include a review of Chapter 2 of American Concrete Institute Guide ACI 201.1R-08 with descriptions and photographs of concrete distress. All inspections will be performed during daylight hours and will be performed using a scissor lift or ladder placed close enough to the Concrete Casks to ensure that defects and irregularities can be detected. Tools used to perform the inspections include items such as feeler gauges, tape measures or rulers, go-no-go gauges, flashlights, ball peen hammers, and wire or bristle brushes. Certified ISFSI Specialists are subject to annual physical exams that include measurement of visual acuity, measurement of field of vision (peripheral vision), and confirmation of color vision ability. Trojan Certified ISFSI Specialists meet or exceed the minimum qualifications of ANSI N18.1-1971 for a comparable position. In addition, with over 15 years of experience in performing ISFSI Concrete Cask annual structural inspections, the Certified ISFSI Specialists have demonstrated that they are capable and will be qualified to implement the Trojan ISFSI Concrete Cask Aging Management Program.

The qualified individual that reviews the inspection results for possible entry into the Corrective Action Program is the ISFSI Manager. The qualifications of the ISFSI Manager are provided in Table 9.1-1 of the Trojan ISFSI Safety Analysis Report. The qualifications include a minimum of eight years of responsible power plant experience of which a minimum of three years is nuclear power plant experience. A maximum of two of the remaining five years of power plant experience may be fulfilled by satisfactory completion of academic or related technical training

on a one-for-one basis. The ISFSI Manager meets or exceeds the minimum qualifications of ANSI N18.1-1971 for a comparable position. Additionally, the ISFSI Manager is trained and certified in accordance with the Trojan Certified ISFSI Specialist Training Program. The ISFSI Manager is also required to be qualified as an Independent Safety Reviewer in accordance with the Trojan Independent Safety Reviewer Charter which requires five years of professional experience and either a Bachelor's Degree in Engineering or the Physical Sciences or equivalent in accordance with ANSI/ANS-3.1-1981. This level of training and experience, combined with clear inspection acceptance criteria in the Trojan ISFSI Concrete Cask AMP, provides assurance that the ISFSI Manager is qualified to review inspection results for the Concrete Casks and to determine when to apply the Corrective Action Program.

RAI A-8. Describe the criteria for entering metal subcomponent conditions into the corrective action program for LRA Appendix A: Concrete Cask AMP element 6, Acceptance Criteria.

The LRA states that the loss of material due to age-related corrosion of exterior metal subcomponents will be evaluated in accordance with ACI 349.3R-02. For interior metal surfaces, the LRA states only that minor corrosion will not require further evaluation.

The Concrete Cask AMP does not provide sufficient detail to describe the criteria by which metal conditions will be entered into the CAP. For the exterior metal subcomponent, it is unclear what specific section of ACI 349.3R-02 will be used to define the acceptance criteria, and why these criteria are appropriate for all the intended functions of the exterior metal components (e.g., radiation shielding function of the cask lid). For the interior metal components, it is unclear at what threshold "minor" corrosion is exceeded such that corrective actions are taken to ensure that the structural, radiation shielding, and heat transfer functions of the steel components are maintained. The staff notes that the AMP includes inspections for coating degradation; however, the degree of coating degradation that will prompt corrective actions is not defined in the acceptance criteria.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-8

To be consistent with PGE's proposed Concrete Cask exterior inspection approach described in the response to RAI A-6, Element 6 of the LRA Concrete Cask AMP has been revised to remove the incorrect words referring to ACI 349.3R-02 for acceptance criteria for the exterior metal components.

A new technical basis document[2] has been developed for Concrete Cask subcomponent's base metal acceptance criteria for corrosion, dents, cracks, scratches, and gouges. The technical basis document was added as a footnote to the Concrete Cask AMP in Appendix A of the LRA and was used to revise Element 6, Acceptance Criteria, to state:

2 Response to Request for Technical Information (RRTI) 2536-002R2 provides the technical basis for the following acceptance criteria stated in Element 6 of the Aging Management Plan (AMP) for the Transfer Cask, Concrete Cask and Transfer Station: "No corrosion, dents, cracks, scratches, or gouges in base metal that exceeds 1/8" in depth." The acceptable flaw depth of 1/8" applies to the base metal only.

