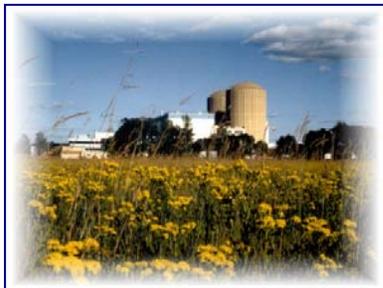




# **ALTERNATIVE SOURCE TERM Steam Generator Tube Rupture Margin to Overfill Evaluation**



## **Prairie Island Nuclear Generating Plant**

**August 25, 2010**

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## Attendees

Lynne Gunderson	Projects Licensing Manager
Tom Verbout	AST Project Manager
Steve Thomas	AST Technical Lead
Oley Nelson	SGTR MTO Subject Matter Expert
Amy Hazelhoff	Senior Licensing Engineer

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## Meeting Purpose

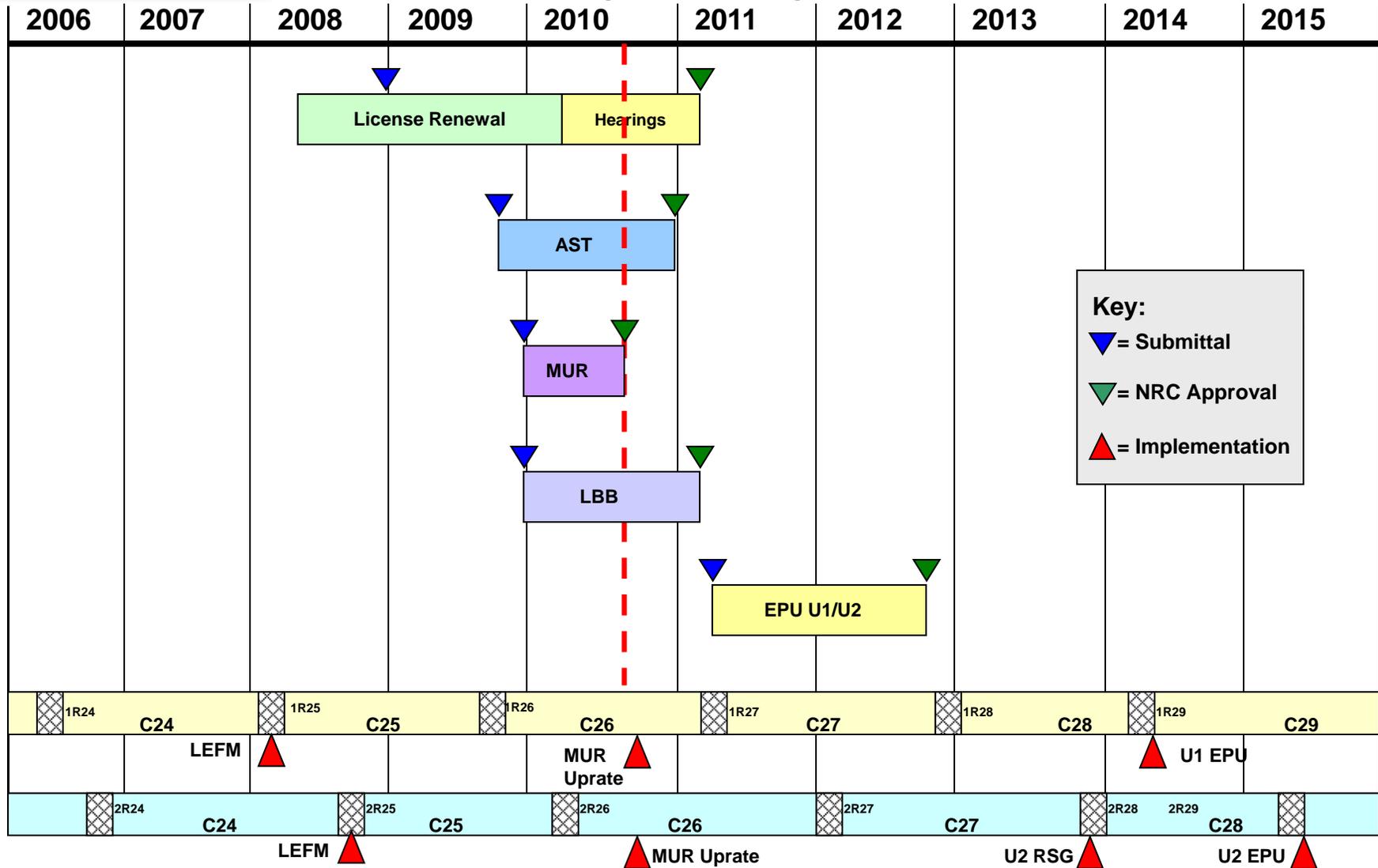
- Discuss the PINGP SGTR MTO licensing basis and RG 1.183 applicability
- Discuss the PINGP SGTR MTO evaluation
- Gain mutual understanding of path forward

