ENCLOSURE 2

MFN 10-160

Presentation Material

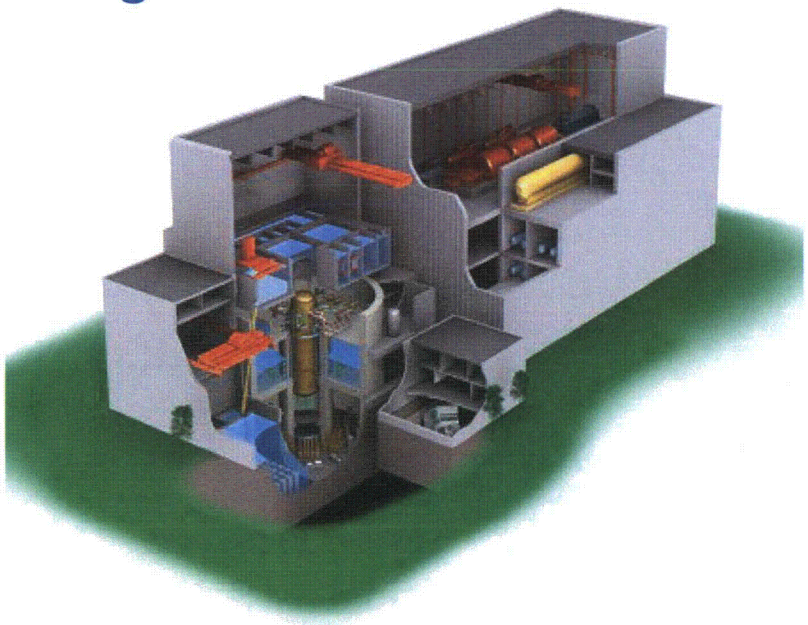
Non-Proprietary Information

IMPORTANT NOTICE

Enclosure 2 is a non-proprietary version of the presentation from Enclosure 1, from which the proprietary information has been removed. Portions that have been removed are indicated by open and closed double brackets as shown here [[ ]].

ESBWR Qualification Plan Requirements for a 72-Hour Duty Cycle Battery

Advisory Committee on Reactor Safeguards



Kevin Nunes

Peter Yandow

May 19, 2010

GE Hitachi Nuclear Energy

HITACHI

Agenda

- Introduction
  - Issue
  - RAI Background
  - Regulatory Guides
- Qualification Plan
  - High Level Overview
  - LTR NEDE-33516P and IEEE 535 "Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations" comparison
- Summary

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Issue

- ESBWR uses 72-hour duty cycle batteries for passive plant design

- GEH based the qualification program for 72-hour duty cycle batteries on existing regulatory guidance for battery qualification for 8-hour duty cycle

- GEH qualification plan is captured in LTR NEDE-33516P

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RAI Background

GEH Received RAI 8.3-64 on January 13, 2009 requesting a description of the methodology for qualification of 72-Hour Duty Cycle battery.

" The ESBWR DCD, Rev. 5, Section 8.3.2.2.1 states that the safety-related batteries meet the qualification requirements of IEEE 535,....Given IEEE 535 does not apply to duty cycles longer than 8 hours, identify the methodology to be used to qualify these batteries for an extended duty cycle of 72 hours."

Response by GEH on April 17, 2009 documented the planned methodology and how GEH would use IEEE-535 type test process with the main exception of the 72-Hour requirement.

Received RAI 8.3-64, Supplement 1 on June 10, 2010 requesting a qualification plan be created and added as a DCD reference.

LTR NEDE-33516P was written and submitted on July 27, 2009 by GEH

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IEEE Battery Requirements for ESBWR

Regulatory Criteria for 8-Hour Duty Cycle Battery used as basis

- Regulatory Guide 1.89, Revision 1, "Environmental Qualification of Certain Electrical Equipment Important to Safety for Nuclear Power Plants" (Endorses IEEE-323, 1974)
- Regulatory Guide 1.100, Revision 2, "Seismic Qualification of Electrical and Mechanical Equipment for Nuclear Power Plants" (Endorses IEEE-344-1987)
- RG 1.129, Revision 2, "Maintenance, Testing, and Replacement of Vented Lead-Acid storage Batteries for Nuclear Power Plants" (Endorses IEEE 450)
- RG 1.128, Revision 1, "Installation Design and Installation of Large Lead Storage Batteries for Nuclear Power Plants" (Endorses IEEE 485)
- RG 1.158, Revision 0, "Qualification of Safety-Related Lead Acid Storage Batteries for Nuclear Power Plants" (Endorses IEEE 535)

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Qualification Plan

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Qualification Plan

Continued

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HITACHI

Qualification Plan Continued

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Summary Points

- Process for qualifying 72-hour duty cycle batteries not specifically addressed in existing regulatory guidance or industry standards

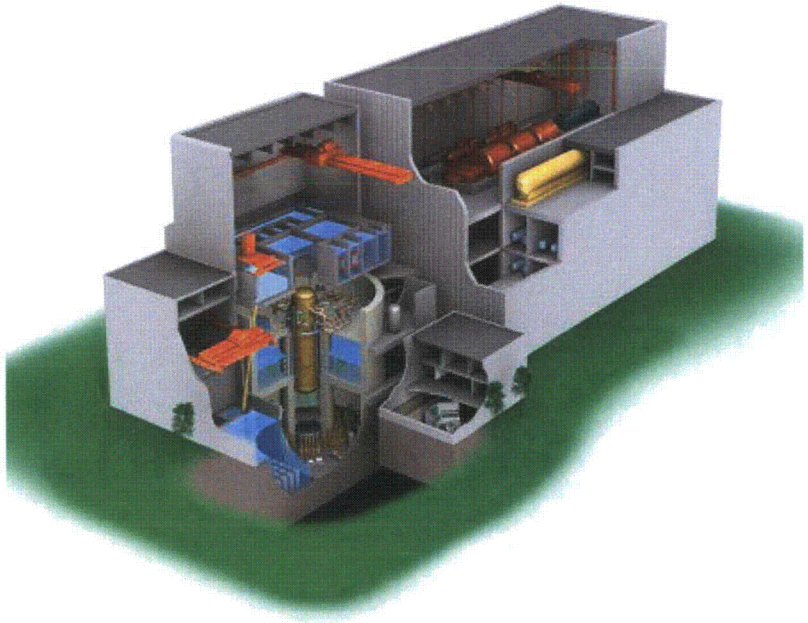
- GEH developed a conservative, thorough battery qualification plan and documented it in LTR NEDE-33516P to address NRC concerns/questions related to 72-hour duty cycle

- NRC staff has indicated acceptance of GEH 72-Hour Duty Cycle Battery Qualification plan.

