

PRA and ER/SAMDA

APR1400-E-P-EC-14005-NP
(Non-Proprietary)

PRA and ER/SAMDA

PRESENTERS

- **LPSD PRA**
 - ✓ Fire Level 1 Greg Rozga (30 min)
 - ✓ Flooding Level 1 Ross Anderson (30 min)
 - ✓ LPSD Level 2 Jeff Leary (30 min)
- **Risk Insights** Young In (20 min)
- **Conclusion** Young In (10 min)
- **ER/SAMDA** Young In (30 min)

PRA

- LPSD PRA
 - ✓ Fire Level 1
 - ✓ Flooding Level 1
 - ✓ LPSD Level 2
- Risk Insights
- Conclusion

LPSD Fire Level 1 PRA

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LPSD Fire Level 1 PRA

Progress to Date

- **Development of LPSD Fire PRA CCDP model**
 - includes addition of LPSD equipment, and their cables/cable routing
- **Calculation of fire compartment frequencies using NUREG/CR-7114 data**
- **Identification of fire-induced LPSD initiators for each fire compartment**
- **Qualitative screening of fire compartments which will not cause a LPSD initiator**
- **CDF calculation for single compartment events**
- **Detailed analysis of Turbine Building Fires (fires capable of LOOP or loss of 4KV bus events)**
- **Initiated detailed analysis of MCR fires**
- **Initiated Multi-Compartment Analysis (MCA)**
 - MCA analysis includes fire compartments which were previously screened

LPSD Fire Level 1 PRA

Initial Results

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LPSD Fire Level 1 PRA

POS Evaluation

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LPSD Fire Level 1 PRA

HRA Evaluation

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LPSD Fire Level 1 PRA

HRA Evaluation

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LPSD Fire Level 1 PRA

Fire-Induced Initiator Evaluation

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LPSD Fire Level 1 PRA

Fire-Induced Initiator Evaluation

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LPSD Fire Level 1 PRA

Fire Compartment Evaluation

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LPSD Fire Level 1 PRA

Conclusion

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LPSD Flooding Level 1 PRA

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LPSD Flooding Level 1 PRA

● Analysis Strategy

- Identify LPSD initiating events
- Identify and quantify appropriate flood frequencies
- Identify vulnerable equipment
- Integrate unique configurations in each POS
- Credit recoveries where appropriate
- Quantify CDF

● Results to date

- Overall results
- Results by Plant Operating State
- Results by “group”

LPSD Flooding Level 1 PRA

Flooding Initiating Events

- Requires or forces an immediate change in shutdown cooling configuration
 - Train “A” is assumed to be in service in POS 3a through 7
 - Train “B” is assumed to be in service in POS 9-13
- Analysis will quantify loss of Train “A” before offload and loss of Train “B” afterward
 - SCENARIO DEVELOPMENT NOTEBOOK identifies vulnerable equipment during each potential flood (SC pumps and their power supplies)
- A flooded pump or power supply is assumed to be unrecoverably lost

LPSD Flooding Level 1 PRA

Flooding Plant Operating States

- **POS 1 and 15 are screened out**
 - Low power, with secondary cooling available
 - Short duration (limited exposure)
- **POS 2 and 14 are screened out**
 - Subcritical, with secondary cooling available
 - Short duration (limited exposure)
- **POS 7-9 are screened out**
 - Cavity is flooded
 - Very long operator recovery times available

LPSD Flooding Level 1 PRA

Flooding “Groups”

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LPSD Flooding Level 1 PRA

More on LPSD Flooding

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LPSD Flooding Level 1 PRA

More on LPSD Flooding

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LPSD Flooding Level 1 PRA

More on LPSD Flooding

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LPSD Flooding Level 1 PRA

Flooding Results to Date

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LPSD Flooding Level 1 PRA

Preliminary Flooding Results by POS

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LPSD Flooding Level 1 PRA

Preliminary Flooding Results by “Group”

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LPSD Flooding Level 1 PRA

Flooding Observations

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LPSD Flooding Level 1 PRA

Most Significant Flood Sources

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LPSD Level 2 PRA

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LPSD Level 2 PRA

LPSD Level 2

- **LPSD Internal Events**

- Updates to methodology since previous meeting
- Phenomena considered in LPSD Level 2
- Ongoing Analyses
- Key Assumptions
- Draft Baseline Results
- Draft Results When No Credit Given to Closing Equipment Hatch

- **LPSD L2 Internal Floods**

- **LPSD L2 Fire**

- **Summary**

LPSD Level 2 PRA

LPSD L2 – Updates to Methodology

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LPSD Level 2 PRA

LPSD L2 – Updates to Methodology (Cont.)

