Summary of Proposed Changes (SOPC) for LAR 9373-1

Proposed Change #1

Revise loading Configuration 3 (Table 7.C.5) for MPC-37 to include the following options for fuel assembly class 16x16C: a) 2 Damaged Fuel Containers (DFCs) containing fuel debris (up to 37 rods per DFC), 10 DFCs containing damaged fuel and 25 undamaged fuel assemblies; b) 1 DFC can be loaded fuel debris (up to 57 fuel rods), 11 DFCs containing damaged fuel and 25 undamaged fuel assemblies; c) 12 DFCs containing fuel debris (up to 11 rods per DFC) and 25 undamaged fuel assemblies.

Reason for Proposed Change #1

Provide more flexibility in loading Configuration 3 for allowable contents for transportation.

Justification for Proposed Change #1

Criticality analysis of revised loading Configuration 3 was performed and the results of these analyses have been added to Chapter 6 of the HI-STAR 190 SAR. The analyses show that the k_{eff} is less than 0.95 for all added options for assembly class 16x16C in Configuration 3. Revised Configuration 3 is provided in Appendix 7.C of the SAR. This proposed change is bounded by the design basis thermal, structural and shielding analyses for the HI-STAR 190 system, therefore no additional analyses are required. Containment is leaktight and therefore not impacted by this change.

Proposed Change #2

Add Guide Tube Anchors (GTAs) as Non-Fuel Hardware (NFH) to Appendix 7.C. Revise definition of Non-Fuel Hardware (NFH) with addition of ITTRs and GTAs.

Reason for Proposed Change #2

Expand options of non-fuel hardware permissible for transportation in the HI-STAR 190. Supports ALARA objective by reducing quantity of spent fuel assemblies on plant sites.

Justification for Proposed Change #2

Guide Tube Anchors (GTAs) are non-irradiated non-fuel hardware installed in the guide tubes post irradiation in the nuclear reactor, prior to lifting of irradiated fuel assemblies susceptible to Stress Corrosion Cracking (SCC) in the guide tube joints. Instrument Tube Tie Rods (ITTRs) (currently authorized for transport in the HI-STAR 190 package) serve the same function, though installed in instrument tube rods. As such, from a licensing perspective, and in accordance with Regulatory Issue Summary (RIS) 2013-11 which includes as an enclosure Used Fuel Storage and Transportation Issue Closure Form No. I-10-01 “PWR Fuel Top Nozzle Stress Corrosion Cracking” [1], GTAs fit into the category of ITTRs as permanently installed modification to an assembly post-irradiation. Post-installation, GTAs are considered assembly components or contents of the package.

To be considered as acceptable contents for a transport package, according to [1], GTAs shall be defined in the SAR that is referenced in the CoC, with appropriate supporting analyses or evaluations in the technical areas of structural, criticality, shielding, thermal, and containment. Evaluations are provided in these technical areas below to support the addition of GTAs as permissible contents of the HI-STAR 190 package, and belonging in the category of ITTRs for licensing purposes.

GTAs, like ITTRs are considered part of the assembly [1]. Since GTAs are inserted in the guide tubes of the assembly, the overall dimensions of the assemblies are met. The conservative weight used for the assembly in the structural analysis bound the weight of the assembly with GTAs installed. Therefore, an assembly with GTAs installed shall meet the assembly specifications in Appendix 7.C; specifically, the dimensional and weight requirements of an assembly. Assemblies modified by the addition of GTAs, and meeting the dimensional and weight acceptance criteria in the Appendix 7.C of the SAR, including assembly weight and overall length are acceptable for transport in the HI-STAR 190 package, with no further structural evaluation.

Since GTAs are a part of the fuel assembly that are installed post-irradiation in a nuclear reactor, similar to ITTRs, the GTAs are not a source of heat in the assembly. Therefore an assembly containing an installed GTA shall continue to generate the same quantity of heat as generated prior to installation of the GTA. The presence of the GTAs permanently installed on the assembly therefore has no impact on the thermal analysis of the HI-STAR 190 package with fuel assemblies meeting Appendix 7.C of the HI-STAR 190 SAR.