"The acceptance criteria for the exterior surface of the Concrete Cask Lid is:

- No corrosion, dents, cracks, scratches, or gouges in base metal that exceeds 1/8 inch in depth (defects in the protective coating are acceptable provided the underlying base metal meets the above criteria)

The acceptance criteria for Concrete Cask accessible interior metal subcomponents are:

- Concrete Cask Liner, Shield Ring, Bottom Plate: No corrosion, dents, cracks, scratches, or gouges in base metal that exceeds 1/8 inch in depth (defects in the protective coating are acceptable provided the underlying base metal meets the above criteria)"

For consistency with the Transfer Cask and Transfer Station AMPs, Element 6 of the Concrete Cask AMP was also revised to add the following words for the exterior surface of the Concrete Cask Lid and the Inlet and Outlet Air Assemblies:

> "The inspection results are evaluated by the Trojan ISFSI Manager and if degradation of material was detected on the exterior surface of the Concrete Cask Lid, or a reduced cross-section area for an Inlet or Outlet Air Assembly or flow channel that exceeds the above acceptance criteria was detected, the issue will be entered into Trojan's CAP."

For consistency with the MPC AMP, Element 6 of the Concrete Cask AMP was revised to add the following words for the interior Concrete Cask accessible surfaces of the Liner, Shield Ring, and Bottom Plate:

> "The inspection results are evaluated by the ASME VT-3 or VT-1 Inspector and if degradation of material was detected on any of the identified subcomponents within the Concrete Cask that exceeds the above acceptance criteria, the issue will be entered into Trojan's CAP."

Based on the above technical basis document, no acceptance criteria are required for the Concrete Cask metal protective coatings. However, PGE plans to repair accessible degraded coatings to maintain the protective barrier.

Transfer Station (TS) AMP:

RAI A-9. Clarify that the AMP manages aging effects for concrete in LRA Appendix A: Transfer Station AMP or justify why not.

The introduction to the Transfer Station AMP states that the AMP manages loss of material due to corrosion. However, LRA Table 3-5 states that the AMP is also used to manage loss of strength, spalling, cracking, and scaling of concrete.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-9

LRA Table 3-5, Aging Management Review for Transfer Station Subcomponents, is correct in stating that the aging effects requiring management are loss of strength, spalling, cracking, and scaling of the Transfer Station Pad concrete. The Transfer Station AMP is also used to manage loss of material due to corrosion of the embedded carbon steel rebar and embedded/exposed carbon steel plate.

LRA Section 3.6.5 and the introduction to the Transfer Station AMP in LRA Appendix A have been revised to clarify that the aging effect requiring management for the Transfer Station Pad is concrete aging (loss of strength, spalling, cracking, scaling) caused by freeze-thaw cycles, alkali-silica reaction, calcium hydroxide leaching, and corrosion of embedded reinforcing steel.

RAI A-10. Provide the specific parameters that will be inspected to identify concrete degradation before a loss of intended function for LRA Appendix A: Transfer Station AMP element 3, Parameters Monitored or Inspected.

The LRA states that the AMP addresses degradation of the concrete pad.

The AMP does not provide sufficient detail for the staff to evaluate whether the proposed inspection methods for the pad are capable of identifying conditions and quantifying their severity. If all parameters associated with the ACI 349.3R acceptance criteria will be monitored (e.g., popouts, spalling, cracks, leaching), then the AMP should clearly state those parameters.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-10

The complete exposed surface of the Transfer Station pad will be visually examined for indications of deterioration that could affect its structural function to support the Transfer Station under all normal and accident loads. Deterioration of the exposed surface of the pad will be detected by identification of defects and irregularities or other signs of damage.

