Edwin I. Hatch Nuclear Plant – Units 1 & 2
July 17, 2025 Pre-Application Meeting

Attachment 2 to NL-25-0270
GE Replacement Steam Dryer presentation redacted (Public, non-proprietary)

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EDWIN I. HATCH UNITS 1 & 2 REPLACEMENT STEAM DRYER EVALUATION APPROACH FOR EPU

RSD NRC Presentation Outline

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1.1 Introduction

Background:

- General Electric BWR/4 Mark I Containment
- Licensed Thermal Power History
  - Original Licensed Thermal Power: 2436 MWt (1974/1978)
  - Stretch Power Uprate Approved: 2558 MWt (1995)
  - Extended Power Uprate Approved: 2763 MWt (1998)
  - Measurement Uncertainty Recapture Approved: 2804 MWt (2003)
  - Currently Licensed Thermal Power: 2804 MWt (Present)

Overall Project Objective:

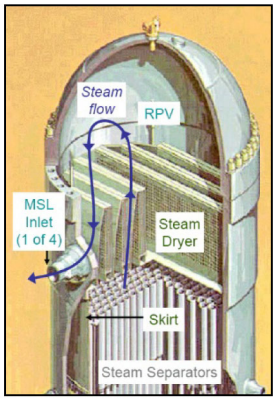
- Implement EPU program for Units 1 & 2 [[ ]]
  - Includes installation of a Replacement Steam Dryer
  - Proposed EPU: 2960 MWt (5.6% increase from CLTP)

Meeting Objective:

- Present Hatch Replacement Steam Dryer EPU Evaluation Approach and receive any NRC feedback/questions.

- The steam dryer is a nonsafety-related component and performs no active safety function; however, the steam dryer must maintain structural integrity during normal, transient and accident conditions and not generate any loose parts that may interfere with the operation of the safety systems.

Steam Dryer within RPV



Replacement Steam Dryer

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1.1 Introduction

[[ ]] Update:

- [[ ]] evaluation is currently being performed.
- No adverse effects to plant safety have been identified by introducing the GEH RSD into [[ ]].
- [[

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Notable Items:

- [[ ]] The GEH RSDs are suited for the steam dryer loads mentioned in RG 1.20 Rev. 4 including FIV, MSL dead legs, VPF and SRV resonance.
- [[

]] High stress locations rely on steam dryer geometry than RPV size.

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1.2 Overview

- Hatch Units 1 & 2 will be implementing EPU in [[ ]], which will include an RSD
- The GEH RSD is qualified for EPU conditions at [[

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Takeaways:

- [[

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2.1 GEH OEM Steam Dryer EPU History

BWR Type	RPV Size (in)	OEM SD Hood Design	EPU Approval Year	EPU Thermal Power
BWR/3	205	[[	1998[2]	6% increase from OLTP
BWR/4	183		2001 (shut down 2020)	20% increase from OLTP
BWR/4	205		2006 (shut down 2014)	20% increase from OLTP
BWR/4[1]	218		2002	20% increase from OLTP
BWR/4[1]	218		1998 EPU/ 2003 MUR	13/15% increase from OLTP
BWR/4	251		2008	~19% increase from OLTP
BWR/5[1]	201		2007	20% increase from OLTP
BWR/5	251		2011	20% increase from OLTP
BWR/6	218		2002	12% increase from OLTP
BWR/6	218		2002	20% increase from OLTP
BWR/6	238	]]	2002	20% increase from OLTP

(1) [[ ]]
(2) In 2013, unit experienced a 20% increase from OLTP with RSD.

Takeaways:

- A range of OEM steam dryers have gone to EPU successfully without an RSD.
- The curved hood steam dryer design is the best design compared to the slanted and square hood design.

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2.2 BWR/3 Quad Cities/Dresden Steam Dryer History

Overview of BWR/3 OEM Steam Dryer EPU Experience:

- BWR/3 QC/Dresden OEM steam dryers operated at OLTP for ~30 years with no structural issues
- The QC/Dresden EPU steam dryer failures ([[ ]]) had three causal factors:
  - [[[[

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- Steam dryer structural integrity and fatigue failure concerns for EPU projects are a result of the BWR/3 failures that occurred at EPU.

BWR/3 RSD

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BWR/3 SD PLTP and EPU Measured PSD Loads (Outer Hood Location)

Takeaways:

- [[ ]]
- The BWR/4-6 OEM designs are structurally more robust.