GTAs are installed post-irradiation of the fuel assembly in a nuclear reactor. GTAs are not activated and not considered a source of radiation in the HI-STAR 190 package, and may be considered extra material for shielding purposes (although not credited), similar to ITTRs. Therefore, similar to ITTRs, assemblies with GTAs may be stored in any location in the MPC.

GTAs presence in a guide tube reduces the quantity of water in the system. Therefore moderation is reduced and margin to criticality limit may be increased, similar to ITTRs.

GTAs presence has no impact on the containment analysis, since the MPC is considered leaktight in accordance with ANSI N14.5.

Related changes to the SAR are made to the glossary, Chapter 5 and Appendix 7.C.

[1] Used Fuel Storage and Transportation Issue Closure Form , Issue Number I-10-01, “PWR Fuel Top Nozzle Stress Corrosion Cracking”, dated 4/17/12.

<u>Proposed Change #3</u>

Add new heat load Pattern 7 to Table 7.C.7 for MPC-37 that covers damaged fuel assemblies with decay heat up to 1.1 kW/assembly.

Reasons for Proposed Change #3

The current decay heat load patterns for the MPC-37 allow loading damaged fuel assemblies with decay heat up to 0.84 kW. The new pattern increases the damaged fuel assemblies decay heat limit, thus giving the user additional loading flexibility for the MPC-37.

Justification for Proposed Change #3

Analyses and evaluations support the inclusion of this decay heat load pattern for the MPC-37. The proposed changes to Chapter 3 of the SAR include the description of the models, analysis, and results pertaining to the decay heat load limits for MPC-37. Heat load Pattern 7 is provided in Appendix 7.C of the SAR.

Thermal analyses have been performed for new heat load Pattern 7, and the results show that Loading Pattern 7 is bounded by the design basis heat load in Pattern 1. The PCT is below the ISG-11 Rev. 3 limits, specifically 86^{o}C below the limits. The cavity pressure is below the design basis limit for Pattern 1.

The temperatures and pressures in the HI-STAR 190 for heat load Pattern 7 are bounded by the design basis (Pattern 1). There is no effect on the currently approved structural analysis.

The does rates from heat load Pattern 7 are bounded by the maximum dose rates in Section 5.1 of the SAR. Thus the dose rates for Pattern 7 do not exceed the 10 CFR 71.47 limit for normal conditions and the 10 CFR 71.51 limit for accident conditions.

Since the temperatures and pressures in HI-STAR 190 for heat load Pattern 7 are bounded by the design basis (Pattern 1), there is no effect on the currently approved containment criteria, which is that leakage is non-credible.

Since criticality does not utilize or credit any of the heat load loading configurations, there is no effect on criticality.

Proposed Change #4

Reduced the minimum cooling time requirements for Neutron Source Assemblies (NSAs) from a current maximum of 14 years (630 GWD/MTU) to 7 years cooling time, independent of NSA burnup, for a cask loaded with CE 16x16 fuel assemblies (Table 7.C.8(b)). Additional restrictions on number and types of non-fuel hardware (NFH) devices and/or loading patterns are included.

Reason for Proposed Change #4

The current cooling time requirements for NSAs may cause undue burden to some users by requiring radioactive materials to remain at the plant sites for extended periods of time. The proposed change lowers the NSA cooling time requirements and thereby increases the inventory of NSAs at higher burnups that are available for transport in the HI-STAR 190 system after 7 years.