GT System for LPRM Calibration and Power Shape Monitoring
NEDC-33197P

Advisory Committee on Reactor Safeguards

Stephan C. Moen
Brian R. Moore



May 18, 2010

GE Hitachi Nuclear Energy

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Overview

- Introduction
- Overview of Device Principle and Operation
- GT Calibration
- LPRM Calibration
- GT CMS Power Shape Monitoring
- GT CMS Uncertainties
- Summary

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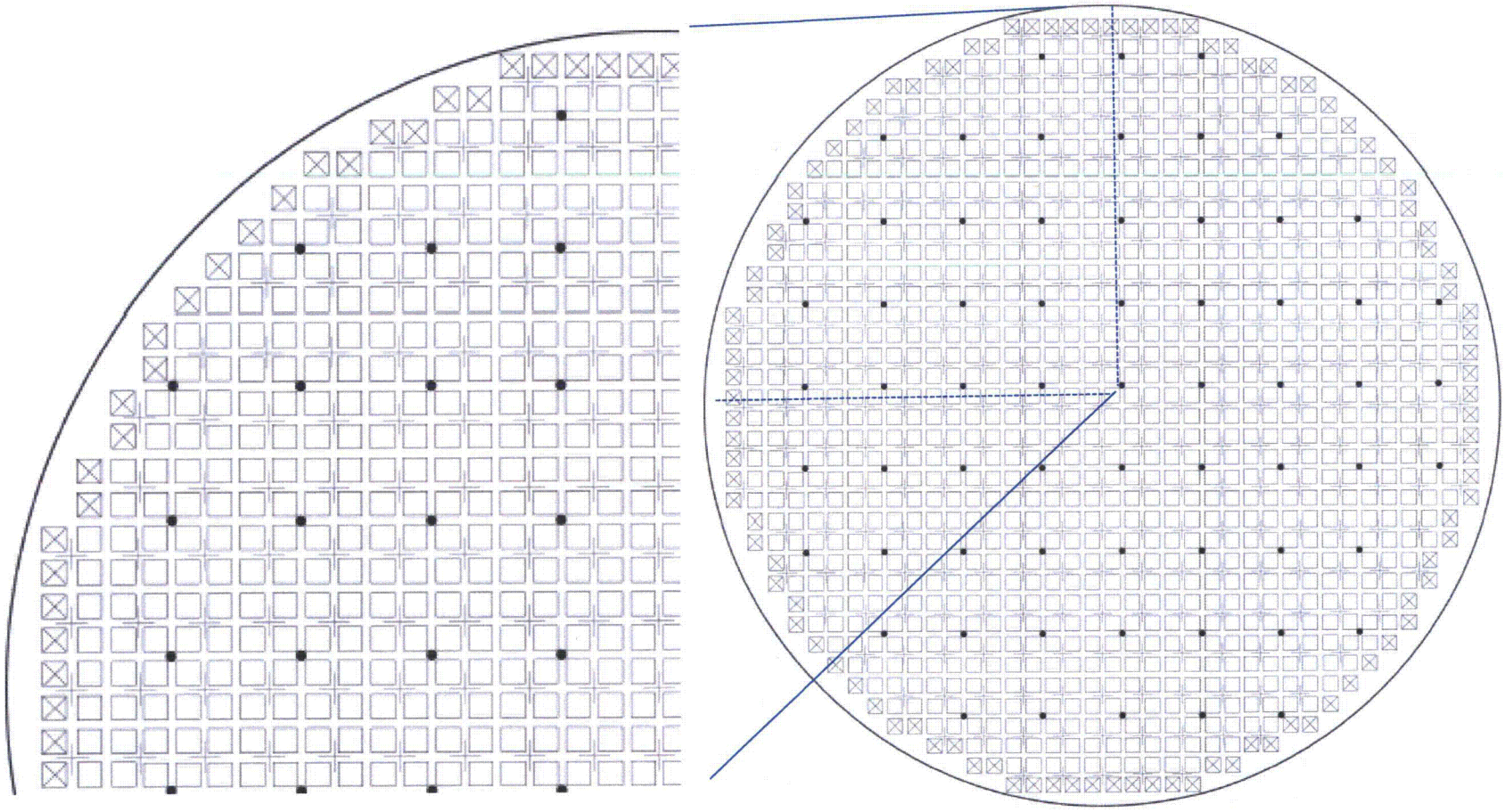
Introduction

Design Requirement: ESBWR needs calibration of incore power monitors (LPRM/APRM).

Solution: Introduce the AFIP/GT: simple, fixed (no moving parts), with capability for easy in-situ calibration and can reduce maintenance requirements and worker exposure.

Core Arrangement



Central Region Bundle	1028	Control Rod	269
Peripheral Region Bundle	104	LPRM	64
Total	1132		

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Typical LPRM/GT Assembly

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Heat Flow Path of GT

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GT Cross Section

[[

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GT Monitoring System Configuration

[[

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GT Calibration Model; 1/2

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GT Calibration Model; 2/2

[[ ]]

Factory Calibration

[[

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In-Plant Calibration

[[

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LPRM Calibration; 1/2

[[

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LPRM Calibration; 2/2

Calibration interval of 750 MWd/T

Update/Failure Study determined:

- Minimum Core Configuration of GT array
- Uncertainties

GT CMS Power Shape Monitoring

Modifications from TIP-CMS model...

[[

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GT CMS Uncertainties, MCPR

[[

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GT CMS Uncertainties, LHGR

[[

]]

Summary

Gamma Thermometer basis established

- GT calibration/usage
- LPRM calibration process
- Core Monitoring Process
- Core Monitoring Uncertainties

Thank You !