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2.3 Steam Dryer EPU Impact and RG 1.20 CVAP

- After the Quad Cities Units 1&2/Dresden Units 2&3 steam dryer failures, the EPU projects for the rest of the fleet have followed RG 1.20 guidance [[ ]]
- The NRC has recommended that the EPU fatigue analysis results show a factor of 2.0 margin to the ASME fatigue limit.
  - The factor of 2.0 margin was included primarily to address lack of benchmarking in indirect acoustic load measurement techniques.
- [[

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- As the steam dryer analysis methodologies have matured and have been benchmarked against on-dryer measurements, [[

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- The previous GEH RSDs [[ ]] were [[ ]] with full CVAP performed.

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2.4 Replacement Steam Dryer Design Improvements

- GEH has designed the RSD with design improvements to maintain structural integrity at EPU conditions which includes:
  - [[

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Takeaways:

- As a result, the GEH RSD design is significantly more robust than the original steam dryer for Units 1 & 2.
- Design improvements address all locations experiencing fatigue cracking in the GEH fleet of OEM steam dryers.

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2.4 Replacement Steam Dryer Design Improvements (continued)

- All installed GEH RSDs qualified through vibration design/test/inspection program for prototype steam dryers as laid out in RG 1.20 Rev. 4 Appendix A (Rev. 4 captures the experience and lessons learned from these prototype programs).

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- Lessons learned from operating experience of each prototype RSD were factored into subsequent RSD designs.

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Takeaways:

- The GEH RSD design has been refined over multiple design iterations and has been demonstrated to have adequate fatigue margin under a variety of acoustic loading conditions.
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3.0 Hatch OEM/RSD and RG 1.20 CVAP

The following section will go into more detail about Hatch as it relates to the OEM dryer, RSD, and the EPU approach for the RSDs:

3.0 Hatch OEM/RSD and RG 1.20 CVAP

3.1 Steam Dryer OEM vs. GEH RSD Design: Geometric Comparison
3.2 Plant vs. Prototype RSDs: Plant Operating Conditions
3.3 Steam Dryer FIV Loads
3.4 RSD Evaluation Approach vs. NRC RG 1.20 CVAP
3.5 Transient and Accident Load Stress Qualification
3.6 Replacement Steam Dryer Inspections
3.7 Risk and Mitigation
3.8 Plan
3.9 Summary

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3.1 Steam Dryer OEM vs GEH RSD Design: Geometric Comparison

Component	Hatch Unit 1 OEM SD	Hatch Unit 2 OEM SD	[[ ]]	[[ ]]
Steam Dryer Hood Design	[[			
Support Ring – Inner/Outer Diameter				
Bank Height				
Bank to Bank Spacing				
Hood Entrance (Opening)				
Outer Hood Thickness				
Inner and Middle Hood Thickness				
Cover Plate Thickness				
Base Plate Thickness				
Bank Top Cap Thickness				
Inlet End Plate Thickness – Outer/Inner				
Bank End Plate Thickness – Outer/Inner				
Hood Support Thickness				
Skirt Thickness/Drain Channel Thickness				
Support Ring – Height x Width				
Skirt Ring – Height x Width				]]

Takeaway:

- The Hatch RSD adds [[ ]]

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3.2 Plant vs Prototype RSD: Plant Operating Conditions

Component	[[ ]] EPU	[[ ]][1] EPU	[[ ]][2] EPU	[[ ]] EPU	[[ ]] EPU	[[ ]] EPU
Rated Core Thermal Power (MWt)	2957	3952	3952	4408	2960	2960
Thermal Power: % of OLTP	18% increase	20% increase	20% increase	15% increase	21.5% increase	21.5% increase
EPU Approval Year	2001	2017	2008	2012	-	-
[[						
						]]

(1) [[ ]] EPU" is an RSD named due to its earlier construction date for [[ ]] and has a Mark I containment. Note that [[ ]] EPU" would be most similar to the [[ ]] EPU" plant in terms of general plant setup.
(2) [[ ]] EPU" is an RSD named due to its later construction date for [[ ]] and has a Mark II containment.

