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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Clinton Power Station Introduction of Lead Use Channels

Reference: Letter from T. A. Ippolito (U. S. NRC) to R. E. Engle (General Electric Company), "Lead Test Assembly Licensing," dated September 23, 1981

The purpose of this letter is to notify the U. S. Nuclear Regulatory Commission of the use of a Lead Test Assembly (LTA) as required by the referenced letter and the General Electric Standard Application for Reactor Fuel (GESTAR). In 2006, Global Nuclear Fuel (GNF) and AmerGen Energy Company, LLC (AmerGen) collaborated to introduce advanced channel materials of various types in the Clinton Power Station (CPS), Unit 1. The advanced channel materials used included a zirconium-based alloy containing Niobium, called NSF, instead of Zircaloy 2 and a high iron zirconium based alloy called GNF-Ziron. The channel material type is not specifically identified in the GNF licensing topical report (LTR), GESTAR; however, in LTRs referenced in GESTAR the channels are described as being manufactured from Zircaloys. Zircaloys, referring to the industry standard Zircaloy-2 and Zircaloy-4, are zirconium-based alloys that contain a specific composition of materials. Therefore, the use of these channels required the application of the LTA provision of GESTAR and the referenced letter, requiring that AmerGen provide an information letter to the NRC describing the LTA program. Due to an oversight on the part of GNF and AmerGen, this notification did not occur at the time the lead use channels were introduced at CPS.

In accordance with GESTAR, the elements of an approved licensing process for LTA programs include the following.

- The analysis of the LTAs using approved methods meets approved criteria,
- The Licensee will provide an information letter to the NRC describing the LTAs, stating the applicability of GESTAR, describing the objectives of the LTA program, and outlining the kinds of measurements that will be made on the LTAs, and
- The results obtained from the LTA program will be summarized in a timely manner in subsequent GNF fuel experience reports.

Analysis of the NSF and GNF-Ziron channels was previously conducted using an approved methodology and the channels were demonstrated to meet the approved criteria for use. The required information letter is provided in the attachment to this letter and contains the required information on the LTAs. As required by GESTAR, GNF will summarize the results obtained from the LTA program in a timely manner in subsequent reports. The CPS channels are still in their first cycle of use and consequently have no experience to report at this time.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this letter, please contact Mr. Timothy A. Byam at (630) 657-2804.

Respectfully,

Patrick R. Simpson

Patrick R. Simpson
Manager – Licensing

Attachment: Information Submittal for Clinton Lead Test Assemblies

ATTACHMENT

Information Submittal for Clinton Lead Test Assemblies

Global Nuclear Fuel
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Global Nuclear Fuel – Americas, LLC
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Ref: MAD-EXN-LH1-07-004

February 11, 2007

TO: Candice Chou
Manager, TSSA
Exelon Nuclear

SUBJECT: INFORMATION SUBMITAL FOR CLINTON LTAs

REF. 1. Email from M.Downs to C.Chou, *LTA Channel Question*, sent Wednesday, January 03, 2007 1:33 PM

In 2006, GNF and Exelon collaborated to introduce advanced channel materials of various types, including NSF and High Fe variants, in the Clinton plant beginning in Cycle 11. As communicated in Reference 1, the use of these channels required the application of the Lead Test Assembly (LTA) provision of GESTAR, requiring that Exelon provide an information letter to the NRC describing the LTA program. Specifically, the agreed content includes a description of the LTAs, a statement of applicability of GESTAR, a description of the objectives of the LTA program, and an outline of the kinds of measurements that will be made on the LTAs. It appears that GNF did not adequately communicate the notification requirement to Exelon at the onset of the program and, as a result, the notification was not made at the appropriate time. Upon realizing this in the last few months, GNF established an item in its Corrective Action Program and is actively pursuing corrective and preventative actions. This letter is intended to communicate the content required in the notification for Exelon's use in preparing the information letter.

Description of Lead Test Assemblies

Six LTAs were loaded into the Clinton plant at the beginning of Cycle 11. The GNF-supplied assemblies contained standard GE14 components and fuel with the exception of the channel materials. Three channels were made of a zirconium-based alloy containing Niobium, called NSF, instead of the standard Zircaloy 2. The other three channels were made of a high-Fe zirconium based alloy, called GNF-Ziron. 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 (Nb), Tin (Sn) and Iron (Fe) as the primary alloying metals combined with Zirconium. Similar Niobium alloys are commonly used in PWR and Russian plants, but not commercially used in BWR's.

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 similarly adequate mechanical properties and similar excellent corrosion resistance as Zircaloy-2.

Applicability of 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 LTRs. GNF has concluded that the use of NSF and GNF-Ziron as channel materials meets the approved criteria of GESTAR and may be applied as LTAs.

Objectives of LTA Program

The objective of this 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 first 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 will allow for representative bulge behavior to be characterized. Additionally, the corrosion resistance of both alloys, but NSF in particular, can be confirmed as adequate.

Outline of Measurements

Since characterizing the dimensional performance is the primary objective of the 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.

Please let me know if you have any questions or concerns.

Best regards,

Mark A. Dubecky
Manager, Materials Technology and Fuel Reliability

Cc.	Exelon	R.Ralph, M.Reitmeyer, M.Eyre
	GNF:	A.Lingenfelter; J.Harrison; M.Downs; G.Latter; D.White; Y.P. Lin