Defects are defined as visible signs of settling or movement, or holes or large cracks greater than ½ inch across or extending to rebar. Defects also include evidence of leachate deposits or staining on the concrete surface. The inspections will identify defects or irregularities of any form that meet or exceed the above criteria regardless of their cause or origin. An irregularity is defined as damage or degradation to a component that is noted, but is less severe, and does not meet the definition of a defect.

All noted defects and irregularities will be documented on an inspection data sheet and recorded in a Defect Log. Previously reported defects and irregularities will be reviewed against the Defect Log and evaluated to determine whether their condition has visibly changed. Areas where new defects are found, or previously identified irregularities or defects have changed, will be closely examined to determine the extent of the damage.

This inspection program provides the means to detect and address the concrete aging effects and mechanisms identified in Section 3.6.5, including:

- Cracking or loss of material due to freeze-thaw degradation
- Cracking or loss of material due to alkali-silica reactions
- Cracking or loss of material due to corrosion of embedded reinforcing steel
- Calcium hydroxide leaching that could cause loss of strength
- Cracking and distortion due to differential movement

Inspecting to this level of detail for defects and irregularities ensures that degradation will be detected and addressed before it becomes significant or impairs the structural support function of the Transfer Station Pad.

Significant cracking and differential movement may be a sign of structural degradation of the pad and its ability to support the Transfer Station. Defects or degradation that exceed acceptance criteria will be entered in the Corrective Action Program to ensure that structural integrity is maintained.

Acceptance criteria for the Transfer Station Pad are:

- No cracks or holes greater than ½ inch wide or extending to rebar
- No leachate deposits or staining on the concrete surface
- No unsound concrete
- No differential movement greater than one inch between portions of the pad or between the pad and Transfer Station footings

The Transfer Station AMP in LRA Appendix A has been updated to incorporate the details of this inspection program and these acceptance criteria.

RAI A-11. Provide details on the concrete inspection method, inspection coverage, and the qualification of the inspector and the individual that reviews inspection results for LRA Appendix A: Transfer Station AMP element 4, Detection of Aging Effects.

The LRA states that a qualified individual will perform the inspections of the concrete transfer station pad and that the inspections identify the current condition of the structure.

The LRA should include sufficient information to demonstrate that the inspections are capable of identifying and evaluating the concrete degradation parameters, citing relevant standards (e.g., ACI), as applicable. The LRA should provide details on the visual inspection method (e.g., distance, lighting requirements, use of gauges), coverage (extent of concrete areas inspected), and to which standard(s) inspectors and those reviewing inspection results are qualified.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

PGE Response to RAI A-11

The Transfer Station Pad will be inspected by qualified individuals in accordance with the Transfer Station AMP which is based on the current Trojan ISFSI Structural Inspection Program. The complete exposed surface of the pad will be visually inspected for defects and irregularities or other signs of damage.

The inspections will be performed by Certified ISFSI Specialists and the inspection results will be reviewed by the ISFSI Manager. The Certified ISFSI Specialists will be trained on implementation of the Trojan ISFSI Transfer Station AMP through both self-guided study and on-the-job practical training. The self-guided study will include a review of Chapter 2 of American Concrete Institute Guide ACI 201.1R-08 with descriptions and photographs of concrete distress. All inspections will be performed during daylight hours and will be performed close enough to the concrete surface to ensure that defects and irregularities can be detected. Tools used to perform the inspections include items such as feeler gauges, tape measures or rulers, go-no-go gauges, flashlights, ball peen hammers, and wire or bristle brushes. Certified ISFSI Specialists are subject to annual physical exams that include measurement of visual acuity, measurement of field of vision (peripheral vision), and confirmation of color vision ability. Trojan Certified ISFSI Specialists meet or exceed the minimum qualifications of ANSI N18.1-1971 for a comparable position. In addition, with over 15 years of experience in performing Transfer Pad annual inspections, the Certified ISFSI Specialists have demonstrated that they are capable and will be qualified to implement the Trojan ISFSI Transfer Station AMP Transfer Pad inspection.