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LPSD Level 2 PRA

17th Pre-application Review Meeting

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LPSD Level 2 PRA

LPSD L2 – Phenomena Considered

- Containment Hatch closure considered for POSs with hatch open
- Containment bypass (purification line rupture) and containment isolation
- Cavity flooding (SAMG action)
- Core melt arrest in-vessel if SI initiated per SAMGs
- Alpha-mode containment failure (modeled consistent with at-power low pressure core damage sequences)

LPSD Level 2 PRA

LPSD L2 – Phenomena Considered (Cont.)

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LPSD Level 2 PRA

LPSD L2 – Ongoing Analyses

- **Hydrogen calculations being performed to determine appropriate success criteria of PARs (and igniters, if necessary)**
 - With the RCS intact and with it open
 - With H2 mass = 150% clad oxidation and with mass as predicted by accident analysis
 - With and without containment sprays
 - Will possibly change H2 success criterion and CPLR given failure
- **Possible credit for offsite power recovery that was not credited in Level 1 (e.g., LP event tree for cutsets with diesel failures, LX event tree for containment sprays)**

LPSD Level 2 PRA

LPSD L2 Continuing Analyses (Cont.)

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LPSD Level 2 PRA

LPSD L2 – Key Assumptions

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LPSD Level 2 PRA

LPSD L2 Key Assumptions (Cont.)

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LPSD Level 2 PRA

LPSD L2 Draft Baseline Results

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LPSD Level 2 PRA

LPSD L2 Baseline Results (Cont.)

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LPSD Level 2 PRA

LPSD L2 Baseline Results (Cont.)

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LPSD Level 2 PRA

LPSD L2 Baseline Results (Cont.)

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LPSD Level 2 PRA

LPSD L2 Baseline Results (Cont.)

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LPSD Level 2 PRA

LPSD L2 Draft Results When No Credit For Closing Hatch

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LPSD Level 2 PRA

LPSD L2 Internal Flood Analysis

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LPSD Level 2 PRA

LPSD L2 Fire Analysis

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LPSD Level 2 PRA

LPSD L2 Summary

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Risk Insights

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PRA

Risk Insights

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PRA

Conclusion

- **Draft results for following assessments presented**
 - LPSD Fire PRA Level 1
 - LPSD Flooding PRA Level 1
 - LPSD Level 2
- **Preliminary risk insights**

Environmental Report (SAMDA)

- Background
- Process
- Initial screening review
- Conclusion

ER/SAMDA

NRC Comments from Acceptance Review

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ER/SAMDA

NRC Comments from Acceptance Review

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ER/SAMDA

Process Overview

- **SAMDA Implementation Procedure**

- DC-DG-03-23
- Requires review and approval by the Change Control Board (CCB)

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ER/SAMDA

SAMDA review process

- **Initial Screening**

- Review potential SAMDA candidate list
 - Generic items based on NEI 05-01
 - Design specific items
- Select candidates for further evaluation
 - May need risk sensitivity analysis

- **Final Screening**

- Select final items for SAMDA calculation

ER/SAMDA

Initial screening review

- **Review potential SAMDA candidate list**
 - Generic items with potential discrepancies
 - Design specific items
- **Develop Unscreened Items**
 - Candidates for further evaluation
 - May need risk sensitivity analysis
- **Items for further evaluation**
 - Select final items for SAMDA calculation

ER/SAMDA

Design Specific SAMDA List

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ER/SAMDA

Conclusion

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THANK YOU!