Edwin I. Hatch Nuclear Plant – Unit 1
Information Reports for Lead Test Assemblies
Enclosure 4

Non-Proprietary Report NEDC-33883, Revision 0

GNF ARMOR Lead Test Assembly

Global Nuclear Fuel

A Joint Venture of GE, Toshiba, & Hitachi

Global Nuclear Fuel

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Non-Proprietary Information - Class I (Public)

GNF ARMOR LEAD TEST ASSEMBLY FOR EDWIN I. HATCH NUCLEAR PLANT, UNIT 1

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REVISION HISTORY

Revision	Date	Description of Change
0	09/2017	Initial Release

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ACRONYMS

Term	Definition
ARMOR	Abrasion Resistant, More Oxidation Resistant
COLR	Core Operating Limits Report
CRDA	Control Rod Drop Accident
GNF	Global Nuclear Fuel – Americas, LLC
HNP-1	Edwin I. Hatch Nuclear Plant, Unit 1
LOCA	Loss-of-Coolant Accident
LTA	Lead Test Assembly
LTR	Lead Test Rod
NRC	Nuclear Regulatory Commission
OLMCPR	Operating Limit Minimum Critical Power Ratio
[[ ]]	[[ ]]
SAFDL	Specified Acceptable Fuel Design Limit
SNC	Southern Nuclear Operating Company, Inc.
SRLR	Supplemental Reload Licensing Report
TMOL	Thermal Mechanical Operating Limit

ABSTRACT

Southern Nuclear Operating Company, Inc. (SNC) plans to load [[ ]] Lead Test Assemblies (LTAs) as part of the Edwin I. Hatch Nuclear Plant, Unit 1 (HNP-1) Reload 28 Cycle 29 during the 2018 refueling outage. These bundles, also referred to as Abrasion Resistant, More Oxidation Resistant (ARMOR) LTAs, are standard GNF2 assemblies in which a [[

]]

This report contains information that is to be provided to the Nuclear Regulatory Commission (NRC). Included in this report are a description of the ARMOR coating and the ARMOR LTAs, a discussion of the licensing analyses, a description of the ARMOR LTA program objectives, and measurements planned for the ARMOR LTAs.

1.0 Introduction

SNC plans to load [[ ]] LTAs as part of the HNP-1 Reload 28 Cycle 29 during the 2018 refueling outage. These bundles, also referred to as ARMOR LTAs, are planned to be in operation as part of a joint program with Global Nuclear Fuel – Americas, LLC (GNF).

This report contains information that is to be provided to the NRC to comply with Reference 1. Reference 1 provides guidelines to be followed to install and operate LTAs. Included in this report are a description of the ARMOR LTAs, a discussion of the licensing analyses, a description of the LTA program objectives, and any applicable measurements planned for the LTAs.

The LTA design is described in Section 2.0 along with the ARMOR coating that is the feature to be tested. The subject LTAs are GNF2 bundles [[

]] No other aspects of the bundle are modified. The fuel material is standard UO_2.

Section 3.0 describes the licensing analyses that will be performed. Section 4.0 states the objectives of the ARMOR LTA program and describes the measurements planned.

2.0 ARMOR Coating and LTA Description

As part of GNF's effort to improve fuel performance against debris fretting, GNF has developed a fuel cladding coating that provides greater resistance to cladding failure due to debris wear. The coating has been named ARMOR, based on its abrasion resistant and more oxidation resistant characteristics.

2.1 ARMOR Coating

ARMOR is a [[ ]] coating that is applied by [[ ]] as an add-on process following production of fuel cladding using standard manufacturing processes. The coating is [[ ]] with a nominal chemical composition as indicated in Table 2-1. [[

]]
when compared with Zircaloy-2 cladding without ARMOR coating. The ARMOR coating has demonstrated [[ ]]

As the ARMOR coating is [[

]] by that of the base Zircaloy-2 cladding.