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GE14E Fuel Assembly Mechanical Design & Fuel Rod Thermal-Mechanical Design

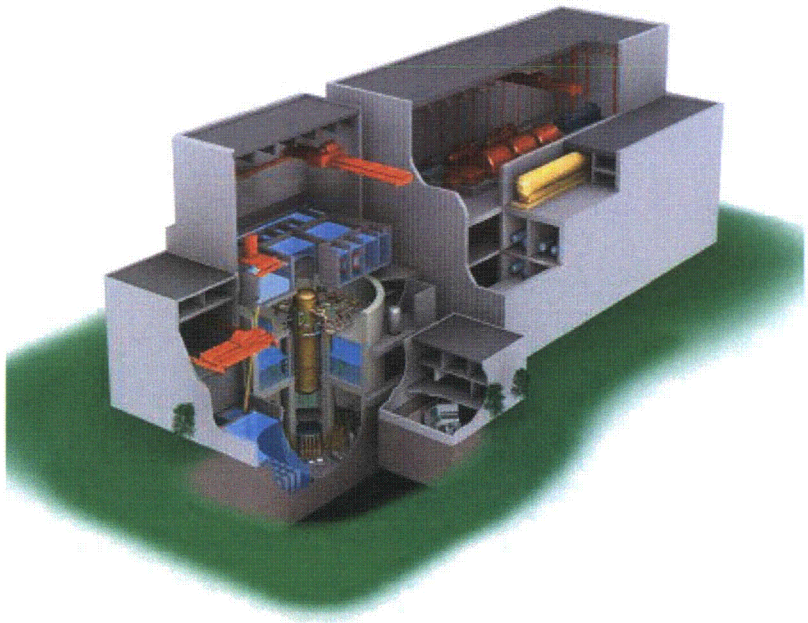
Advisory Committee on Reactor Safeguards

Nayem Jahingir

Steve Moen

Russell Higgins

Peter Diller



May 18, 2010

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NEDC-33240P: GE14E Fuel Assembly Mechanical Design

Report Content

- Fuel assembly component description & design
  - Fuel rods
  - Water rods
  - Spacers
  - Upper & lower tie plates
  - Upper & lower end plugs
  - Channel & channel fastener
  - Plenum spring
- Overview of the materials used and their processing techniques

GE14E Fuel Design Overview

Design Derived from GE14

[[

- Proven Materials & Components
  - More than 2 million GE14 rods irradiated in BWRs
  - Exposures to [[ ]]
- Fuel Design Basis and Testing Applies to ESBWR

Differences

- Length reduced for dp
  - Increased fuel rod plenum
- PLR length reduced
- Spacer positions slightly altered

{3}]]

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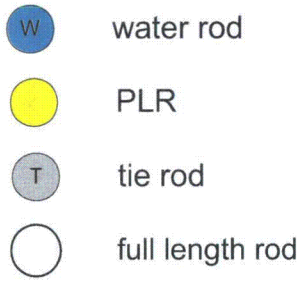
GE14E Fuel Lattice

[[



{3}]]

Same as the standard GE14 design

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GE14E Fuel Rods

[[

Same as GE14

- Only the Active Fuel Length is Shorter and Plenum Length is Larger

Rod Types	Plenum to Fuel Ratio	
	GE14E	GE14
Full Length UO_2 Rod	[[	
Gadolinia Rod		
Part Length Rod		

{3}]]

{3}]]

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GE14E Spacers

[[

{3}]]

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GE14E Upper & Lower Tie Plates

[[

{3}]]

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GE14E Water Rod

[[

Same as GE14 (only the length is shorter)

Evaluated to demonstrate adequate margin to

- The differential wall pressure
- The spacer lift forces from flow or differential component growth

Staff's Concern

- Fuel handling calculations ignore the holes at the top and bottom

Resolution

- Detailed finite element analyses performed including the water rod holes

Significant design margins for the water rods

{3}]]

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GE14E FIV Characteristics

No significant FIV concerns for GE14E

- GEH conclusions are based on similarities between the GE14 and GE14E designs and successful operation of the GE14 design without any FIV issues
  - No FIV-related failures in more than 2 million rods irradiated at different operating conditions
  - No FIV-related wear marks observed in more than 100 inspection campaigns
  - FIV test indicated acceptable RMS accelerations for GE14
  - Lower flow rate of ESBWR

Staff's Concern

  - RMS acceleration increases with quality and the current test data may not be applicable to the higher quality for ESBWR

Resolution

  - ITAAC is proposed to perform the FIV test for GE14E before fuel load
  - RMS acceleration acceptance criteria include penalty for the higher quality of the ESBWR

GE14E Fuel Rod Thermal-Mechanical Design Report (NEDC-33242P)

NEDC-33242P: GE14E Fuel Rod Thermal-Mechanical Design

Report Content

- Fuel rod description
- Design criteria & analyses methodology
- Design analyses results
- Operating experience update
- Fuel rod processing description

Fuel Rod Design Methodology

Conservative assumption of fuel operation throughout its lifetime (70 GWd/MTU peak exposure)

- Operation along a bounding LHGR Envelope

Best estimate method with **statistical** & **worst tolerance** application methodology for addressing the uncertainties

- GSTRM Code is used for the GE14E design

Statistical analysis methodology

- Realistic assessment of manufacturing, operational and analytical modeling uncertainties
- Uncertainty propagated through analytical model
- Statistically bounding/worst tolerance results compared to design limit (95% confidence)

Worst tolerance analysis methodology

- Inputs are biased to the maximum possible fabrication tolerance in the direction that produces the most severe results
- Only applied for the cladding strain analyses

Fuel Rod Thermal-Mechanical Design and Licensing Criteria

	Analysis Condition	Criterion
Fuel rod internal pressure	SS	Creepout rate $\leq$ Swelling rate
Fuel temperature	AOO	$\leq$ Melting temperature
Cladding stress	AOO	$\leq$ Ultimate strength
Cladding fatigue	SS/AOO	Usage $\leq$ 1.0

[[

{3}]]

GE14E Compliance with the Fuel Rod Internal Pressure Limit

Fuel Rod Internal Pressure Limit

- Protects against fuel rod ballooning and failure due to high fuel rod internal pressure

- GE14E is designed with 95% confidence that rod internal pressure will not exceed critical (liftoff) pressure (design ratio <1.0)