The qualified individual that reviews the inspection results for possible entry into the Corrective Action Program is the ISFSI Manager. The qualifications of the ISFSI Manager are provided in Table 9.1-1 of the Trojan ISFSI Safety Analysis Report. The qualifications include a minimum of eight years of responsible power plant experience of which a minimum of three years is nuclear power plant experience. A maximum of two of the remaining five years of power plant experience may be fulfilled by satisfactory completion of academic or related technical training on a one-for-one basis. The ISFSI Manager meets or exceeds the minimum qualifications of ANSI N18.1-1971 for a comparable position. Additionally, the ISFSI Manager is trained and certified in accordance with the Trojan Certified ISFSI Specialist Training Program. The ISFSI Manager is also required to be qualified as an Independent Safety Reviewer in accordance with the Trojan Independent Safety Reviewer Charter which requires five years of professional experience and either a Bachelor's Degree in Engineering or the Physical Sciences or equivalent in accordance with ANSI/ANS-3.1-1981. This level of training and experience, combined with clear inspection acceptance criteria in the Trojan ISFSI Concrete Cask AMP, provides assurance that the ISFSI Manager is qualified to review inspection results for the Concrete Casks and to determine when to apply the Corrective Action Program.

RAI A-12. Describe the criteria for entering metal subcomponent conditions into the CAP for LRA Appendix A: Transfer Station AMP, element 6, Acceptance Criteria.

Transfer Station AMP element 6, Acceptance Criteria, states that if corrosion of material is detected on any of the identified subcomponents within the Transfer Station, the issue would be entered into Trojan's CAP and an engineering evaluation would be performed to determine the extent and impact of the corrosion on the ability of the Transfer Station to perform its intended

function. However, AMP element 7, Corrective Actions, states that, if the engineering evaluation shows that the transfer station has indications that exceed acceptable limits, the issue will be entered in the CAP.

It is unclear to the staff what specific criteria will be used to determine if degradation is present and the issue is entered into the CAP. Also, the AMP appears to have conflicting information regarding whether the engineering evaluation is part of the CAP, or whether it is used to determine entrance in to the CAP. If the intent of the AMP is to enter into the CAP <u>any</u> indication of the parameters monitored (e.g., chipped or cracked paint, signs of corrosion, scratches), then the AMP should clearly state so. If the intent of the AMP is to enter into the CAP some other threshold that is determined through evaluation, then the AMP should identify that threshold.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

<u>PGE Response to RAI A-12</u>

Element 6 (Acceptance Criteria) and Element 7 (Corrective Actions) of the Transfer Station AMP in LRA Appendix A have been revised to specify the acceptance criteria and the decision process used to enter an issue into the Trojan Corrective Action Program (CAP).

The Transfer Station AMP detailed inspection results are documented by the qualified individuals (Certified ISFSI Specialists) and reviewed by the ISFSI Manager, who decides whether the acceptance criteria are met. If a condition is identified that does not meet one or more of the Transfer Station's specified AMP Acceptance Criteria, the issue will be entered into the Trojan CAP. When necessary, performance of an engineering evaluation is part of the CAP. In addition, the ISFSI Manager may have an engineering evaluation of a questionable condition performed as a part of his decision on whether to enter the condition into the CAP.

A new technical basis document[3] has been developed for Transfer Station metal subcomponent base metal acceptance criteria for corrosion, dents, cracks, scratches, and gouges. The technical basis document was added as a footnote to the Transfer Station AMP in LRA Appendix A and was used to revise Element 6 (Acceptance Criteria) to state:

> "<u>Transfer Station</u>
>
> The acceptance criteria for Transfer Station metal subcomponents are:
>
> - Metal: No corrosion, dents, cracks, scratches, or gouges in base metal that exceeds 1/8" in depth (defects in the protective coating are acceptable provided the underlying base metal meets the above criteria)"

Element 6 was also revised to delete the confusing "engineering evaluation" wording and to clearly state that "The inspection results are evaluated by the Trojan ISFSI Manager and if

[3] Response to Request for Technical Information (RRTI) 2536-002R2 provides the technical basis for the following acceptance criteria stated in Element 6 of the Aging Management Plan (AMP) for the Transfer Cask, Concrete Cask and Transfer Station: "No corrosion, dents, scratches, or gouges in base metal that exceeds 1/8" in depth."

degradation of material is detected on any of the identified subcomponents within the Transfer Station that exceeds the above acceptance criteria, the issue will be entered into Trojan's CAP."

