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March 28, 2007
PY-CEI/NRR-3031L

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United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Perry Nuclear Power Plant
Docket No. 50-440

Notification of the Use of Lead Test Assemblies at the Perry Nuclear Power Plant

Ladies and Gentlemen:

In accordance with NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," (GESTAR), the FirstEnergy Nuclear Operating Company (FENOC) is to notify the Nuclear Regulatory Commission (NRC) of the use of Lead Test Assemblies (LTA) at the Perry Nuclear Power Plant (PNPP). Through modifications to the PNPP Fuel Cycle 11 core design, appropriately evaluated under 10 CFR 50.59, eight (8) LTAs were loaded during Refueling Outage 10 (February 22 through May 6, 2005); however, the subject notification was not made in conjunction with the refueling activities.

GESTAR indicates the NRC notification should include a description of the LTAs, a statement of applicability to GESTAR, a description of the LTA program, and an outline of the measurements that will be made on the LTAs. Enclosure 1 contains the aforementioned information.

There are no regulatory commitments contained in this letter or its enclosure.

If there are any questions or if additional information is required, please contact Mr. Henry L. Hegrat – Supervisor, FENOC Fleet Licensing, at (330) 374-3114.

L. W. Pearce

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Enclosure

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III
State of Ohio

A001

Lead Test Assemblies for Use in Perry Nuclear Power Plant Fuel Cycle 11

Description of Lead Test Assemblies

Eight (8) Lead Test Assemblies (LTA) were loaded into the Perry Nuclear Power Plant (PNPP) during Refueling Outage 10 for use in Fuel Cycle 11. The Global Nuclear Fuel (GNF) supplied assemblies contained standard GE14 components and fuel with the exception of the channel materials. Four (4) channels were made of a zirconium-based alloy containing niobium, called NSF, instead of the standard Zircaloy 2. The other four (4) channels were made of a high-iron zirconium-based alloy, called GNF-Ziron. The remaining channels were made from licensed Zircaloy-2 and Zircaloy-4 and are not LTAs. All dimensions were identical to standard GE14 channels.

NSF Alloy

The NSF alloy is composed of 1% niobium, 1% tin, and 0.35% iron. The term NSF reflects the presence of niobium, tin, and iron as the primary alloying metals combined with zirconium. Similar niobium alloys are commonly used in Pressurized Water Reactors and Russian plants, but not commercially used in Boiling Water Reactors (BWR).

Low irradiation growth is the key feature for the consideration of NSF as a channel material because of the reduced likelihood of bowing due to fast-fluence gradient-induced channel bow. In addition, certain channel fabrication processes may potentially leave residual cold work in the finished channel assemblies. Unlike the standard Zircaloys that have a high sensitivity to cold work-enhanced irradiation growth, NSF exhibits a reduced sensitivity to cold work-enhanced irradiation growth, which reduces the likelihood of bowing or other deformations due to this mechanism.

The nominally 1% addition of niobium in NSF occurs at the expense of zirconium, resulting in mechanical properties that are similar to the standard Zircaloys. The mechanical properties of NSF are adequate for reactor service.

One notable feature of Zircaloy-2 has been its superior corrosion resistance when irradiated in a BWR environment. While NSF is expected to demonstrate adequate corrosion resistance for a channel material, it is not expected to be as good as Zircaloy-2.

GNF-Ziron

GNF-Ziron is a high-iron zirconium-based alloy where the iron is specified from a minimum of 0.22 wt% to a maximum of 0.28 wt%. Zircaloy-2 specifies a maximum iron content of 0.20 wt%. All other alloying elements of this alloy fall within the industry specification for Zircaloy-2.

The mechanism of control-blade shadow corrosion-induced channel bow has been shown to result from early exposure to inserted stainless steel control blades, leading to shadow corrosion and increased hydrogen pickup on the channel sides adjacent to the blade. The differential hydrogen on the opposing channel faces has been correlated with differential growth and bow. GNF-Ziron is included in four LTAs because it offers the potential for reduced hydrogen pickup while maintaining excellent corrosion resistance.

Because of the similar composition and processing methods, GNF-Ziron has similar adequate mechanical properties and similar excellent corrosion resistance as Zircaloy-2.

Applicability of NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel" (GESTAR)

GNF has concluded that the analytical methodology for Zircaloy-2 channels can be applied to NSF and GNF-Ziron channels. GNF has reviewed the properties of these alloys relative to the properties of Zircaloy-2 alloy in the context of required functions, including safety, of fuel channels as described in GESTAR and the relevant licensing topical reports. GNF has concluded that the use of NSF and GNF-Ziron as channel materials meets the approved criteria of GESTAR and may be applied to LTAs.

Objectives of LTA Program

The objective of the LTA Program is to characterize the dimensional performance of these two channel materials, which is expected to be improved over that of reference Zircaloy-2. The program is intended to characterize the three deformation mechanisms of significant magnitude, including fast-fluence gradient-induced channel bow, control-blade shadow corrosion-induced channel bow, and channel creep bulge. As such, these assemblies were placed in the core during the initial cycle in locations where the channels will experience heavy early-life exposure to the control blades in order to allow for the future characterization of the control-blade shadow corrosion-induced channel bow behavior. Additionally, the channels will be moved to peripheral positions in later cycles to characterize the fast-fluence gradient-induced channel bow behavior. This core placement approach is relatively common and allows for representative bulge behavior to be characterized. The core placement will be supported by analysis to assure that the safety and licensing bases is maintained. Additionally, the corrosion resistance of both alloys, but NSF in particular, can be confirmed.

Outline of Measurements

Since characterizing the dimensional performance is the primary objective of the LTA Program, bow and bulge will be characterized after each cycle. Also, adequate corrosion resistance will be confirmed via visual examinations of selected channels to characterize the nature and integrity of the oxide layer formed. Depending on the observed performance and the potential for long-term application, coupons (material samples from irradiated channels) may be extracted for hotcell examination.