[[{3}]]

Staff's Concern

- GSTRM rod internal pressure calculation may be non-conservative at higher burnup
- Recommended a [[{3}]] additional conservatism for the critical pressure calculation

Resolution

- Rod internal pressure methodology is revised to reflect the additional conservatism

[[{3}]]

- GE14E is confirmed to conservatively comply with the revised Rod Internal Pressure Limit

GE14E Compliance with the Fuel Temperature Limit

GE14E design is evaluated to assure with 95% confidence that **no fuel melting will occur** during normal operation and anticipated operational occurrences (AOO)

Staff's concern

- Reference to the core wide AOOs
- Reference to the limited fuel melting

Resolution

- Reference to the code wide AOOs and limited fuel melting has been removed from the design basis
- GE14E TMOL and Overpowers are revalidated to confirm that no fuel melting will occur during any AOOs

GE14E Compliance with the Cladding Strain Limit

GE14E design is evaluated to assure with high confidence that the cladding failure due to **pellet-cladding mechanical interaction will not occur** during normal operation and AOOs

Staff's concerns

- 1% plastic strain limit is non conservative at higher burnup/high hydrogen concentration
- No explicit design limit for cladding oxidation and hydrogen pickup

Resolution

- Cladding strain limit is revised at higher burnup [[ ]]
- Implemented cladding oxidation limit of [[ ]] and hydrogen concentration limit of [[ ]] in the design basis

GE14E TMOL and Overpowers are revalidated to confirm compliance for the revised cladding strain, oxide and hydrogen limits

Summary

GE14E design is derived from the GE14 design

- Proven Components & materials
- Fuel Design Basis and Testing Applies to ESBWR
- ITAAC has been proposed for FIV testing before reload

GE14E fuel rod design includes more design margin compared to the standard GE14 design

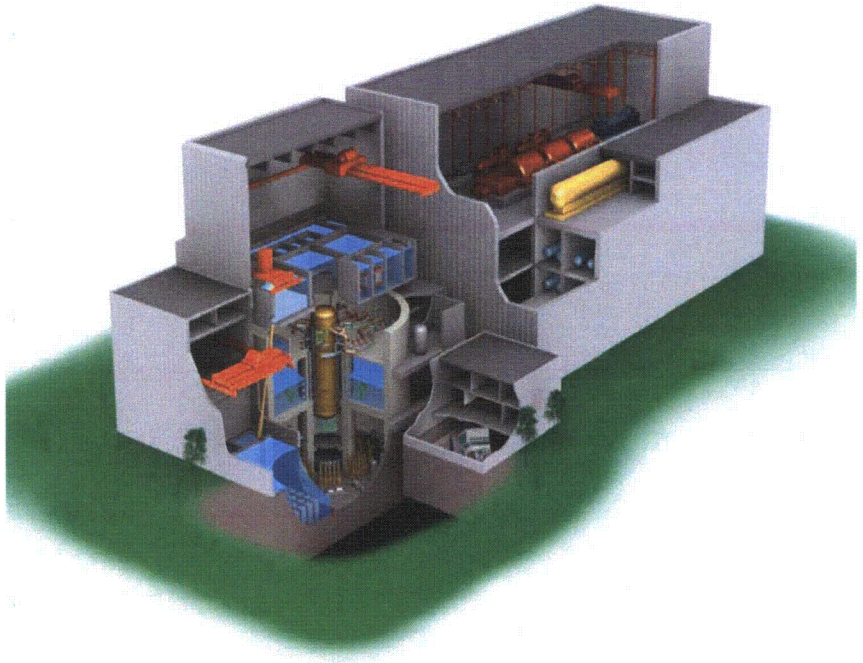
- Significantly larger plenum to fuel volume ratio (more room for fission gas release accommodation)
- Design basis updated to address the high burnup fuel behaviors
- Additional conservatism is applied where necessary/recommended by the Staff
- Best estimate methodology with conservative treatment of uncertainties is applied in the design

ESBWR - Full Scale Critical Power Testing of GE14E & Applicability of GEXL14

Russ Fawcett

Presentation to ACRS

May, 2010



Overview

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- In RAI 4.4-1 Supplement 1, the NRC Staff requires confirmation testing prior to fuel load.
- Full scale testing of GE14E completed in November, 2007.

[[

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- Results documented in NEDC-33413P and transmitted in MFN 08-292
- Staff imposed a 0.01 OLMCPR penalty associated with void correlation experimental database

GE14E Range of Test Conditions

- Cosine axial power shape

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Application Range

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Calculated vs. Measured Critical Power

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GEXL14 Prediction:
ECPR Trend with Mass Flux

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GEXL14 Prediction:
ECPR Trend with Inlet Subcooling

[[

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GEXL14 Prediction:
ECPR Trend with Pressure

[[

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Statistics

[[

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Transient Tests [[

- Transient tests are performed as part of standard test matrix
- Two kinds of transients
  - > Fast power increase
    - Increase in flow
    - Constant flow
  - > Slow power increase
- Delta / Initial CPR compared to GEXL14
- GEXL14 conservatively predicts the transient critical power response

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Summary

- Full scale testing of GE14E performed
  - > Spans ESBWR application range

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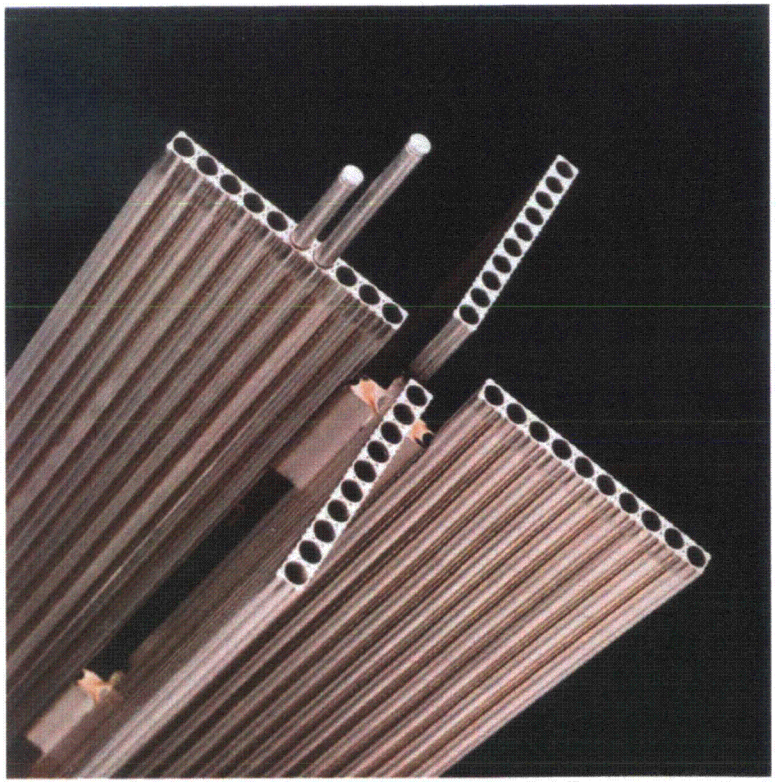
Nuclear Energy