In addition, Element 7 (Corrective Actions) of the Transfer Station AMP has been revised to delete the confusing "engineering evaluation" wording and, for consistency with the Concrete Cask and Transfer Cask AMPs, replace it with the following wording: "In addition, this process may result in an engineering evaluation to determine the extent and impact of the condition on the ability of the Transfer Station to perform its Intended Function."

Based on the above technical basis document, no acceptance criteria are required for the Transfer Station metal protective coatings. However, PGE plans to repair accessible degraded coatings to maintain the protective barrier.

RAI A-13. Provide further detailed description for LRA Appendix G: Proposed Changes to Trojan ISFSI SAR, Section 9.7.8 Aging Management Program summaries.

The Appendix G, AMP SAR supplemental information does not provide sufficient level of detail for the NRC staff to reach reasonable assurance that the AMPs will be effectively implemented. The level of detail in the SAR focused briefly on scope, inspections method, and frequency. NUREG-1927 Section 1.4.7 recommends that the staff, when reviewing the information in the SAR, consider the specific details of the AMPs that were the basis for the staff's decision to issue the renewal.

NUREG-1927 Section 1.4.4 recommends that the SAR supplement should include the scoping and AMR results and a summary of AMPs. The Appendix G AMP summaries do not include some details that the staff considers essential to supporting its safety findings, including the specific aging mechanisms to be managed, inspection method standard (if applicable), timing of the first inspection, and the specific acceptance criteria for each inspection.

Section 2.2.2.8 of NEI 14-03, Revision 2, "Format, Content and Implementation Guidance for Dry Cask Storage Operations-Based Aging Management," provides industry guidance for the content of the SAR supplement. Although the NRC has yet to make a final decision to endorse this document, the staff notes that the recommendations in NEI 14-03 are similar to those discussed above.

This information is required to demonstrate compliance with 10 CFR 72.42(a).

<u>PGE Response to RAI A-13</u>

Page G-1 of LRA Appendix G (Proposed Changes to Trojan ISFSI SAR) has been revised to describe the new content of ISFSI SAR Section 9.7 and to introduce the use of Table "place holders" for selected LRA Chapter 2 and 3 Tables and the four Appendix A AMP Tables that will be extracted from the LRA after NRC final approval and incorporated into ISFSI SAR Section 9.7. In addition, the proposed ISFSI SAR Section 9.7 has been revised to add detailed information consistent with NUREG-1927, Section 1.4.4, for the revised Aging Management Program in Section 9.7.8. These changes also added SAR Page 9-1 for completeness and to show the requirements that apply to all Section 9.7 Programs, including the proposed revised SAR Section 9.7.8.

The following summary describes the organization of new proposed SAR Section 9.7.8 and contains short descriptions of the changes. A "track changes" copy of the revision to proposed Trojan ISFSI SAR Section 9.7, showing all changes to the previously proposed LRA Appendix G (ISFSI SAR) is contained in LRA Appendix G.

NEW Proposed SAR Section 9.7 Organization and Description of Changes

The last sentence in both SAR Sections 9.7.6 and 9.7.7 was corrected to be consistent with Technical Specification 5.5.5.

9.7.6 STRUCTURAL INSPECTION PROGRAM

- Revised words to say: concurrent with implementation of the Aging Management Program specified in Section 9.7.8, the Structural Inspection Program inspections for the Concrete Cask exterior and Transfer Station are replaced by the new AMPs.

9.7.7 CONCRETE CASK INTERIOR INSPECTION PROGRAM

- Revised words to say: concurrent with implementation of the Aging Management Program specified in Section 9.7.8, the Concrete Cask Interior Inspection Program is replaced by the new AMPs.

