ENCLOSURE 2

MFN 09-695

Additive Presentation Slides

Non-Proprietary Information

IMPORTANT NOTICE

This is a non-proprietary version of Enclosure 1 to MFN 09-695, which has the proprietary information removed. Portions of the document that have been removed are indicated by white space with an open and closed bracket as shown here [[ ]].

Pre-Submittal Meeting
Additive UO_2 Fuel

18 August 2009

Global Nuclear Fuel

A Joint Venture of GE, Toshiba, & Hitachi

Non-Proprietary Information

Agenda

- Brief overview
- Review implementation plan
- Review bases for applying an additive in BWR fuel
- Review approach for licensing additive UO_2
- Obtain comments from NRC on Draft LTR

Overview

- GNF wants to introduce additive fuel to gain additional protection to duty-related failures
- The [[ ]] (additive) is an effective remedy for PCI
- Additive fuel is well characterized and has recently completed operation to bundle average exposures of [[ ]]
- Additive fuel has been used in commercial BWR fuel in Japan since 1999

Overview – Cont.

- Additive fuel properties are included in the computer models of GNF
  - GSTRM: Approved in 1987
  - PRIME03: Additive LTR requests approval
  - Intend to only use PRIME for additive fuel

- July ’07 presentation to NRC
  - Identified best process for submittal and review; Additive LTR to support administrative amendment to GESTAR

Implementation Plan

- Phase 1
  - Barrier plus additive fuel for defense in depth to PCI
  - Support industry initiative for zero leakers by 2010
- Phase 2
  - Increased operating flexibility
  - Reduced fuel cycle costs (increased U mass)
  - Core design flexibility (improved thermal limits)

Additive Description

- Composition
  - License target: [[ ]]
  - Experience range:
    - [[ ]]
- Concentration
  - License target range: [[ ]]
  - Experience range: [[ ]]
  - For Reference ASTM Impurity limit [[ ]]

  Mechanisms providing protection against duty-related cladding failures
    - [[
    -]]

Additive Experience

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10x10 Additive Fuel Experience

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- Confirmed PCI protection remains at low concentrations

10x10 Additive Fuel Experience - Continued

[[[[

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- Poolside inspections indicate bundles operating normally
- Confirmed acceptable performance to high exposures

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As-Sintered Pellet Structure

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Post-Irradiation Pellet Structure

LUA

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Post-Irradiation Pellet Structure

Ramp Test

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PCI Resistance

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Additive Pellet Properties

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Additive Pellet Properties – Cont.

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Stress-Strain Behavior

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Creep Rate

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Treatment of Melting Temperature

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Treatment of Melting Temperature

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Alternate Source Term

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Properties Summary

- Small differences between additive fuel and standard UO_2
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- Properties implemented in GSTRM and PRIME03 computer models
- Additive fuel is consistent with existing design methodology

Licensing Approach

- Additive LTR addressing
  - Properties
  - Behavior
  - Model Qualification comparisons
  - Methods
  - Effects on licensing criteria
- Administrative amendment to GESTAR
  - Additive LTR is basis for applicability

LTR Topics

- Model Basis, Qualification, Behavioral Assessments
  - Physical properties
  - Thermal properties
  - Mechanical properties
  - Qualification datasets
  - Washout Characteristics
  - AST
  - Long Term Storage

  } Added after ACRS meeting 9/2008

- Application methodology (GESTAR): Regulatory requirements
  - Fuel melting
  - Gap conductance
  - Stored energy
  - Fuel rod internal pressure
  - Cladding strain
  - AOO
  - Core stability
  - LOCA
  - RIA