ESBWR Marathon Control Rods



Scott Nelson
Sr. Control Rod Blade Design Engineer
Scott.nelson@gene.ge.com
910-819-5829

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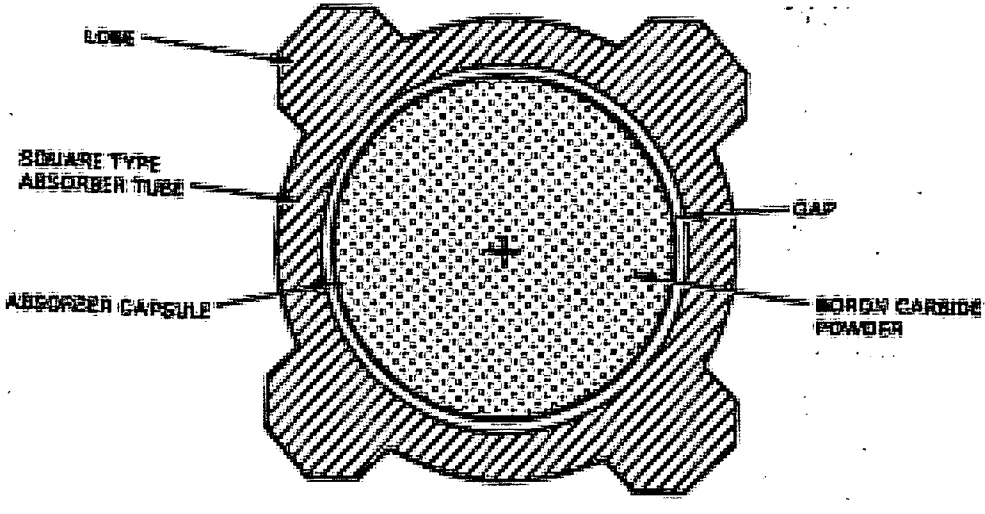
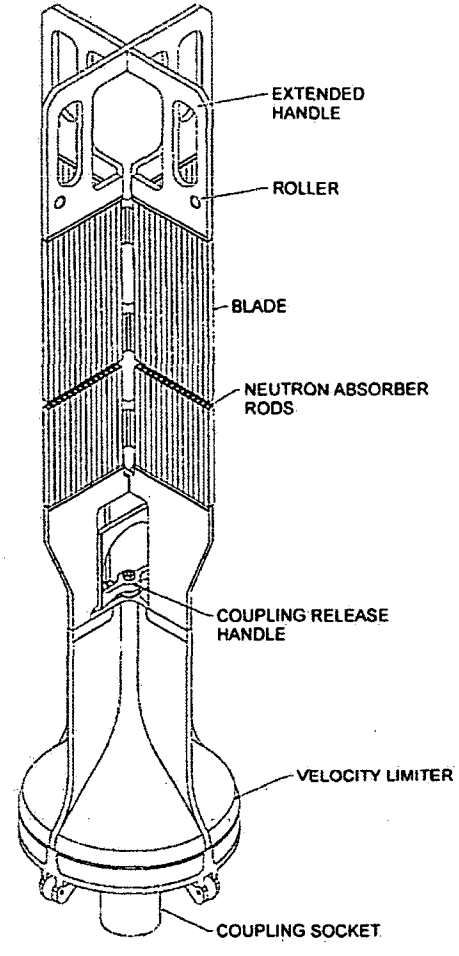
BWR/2-6 Marathon Control Rod Description

- Approved in 1991 (NEDE-31857P-A)
- B_4C powder capsule within a 'square' absorber tube.
- Provides a gap between capsule and absorber tube to accommodate irradiated B_4C swelling and helium release.
- Hafnium rods used in high-duty edge locations.





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ESBWR Marathon Control Rod Description

- Shorter Absorber Section and Capsules
- All B_4C Capsule Design (no hafnium)
- [[