The currently proposed SAR Sections 9.7.8, 9.7.9, and 9.7.10 were revised to organize all of Trojan's Aging Management Program activities into Section 9.7.8 because each of these activities is part of the overall program. The revised ISFSI SAR Section 9.7.8, titled "Aging Management Program," is organized as follows and each section's content is briefly explained:

9.7.8 AGING MANAGEMENT PROGRAM

- Added Tech Spec 5.5.5 wording that establishes the AMP.
- Added description of the content of the overall Aging Management Program including Scoping Evaluation Results, Aging Management Review Results, and Time-Limited Aging Analysis Results. In addition, this section describes the Aging Management Programs for inspection and monitoring of the selected MPC and associated Concrete Cask, Transfer Cask, Concrete Casks, and Transfer Station and describes the Tollgate Assessments of the overall Aging Management Program.

9.7.8.1 SCOPING EVALUATION RESULTS FOR AGING MANAGEMENT PROGRAM

- Added summary of results and references to the new SAR Tables to be extracted from final LRA Chapter 2, Scoping Results, Tables 2-1 through 2-7 (new SAR Tables 9.7-1 through 9.7-7).

9.7.8.2 AGING MANAGEMENT REVIEW RESULTS

- Added summary of AMR results and refers to the new SAR Tables to be extracted from LRA Chapter 3, AMR Results, Tables 3-1 through 3-6 (new SAR Tables 9.7-8 through 9.7-13).

9.7.8.3 TIME-LIMITED AGING ANALYSIS RESULTS

- Moved the previously proposed SAR Section 9.7.9 TLAA words (without changes) to this subsection and deleted unused Section 9.7.9.

9.7.8.4 AGING MANAGEMENT PROGRAMS

- This section describes the Aging Management Programs for inspection and monitoring of the selected MPC and associated Concrete Cask, the Transfer Cask, Concrete Casks, and Transfer Station. It also refers to new SAR Tables to be extracted from the AMPs in LRA Appendix A (new SAR Tables 9.7-14 through 9.7-17).
- Added timing for first inspection (Baseline Inspection) for each of the following AMPs to be performed after the new Aging Management Program is implemented in 2022.

9.7.8.4.1 MPC AGING MANAGEMENT PROGRAM

- Moved the previously proposed SAR 9.7.8.1 words to this subsection.
- Added sentence for final MPC 10 Element AMP to be added as new SAR Table extracted from LRA Appendix A MPC AMP (new SAR Table 9.7-14).
- Made correction by deleting the first sentence that indicated the current SAR 9.7.7 Concrete Cask Interior Inspection Program would continue to be used through the extended storage period. This is replaced by this new MPC AMP.
- Corrected words to say "MPC-28" versus "canister PCC-03".
- Deleted "monitored condition" phrase and bulleted list because MPC AMP will be in new SAR Table.

9.7.8.4.2 TRANSFER CASK AGING MANAGEMENT PROGRAM

- Moved the previously proposed SAR 9.7.8.2 words to this subsection.
- Added sentence for final Transfer Cask 10 Element AMP to be added as new SAR Table extracted from LRA Appendix A Transfer Cask AMP (new SAR Table 9.7-15).
- Deleted "visual inspection" phrase and bulleted list because Transfer Cask AMP will be in new SAR Table.

9.7.8.4.3 CONCRETE CASK AGING MANAGEMENT PROGRAM

- Moved the previously proposed SAR 9.7.8.3 words to this subsection.
- Made correction by deleting two sentences that indicated the old SAR 9.7.6 and 9.7.7 programs would continue into the period of extended storage. These are being replaced by the new AMPs.

- Added sentence for final Concrete Cask 10 Element AMP to be added as new SAR Table extracted from LRA Appendix A Concrete Cask AMP (new SAR Table 9.7-16).

9.7.8.4.4 TRANSFER STATION AGING MANAGEMENT PROGRAM

- Moved the previously proposed SAR 9.7.8.4 words to this subsection.
- Added sentence for final Transfer Station 10 Element AMP to be added as new SAR Table extracted from LRA Appendix A Transfer Station AMP (new SAR Table 9.7-17).
- Deleted "visual inspection" phrase and bulleted list because Transfer Station AMP will be in new SAR Table.