2.2 Lead Test Assembly Description

The LTA is essentially a standard production GNF2 fuel assembly as described in Reference 2 [[

]] as depicted in Figures 2-1 and 2-2. The ends of the fuel rod [[ ]] processes and qualification. The fuel pellet material is standard UO_2. As the ARMOR coating is [[ ]] GNF2 fuel rod. As such, the [[ ]] characteristics associated with the rods and the assembly are [[ ]] As illustrated in Figure 2-3, the LTRs are located in [[ ]] positions in the bundle that operate at [[ ]]. This provides inherent margin relative to the limiting rods within the bundle which accommodates [[

]]

Table 2-1 Nominal ARMOR Coating Composition

Coating	[[	]]
ARMOR		

[[

]]

Figure 2-1 Rod Segment Schematic

[[

]]

Figure 2-2 Segmented Rod Axial Arrangement

[[

]]

Figure 2-3 Planned Lead Test Rod Locations

3.0 Licensing Analyses

For specified engineering evaluations (e.g., fuel rod thermal-mechanical), the ARMOR LTAs have been analyzed using the NRC-approved methods described in Reference 3. These methods [[

]]; however, irradiated material property data of the [[

]] for installing the LTAs. To adequately conform to standard Specified Acceptable Fuel Design Limits (SAFDLs), the following conservatisms are introduced:

- Fuel rod engineering evaluations to establish the LTR Thermal Mechanical Operating Limits (TMOLs) will apply [[

]] in material properties.

- The LTRs shall be limited in number to [[

]]

- The LTAs shall be installed into core locations that are not limiting with respect to thermal limits as stipulated by Reference 3.

Because the ARMOR coating is [[

]] to the analysis and monitoring of the LTAs. While the axial heat flux distribution is [[

]] margin to boiling transition for the LTRs. As such, the [[

]] is applicable to the LTAs. Additionally, the LTAs shall be installed into non-limiting core locations resulting in increased margin. Standard reload licensing analyses will be performed for the LTAs for each cycle of operation. Preliminary evaluations confirm that the presence of [[

]] to the characteristics of the core.

Plant dependent, cycle independent events (e.g., Control Rod Drop Accident (CRDA), fuel handling accident, Loss-of-Coolant Accident (LOCA), and fuel storage) are considered to ensure conformance to established regulatory requirements. Because the ARMOR coating is thin, the zircaloy characteristics dominate, and the existing evaluations are adequate to support the safe installation and operation of the LTAs.

SNC intends to insert the LTAs into HNP-1 starting in Cycle 29 and to operate them under Technical Specification 4.2.1. An evaluation of the effects due to the introduction of the LTAs will be performed under 10 CFR 50.59. However, cycle-specific analyses to establish fuel operating limits are not yet complete. When cycle-specific analyses are complete, GNF and SNC will document the results in each respective Supplemental Reload Licensing Report (SRLR). SNC will update the HNP-1 Core Operating Limits Report (COLR) accordingly.

4.0 LTA Program Objectives and Planned Inspections

The purpose of the ARMOR LTA program is to demonstrate the coating integrity throughout the expected operational life of the LTRs. The program also offers the opportunity to [[

]], thereby supporting fuel rod design for reload application.

Poolside surveillance is planned throughout the irradiation period and [[

]] may be performed. The frequency and extent of these surveillances and examinations will be jointly developed by SNC and GNF consistent with the operational constraints at HNP-1 as determined by SNC.

5.0 References

1. Letter, T. A. Ippolito (NRC) to R. E. Engel (GE), "Lead Test Assembly Licensing," MFN-182-81, September 23, 1981.
2. Global Nuclear Fuel, "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II)," NEDC-33270P, Revision 8, April 2017.
3. Global Nuclear Fuel, "General Electric Standard Application for Reactor Fuel (GESTAR II)," NEDE-24011-P-A-25, March 2017.