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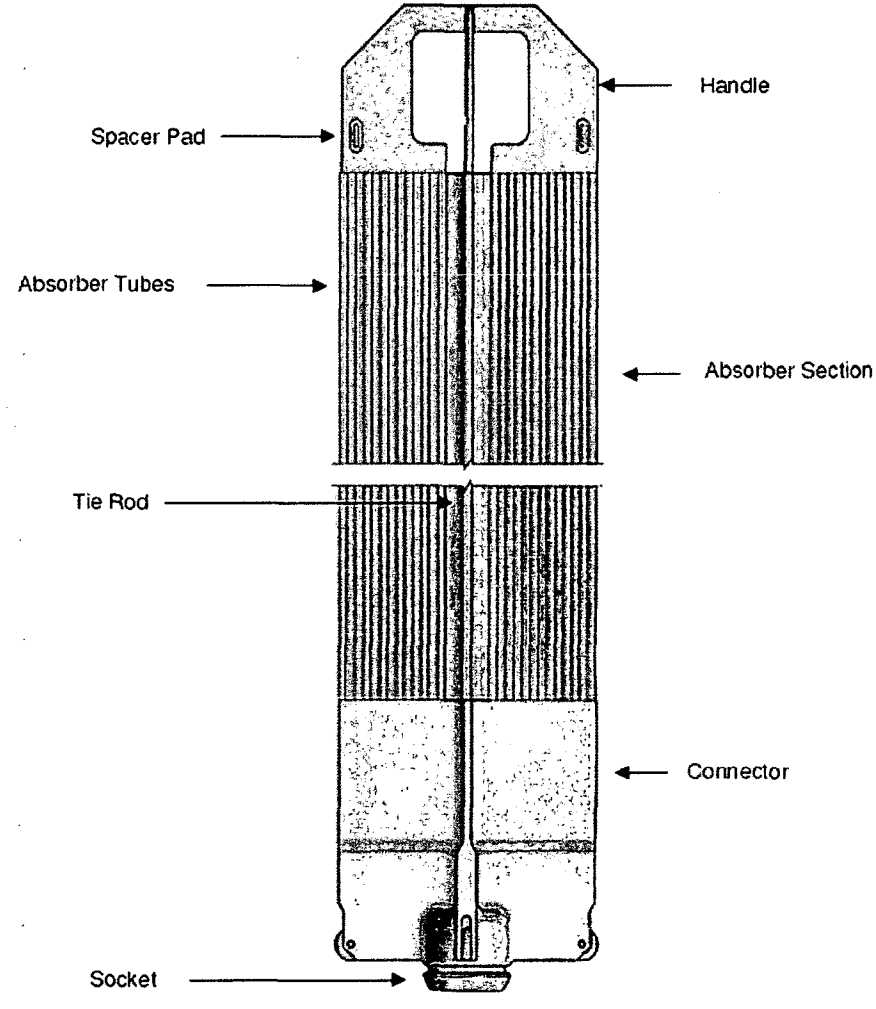
- Full-Length Tie Rod
- Spacer Pads Instead of Handle Rollers
- Connector Instead of Velocity Limiter



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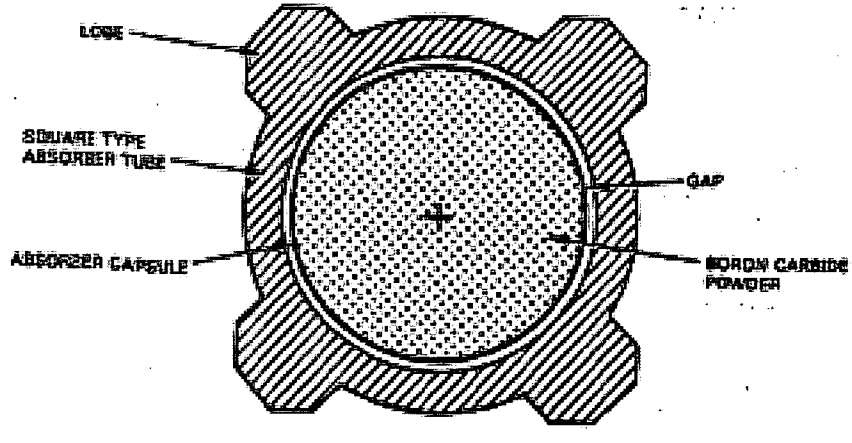
ESBWR Marathon Design

Marathon Design Accommodates the Irradiated Behavior of Boron Carbide

- Helium Generation:
  - Capsules designed to off-gas generated helium gas.
  - Helium gas is contained in the sealed outer absorber tube
- Boron Carbide Swelling:
  - Diametral gap between the inner capsule and outer absorber tube allows the capsule to expand before placing a strain on the outer absorber tube



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ESBWR Marathon Design – Tube Swelling Strain

[[

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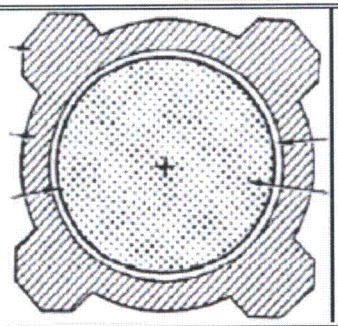
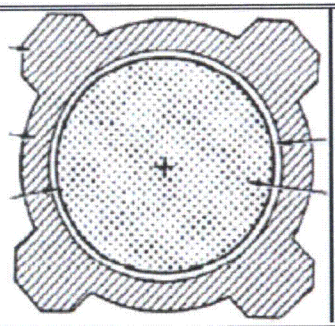
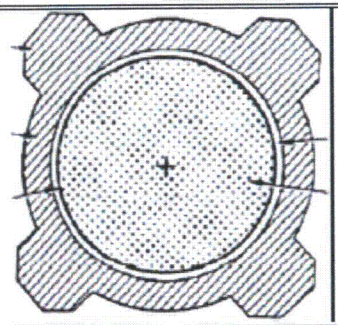
Parameter	D Lattice BWR/2-4 S Lattice BWR/6	C Lattice BWR/4,5	ESBWR
Absorber Tube			
Local Boron-10 Depletion at Capsule Contact	[[		
Swelling Induced Strain at 100% Local Depletion			]]