9.7.8.5 TOLLGATE ASSESSMENTS

- To clearly show that Tollgate Assessments are a part of the overall 9.7.8 Aging Management Program, moved the previously proposed SAR 9.7.10 words to this subsection and deleted unused Section 9.7.10.
- Changed the title of this subsection to say Tollgate Assessments.
- As a result of moving Tollgate Assessments from its own SAR Section 9.7.10 to the revised Section 9.7.8, a conforming proposed change has been made to Technical Specification 5.5.5 to delete the last sentence in the first paragraph that is no longer needed and to delete the words "Section 9.7.8" in the second sentence. Another conforming change was made to the first SAR Tollgate Assessments sentence to delete the corresponding reference to the Trojan ISFSI license.
- Changed the reference numbers for the Tollgate Tables that have changed from 9.7-1 and 9.7-2 to 9.7-18 and 9.7-19 to conform to the new SAR 9.7.8 subsection sequence.

SAR CHAPTER 9.10, REFERENCES

- Added Reference 9 – Trojan's LCA 72-07.
- Added Reference 10 – NUREG-1927, Revision 1.

SAR CHAPTER 9, TABLES SECTION:

- Revised this Table section to add place holders for the new Aging Management Program Tables 9.7-1 through 9.7-17 that will be extracted from LRA Chapter 2, Chapter 3, and LRA Appendix A and added to the SAR subsequent to NRC approval of Trojan's renewed license.
- Revised the Tollgate Table numbers 9.7-1 and 9.7-2 to use SAR Table numbers 9.7-18 and 9.7-19, respectively.
- Corrected Tollgate Table 9.7-2 (new number 9.7-19) title to say "Tollgate Assessment Performance Criteria by Element."
- Corrected Tollgate Table 9.7-19, Element 1. This Table contained the words "For programs requiring sample selection, the bases are applied consistent with those outlined in this application and the associated SER." This was corrected to say: "For programs requiring sample selection, the sample bases are applied consistent with

those outlined in LRA Appendix A, MPC AMP Element 4 and Concrete Cask AMP Element 4."

- Corrected Tollgate Table 9.7.19, Element 4, wording "sample size is expanded" to say: "sample size expansion is considered".
- Corrected Tollgate Table 9.7.19, Element 7, generic wording "Condition reports" to use Trojan's words "Corrective Action Requests".

RAI A-13 Additional Response Details

PGE has revised the AMPs in Appendix A to provide the additional information, summarized below, that the NRC considers essential to supporting its safety findings. As described above, the four AMPs in Appendix A will be added to the ISFSI SAR as Tables 9.7-14 through 9.7-17.

1. The specific aging effects requiring management are specified in Column 5 and aging mechanisms to be managed are specified in Column 6 of the LRA Aging Management Review Tables 3-1 through 3-6 that will be added to the ISFSI SAR as Tables 9.7-8 through 9.7-13.

2. The inspection method standard, if applicable, is specified in Element 4 (Detection of Aging Effects) of the AMP tables in LRA Appendix A.

3. The timing of the first inspections is specified in SAR Section 9.7.8.4 and additional details have been added to LRA Appendix D, Baseline Inspection, for each of the four AMPs' first inspection. The new Aging Management Program will be implemented on January 1, 2022 and the four AMPs' baseline inspections will be performed during years 2022 through 2023.

4. The specific acceptance criteria for each component AMP in LRA Appendix A is specified in Element 6 (Acceptance Criteria).

APPENDIX B - Time-Limited Aging Analyses:

RAI B-1. Provide information to address the design code fatigue evaluations of fuel basket subcomponents in Appendix B of the renewal application.

LRA Table 3-1, Aging Management Review for multi-purpose canister (MPC) Subcomponents, does not contain fatigue-related items for the fuel debris process can capsule, failure fuel can, damaged fuel container and basket components. SAR Section 4.8, Materials, shows the basket and fuel items to be designed to ASME Code Subsection NG. NG-3222.4 includes calculations to verify that cyclic loading is not an issue.