Takeaways:

- The comparison shows that [[ ]]
- The MSL steam flow velocity and steam flow area for [[ ]]
- Therefore, the [[ ]]

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3.3 Steam Dryer FIV Loads

Loads	Design	Hatch Units 1 & 2
[[		
		]]

[[

RSD EPU Projected PSD Loads Comparison: [[ ]] (Entire Dryer)

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Takeaways:

- The comparison shows that [[ ]]
- Most notable is that the MSL flow velocity for [[ ]]

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3.3 Steam Dryer FIV Loads

- Expected Hatch EPU FIV Loads for Units 1 & 2 -versus- GEH Prototype RSD Loads
  - Hatch Units 1 & 2 RPV diameter is 218 inches as compared to the successful 251-inch diameter GEH prototype RSDs. However, [[
    ]]
  - [[ ]] in the Hatch RSD has increased significantly as compared to the OEM dryers for Hatch Units 1 & 2 in identified critical locations such as the outer hood, cover plate, end plates, hood supports, etc.
  - The MSL steam flow for EPU at [[
    ]]
  - The range of acoustic and FIV load conditions for [[ ]]
  - [[ ]]

Takeaway:

- As a result, [[
  ]]
- Based on GEH OEM and RSD operating experience along with successful CVAP of the GEH prototype RSDs, the Hatch Units 1 & 2 RSD meets RG 1.20.

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3.4 RSD Evaluation Approach vs. NRC RG 1.20 CVAP

- **RG 1.20 CVAP Appendix A – "Prototype" Steam Dryer**
  1) A comprehensive vibration and stress analysis program,
  2) An extensive vibration measurement program, and
  3) A full inspection program

- **Previous GEH Replacement Steam Dryers are [[ ]]**
  - Steam dryers are non-safety related components; however, the GEH RSDs followed the [[ ]] RG 1.20 guidelines for structural integrity for the past EPU programs.
  - Previous GEH EPU RSD projects, the NRC recommended analysis, instrumentation and inspections.
    - [[ ]] RSDs were retrofit after EPU due to OEM dryer [[ ]].
    - [[ ]] RSDs performed predictive structural analyses based on plant-specific measurements as part of the EPU license submittal.
  - Previous GEH RSDs have met the key RG 1.20 standards:
    - "Successful CVAP including analysis, extensive measurement, full inspection and no adverse vibration effects".
    - "No evidence of loose parts, cracking, unacceptable motion, or significant wear following the inspection program".

Takeaway:

- Therefore, the previous GEH RSDs are now classified as [[ ]]

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3.4 RSD Evaluation Approach vs. NRC RG 1.20 CVAP

- **Hatch Units 1 & 2 GEH Replacement Steam Dryer [[ ]]:**
  - The significant structural margin improvements achieved with the GEH prototype RSD design and iterations.
  - Variety of EPU plant loads included in the GEH prototype RSD development basis.
  - Successful validation of GEH acoustic and stress analysis methodologies used to develop the RSDs.
  - Years of successful operating history at EPU for both the fleet OEM and RSDs.
  - [[

    ]]
  - Using the RG 1.20 categories:
    - The previous curved hood GEH RSDs are [[ ]]
    - The Hatch Units 1 & 2 RSD design [[ ]]

Takeaway:

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3.5 Transient and Accident Load Stress Qualification

- The Hatch RSD is significantly stronger than the Hatch OEM steam dryer and [[

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Takeaway:

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3.6 Replacement Steam Dryer Inspections

- The Hatch Replacement Steam Dryer Inspection Plan will be:
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Takeaway:

- Therefore, the proper inspection plans and procedures will provide adequate status of the RSD for Hatch Units 1 & 2.

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3.7 Risk and Mitigation

- Risk:
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- Risk Mitigation:
  - The increase in current thermal power to [[ ]]
  - The previous RSDs were designed for [[

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  - RSD design analysis methodology [[

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Takeaway:

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3.8 Plan

- Initial Plan for Hatch [[

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- Contingency Option 1 – [[

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- Contingency Option 2:
  - [[ ]]

Takeaway:

- [[ ]], contingency plans will be in place to address any issues.

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3.9 Summary

- FIV/Acoustic Loading
  - [[

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- The QC/Dresden OEM dryer [[
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- The GEH OEM dryer experience at EPU for the rest of the fleet has been satisfactory.
  - [[ ]]

- The GEH prototype RSD design has gone [[

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3.9 Summary

- [[

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Takeaway:

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4.0 EPU License Amendment Documentation

- EPU Licensing Documentation for GEH Prototype RSD plants submitted for NRC review/approval consisted of:
  - [[

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Takeaway:

- [[ ]]

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4.0 EPU License Amendment Documentation

- EPU Licensing Documentation for Hatch Units 1 & 2 RSD plants to be included in EPU LAR submittal consisting of:
  - [[

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Thank You!!

Hatch Replacement Steam Dryer Evaluation Approach for EPU Program