Justification for Proposed Change #4

Shielding analysis is performed for the reduced cooling time (7 years) for a loaded NSA but with additional restrictions on number and types of non-fuel hardware (NFH) devices and/or loading patterns. It concludes that the dose rates after 7 years of cooling for a loaded NSA are below the maximum dose rates provided in Chapter 5 of the SAR and regulatory dose rates limits per 10 CFR 71.47 for normal conditions and 10 CFR 71.51 for accident conditions. Loading of NSAs with this reduced cooling time is restricted per Appendix 7.C of the SAR. The reduced cooling time for NSA has a negligible impact on the thermal margin. The proposed change has no impact on the structural, confinement and criticality evaluations. Changes are documented in Chapter 5 and Appendix 7.C of the SAR.

Proposed Change #5

Increase the allowable activity limit for APSRs loaded with CE 16x16 fuel assemblies with higher cobalt-60 activity. Additional restrictions on number and types of non-fuel hardware (NFH) devices and/or loading patterns are included.

Reason for Proposed Change #5

Increases population of APSRs available for transport in the HI-STAR 190. Reduce the burden on some users that requires radioactive materials to remain at the plant sites for extended periods of time.

Justification for Proposed Change #5

Shielding analysis is performed for the reduced cooling time (7 years) for APSRs, and concludes that even with the APSR activities higher than design basis APSR activities, the dose rates are below the maximum dose rates provided in Chapter 5 of the SAR, and regulatory dose rates limits per 10 CFR 71.47 for normal conditions and 10 CFR 71.51 for accident conditions. The reduced cooling time for the APSR has a negligible impact on the thermal margin. The proposed change has no impact on the structural and criticality evaluations. Containment leak-tight criteria continues to apply. Related changes were made to Chapter 5 and Appendix 7.C of the SAR.

Proposed Change #6

Delete Condition 8(d) from the CoC and add to Appendix 7.C (Table 7.C.5 Note 2) of the SAR. Modify this condition to allow insertion of control rods that exceed 8 inches for CE 16x16 fuel assemblies.

Reason for Proposed Change #6

During the reactor operation at full power some control rods may be inserted more than 8 inches from the top of the active length for part of the fuel irradiation history or even for entire irradiation period for CE 16x16 fuel assemblies. This proposed change expands the permissible content conditions for MPC-37 and increase a number of loaded fuel assemblies irradiated under the CRs for transport in the HI-STAR 190.

Justification for Proposed Change #6

Criticality analyses performed in Chapter 6 of the SAR confirmed that for CE 16x16 assemblies under a full length control rod bank during full power, control rod insertion is permitted up to 33.3 inches from the top of the active length, but such assemblies can be only loaded up to 9 regular cells of the regionalized basket loading configurations, while the design basis spent undamaged fuel assemblies are placed in the remaining regular cells. For CE 16x16 assemblies under a part-length control rod bank, control rod insertion is permitted up to 41.7 inches during full power, and such assemblies can be loaded into all regular cells of the regionalized basket loading configurations. For all other assemblies, control rod insertion shall not exceed eight inches from the top of the active fuel during full power operation. Design basis Shielding, Thermal and Structural analyses bound this proposed change, and therefore no additional analysis is required. Containment leak-tight criteria continues to apply. Changes are made to the CoC, and Chapter 6 and Appendix 7.C of the SAR (Revision 2).

Proposed Change #7

Add new DFC design to SAR (drawing no. 11107R0).

Reason for Proposed Change #7

New enhanced DFC design with slightly wider opening and top/bottom details to facilitate assembly placement.

Justification for Proposed Change #7

The new DFC design has been Structurally qualified for all loading conditions. The new DFC design has no impact on Shielding, Thermal and Criticality analyses as the current NRC-approved DFC design bounds the new design. Containment leak-tight criteria continues to apply. The storage locations for the new design are the same storage locations for the currently approved DFC design for the HI-STAR 190.

Clarifications and editorial changes

Editorial corrections to charpy absorbed energy and lateral expansion impact testing values. Clarifications made to align impact testing acceptance criteria with the ASME Code Section III Subsection NF. Editorial changes are made to Table 8.1.8 of the HI-STAR 190 SAR (Revision 2). Related editorial changes are made to Chapter 2 of the SAR.