NUREG-1927, Revision 1, states that renewal applications should address aging-related design-basis analyses in the initial license that involve time-limited assumptions to demonstrate that functions will be maintained in the period of extended operation.

It does not appear that TLAAs associated with the fuel basket components are addressed by the MPC fatigue evaluation in LRA Appendix B. The application should demonstrate that the

fuel basket fatigue analyses performed for the initial license remain valid for the period of extended operation.

This information is required to determine compliance with 10 CFR 72.24(c) and 10 CFR 72.42(a).

PGE Response to RAI B-1:

The MPC subcomponents (e.g., debris process can capsule, failed fuel can, damaged fuel container, basket components) do not require a detailed fatigue analysis because all applicable loadings are well within the range that permits exemption from fatigue analysis per the provisions of Section III of the ASME Code. Paragraph NG-3222.4 (d) of Section III of the ASME Code provides four criteria that are strictly material and design condition dependent to determine whether a component can be exempted from a detailed fatigue analysis.

The Design Fatigue curves for the MPC subcomponents materials are given in Appendix I of Section III of the ASME Code. Each of the four criteria is considered in the following:

i. Temperature Difference - Startup and Shutdown

Fatigue analysis is not required if the temperature difference ΔT between any two adjacent points on the component during normal service does not exceed $S_a/2E\alpha$, where S_a is the cyclic stress amplitude for the specified number of startup and shutdown cycles. E and α are the Young's Modulus and instantaneous coefficients of thermal expansion (at the service temperature). Assuming 500 startup and shutdown cycles, based on the material properties at 500°F and the appropriate ASME fatigue curves in Appendix I of Section III of the ASME Code give:

$$(\Delta T)_{MPC} = \frac{148{,}000}{(2)(25.8)(10.10)} = 284°F$$

There are no locations on the MPC subcomponents where ΔT between any two adjacent points approaches this calculated temperature. As reported in Table 4.2-12 of the ISFSI SAR, the maximum ΔT that occurs between the MPC shell and the fuel cladding is only 263°F under normal conditions. The maximum ΔT for a given MPC subcomponent (e.g., debris process can capsule, failed fuel can, damaged fuel container) is much less than the temperature difference between the MPC shell and the fuel cladding. Therefore, it is evident this temperature criterion is satisfied for 500 startup and shutdown cycles, which is extremely conservative since the MPC and its subcomponents are only expected to undergo one loading cycle during their service life.

ii. Temperature Difference - Normal Service

Significant temperature fluctuations that require consideration in this criterion are those in which the range of temperature difference between any two adjacent points under normal service conditions is less than S/2Eα where S corresponds to 10^6 cycles. Substituting, gives

$$(\Delta T)_{MPC} = \frac{28{,}300}{(2)(25.8)(10.10)} = 54.3°F$$

During normal operation, the temperature fields in the MPC are steady state. Therefore, normal temperature fluctuations are negligibly small. Normal temperature fluctuations do not warrant a fatigue usage factor evaluation.

iii. Temperature Difference – Dissimilar Materials

These criteria are not applicable to the MPC subcomponents since dissimilar materials are not involved. All MPC subcomponents are fabricated from stainless steel.

iv. Mechanical Loads

Since the MPC is a passive system, mechanical loadings of appreciable cycling do not occur during normal storage conditions. Therefore, no potential for fatigue expenditure in the MPC subcomponents is found to exist under normal storage conditions.

In conclusion, the MPC subcomponents do not require fatigue evaluation under the exemption criteria of the ASME Code.

Our response to RAI B-1 states that fatigue analysis is not required for certain components. To incorporate this conclusion into the LRA itself, a reference to Holtec RRTI 2536-004R0 (which draws this conclusion) has been added by reference to Table 3-1, Aging Management Review for MPC Subcomponents, as Note (3). Note (3) states: "Response to Request for Technical Information (RRTI) 2536-004R0 concluded that these MPC subcomponents do not require fatigue evaluation under the exemption criteria of the ASME Code."