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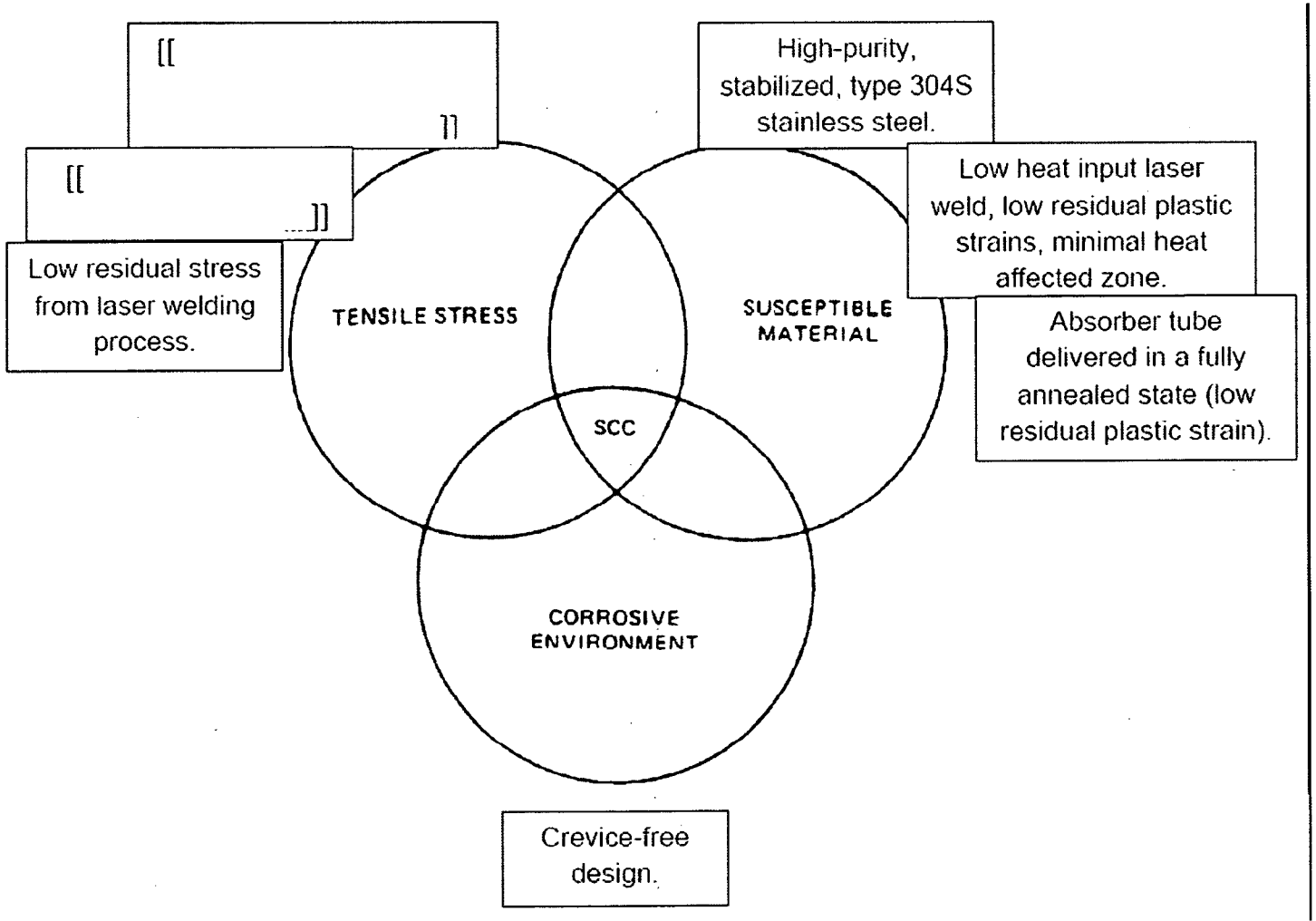
ESBWR Marathon Design - IASCC



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ESBWR Marathon Design – Nuclear Analysis

- Depletion analysis performed using a GEH-controlled version of an industry standard Monte Carlo neutron transport code (MCNP).
- The control rod model accounts for the self-shielding of depleted boron (a.k.a. B-10 drift) by modeling the boron carbide column as a series of concentric rings.
- As in BWR/2-6 analyses, nuclear end-of-life is defined as the peak ¼-segment Boron-10 depletion at which the cold (room temperature) reactivity worth has been reduced by 10% from the initial value.
- Heat generation rates due to the neutron capture reaction are calculated using a conservative methodology.

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ESBWR Marathon – Surveillance Program

- The four (4), fleet-wide, highest depletion ESBWR Marathon control rods will be visually inspected each refueling outage.
- Inspections will continue until the control rods have reached as close to end of nuclear life as possible.
- Should a material integrity issue be observed, GEH will:
  - Arrange for additional inspections to determine a root cause
  - If appropriate, recommend a revised lifetime limit to the NRC based on the inspections and other applicable available information.
- GEH will report to NRC the results of all ESBWR Marathon inspections at least annually.

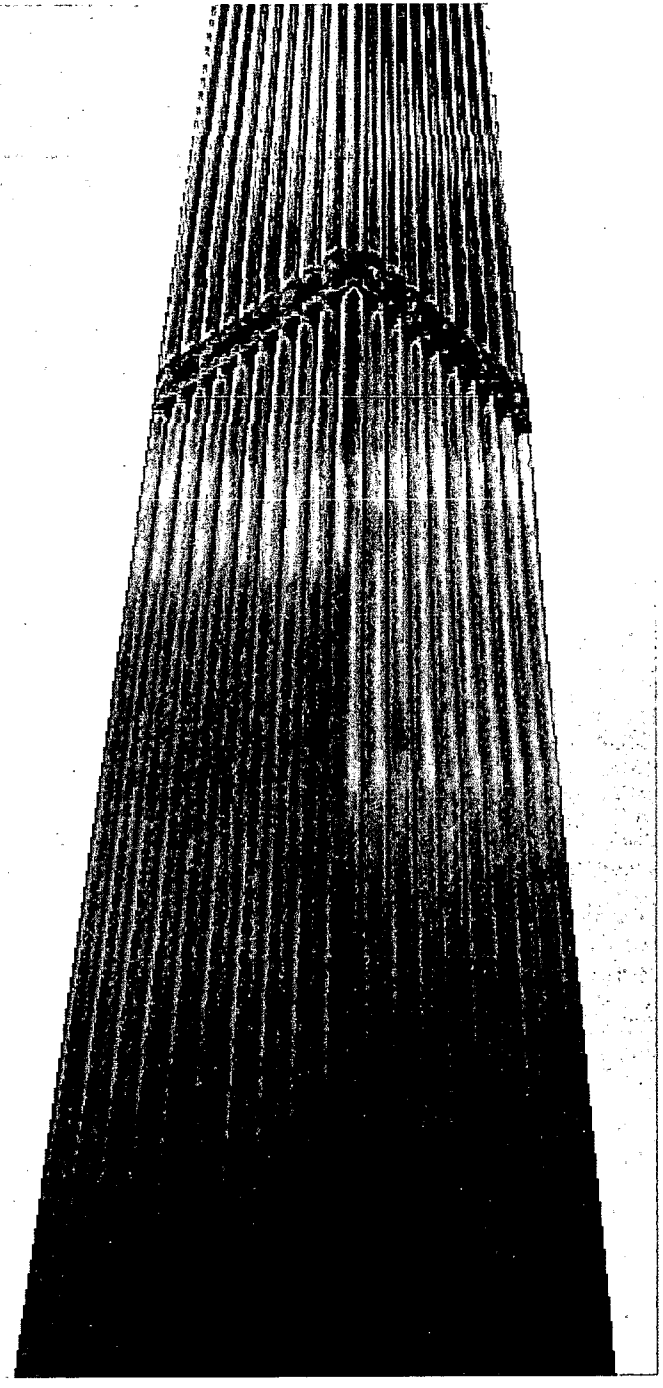
HITACHI

GE14E for ESBWR Nuclear Design Report NEDC-33239

Russ Fawcett

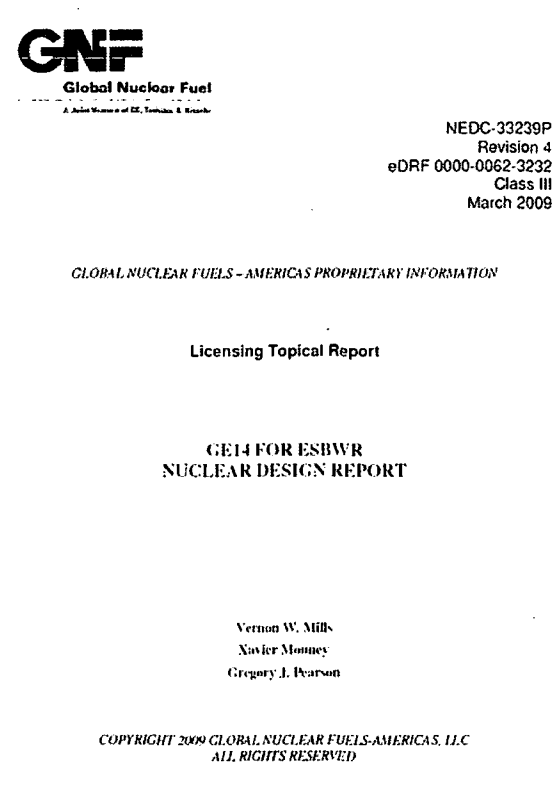
Presentation to ACRS

May 2010



Nuclear Design Report Scope

- Limitations and conditions
  - > 14 total
- Revision history
- Steady state methods description
  - > Lattice physics (TGBLA06)
    - – Model description
    - – Qualification
- 3D core simulation
  - > 3D nuclear model
  - > Thermal hydraulics model
  - > Qualification



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NEDC-33239P
Revision 4
eDRF 0000-0062-3232
Class III
March 2009

GLOBAL NUCLEAR FUELS - AMERICAS PROPRIETARY INFORMATION

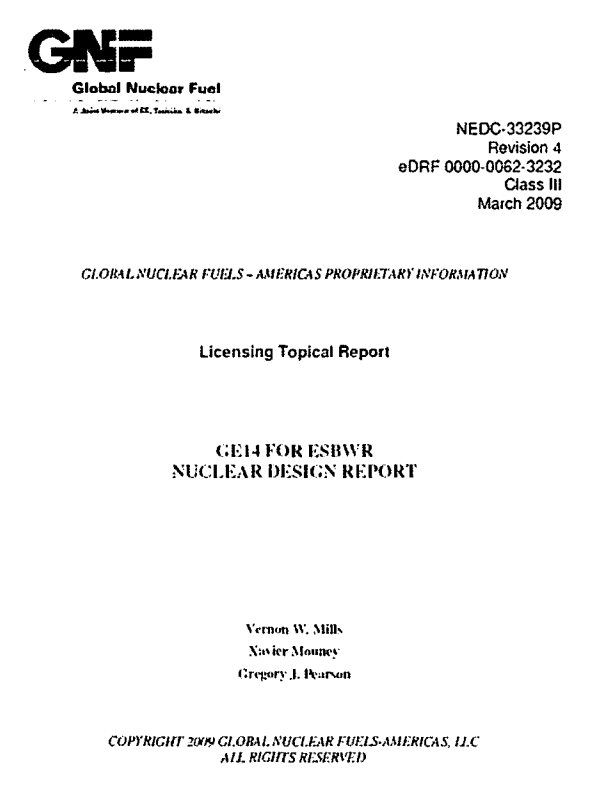
Licensing Topical Report

GE14 FOR ESBWR
NUCLEAR DESIGN REPORT

Vernon W. Mills
Xavier Mouney
Gregory J. Pearson

Nuclear Design Report Scope

- Nuclear design basis
  - > Reactivity feedback requirements
  - > Reactivity control requirements
  - > Thermal limit requirements
- Bundle nuclear design evaluation
- Core nuclear design evaluation
  - > Core loading pattern
  - > Control rod patterns & power distributions
  - > Thermal limit evaluation
  - > Reactivity limit evaluation
  - > Reactivity feedback evaluation



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NEDC-33239P
Revision 4
eDRF 0000-0062-3232
Class III
March 2009

GLOBAL NUCLEAR FUELS - AMERICAS PROPRIETARY INFORMATION

Licensing Topical Report

GE14 FOR ESBWR
NUCLEAR DESIGN REPORT

Vernon W. Mills
Xavier Mouney
Gregory J. Pearson

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ENCLOSURE 3

MFN 10-160

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Richard E. Kingston, state as follows:

(1) I am Vice President, ESBWR Licensing, Regulatory Affairs, GE-Hitachi Nuclear Energy Americas LLC ("GEH"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter, MFN 10-160, Richard E. Kingston (GEH) to Document Control Desk (USNRC), Subject: Transmittal of Presentation Material from Advisory Committee on Reactor Safeguards (ACRS) Meeting of the Subcommittee on ESBWR, Rockville MD, May 18-19, 2010

GEH proprietary text in Enclosure 1, which is entitled "Presentation Material", is identified by double square brackets [[This sentence is an example.{3}]]. Figures and large equation objects containing GEH proprietary information are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) is classified as proprietary because it contains details of the design and licensing methodology of the GEH ESBWR, and research and development activities of GEH or its licensor.

The development of this methodology, along with the testing, development, and approval of the supporting methodology is derived from an extensive experience database that constitutes a major asset of GEH or its licensor.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology

base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 26th day of May 2010.

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing,
Regulatory Affairs
GE-Hitachi Nuclear Energy Americas LLC