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## Agenda

- PINGP Background
- AST LAR and RAI Background
- Overview of PINGP SGTR MTO Licensing Basis
- RG 1.183 Applicability
- NRC Concerns with 5/25/10 RAI Response
- Specific Aspects of SGTR MTO Evaluation
- Path Forward

# PINGP Major Projects Schedule



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## PINGP Background

- Designed prior to the GDC being issued in 10 CFR 50 Appendix A
- Designed and constructed to the draft AEC GDC as proposed July 10, 1967
- Not licensed to NUREG-0800 or NUREG-75/087, “Standard Review Plan”
- Not an SEP plant

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## AST LAR and RAI Background

- AST LAR
  - Submitted October 2009 (ADAMS #ML093160583)
  - Six accident sequences analyzed for radiological consequences, including SGTR
  - Radiological Consequence Analyses per RG 1.183
  - SGTR radiological consequence analysis discussion in LAR included discussion of SGTR MTO evaluation
    - Based on discussion with the NRC during the pre-application meeting

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## AST LAR and RAI Background

- NRC RAI on SGTR MTO Evaluation – March 2010
  - Requested Details Regarding:
    - Methods used in evaluation
    - Input parameters and values
    - Operator action times credited
    - Single failure considerations
    - Results
- NSPM Responded to RAI in May 2010
  - ADAMS Accession #ML101460064

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## Overview of PINGP SGTR MTO Licensing Basis

USAR, Section 14.5.4.1 states:

*“The recovery procedure can be carried out in a time scale which ensures that break flow to the secondary system is terminated before water level in the affected steam generator rises into the main steam pipe. Sufficient indications and controls are provided to enable the Operator to carry out these functions satisfactorily.”*

USAR Section 14.5.4.5 states:

*“There is ample time to carry out the above recovery procedure such that isolation of the ruptured steam generator is established before water level rises into the main steam pipes. Normal operator vigilance assures that excessive water level will not be attained.”*

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## Overview of PINGP SGTR MTO Licensing Basis

- USAR relies on recovery procedures and operator response to ensure ruptured steam generator is not overfilled
- SGTR MTO evaluation not considered a safety analysis within licensing basis
- Purpose of MTO evaluation is to demonstrate that operator response using recovery procedures with conservative inputs and assumptions precludes overfilling ruptured steam generator

## RG 1.183 Applicability

RG 1.183 Section 5.1.4, “Applicability of Prior Licensing Basis,” states:

*“The NRC staff considers the implementation of an AST to be a significant change to the design basis of the facility that is voluntarily initiated by the licensee. In order to issue a license amendment authorizing the use of an AST and the TEDE dose criteria, the NRC staff must make a current finding of compliance with regulations applicable to the amendment. The characteristics of the ASTs and the revised dose calculational methodology may be incompatible with many of the analysis assumptions and methods currently reflected in the facility’s design basis analyses. The NRC staff may find that new or un-reviewed issues are created by a particular site-specific implementation of the AST, warranting review of staff positions approved subsequent to the initial issuance of the license. This is not considered a backfit as defined by 10 CFR 50.109, “Backfitting.” However, prior design bases that are unrelated to the use of the AST, or are unaffected by the AST, may continue as the facility’s design basis. Licensees should ensure that analysis assumptions and methods are compatible with the ASTs and the TEDE criteria.”*

## RG 1.183 Applicability

RG 1.183 Section 1.3.2, “Re-Analysis Guidance,” helps to determine if an analysis is affected by AST:

*“An analysis is considered to be affected if the proposed modification changes one or more assumptions or inputs used in that analysis such that the results, or the conclusions drawn on those results, are no longer valid.”*

–Thus, an analysis is affected if the assumptions or inputs are changed which requires the analysis to be revised

## RG 1.183 Applicability

Changes made to SGTR Radiological Consequence Analysis for AST:

- Source Term
- Transport Calculation
  - Break flow through ruptured SG tube
  - Steam release from ruptured SG
  - Steam release from intact SG
- Control Room Dose Considered

## RG 1.183 Applicability

MTO evaluation was not affected by the revised SGTR radiological consequence analysis:

- Non-conservative to use SGTR radiological consequence analysis transport calculation for the MTO evaluation
- No impact to RCS/SG differential pressures
- No impact to AFW and SI flow rates
- No impacts to system volumes
- No changes to Operator Recovery Procedures

## RG 1.183 Applicability

Conclusion:

- No changes to inputs or assumptions in MTO evaluation
- MTO evaluation was not affected by AST analyses
- Therefore, acceptable to retain the current design basis for the MTO evaluation for AST

## RG 1.183 Applicability

- Discussion

## Discussion of NRC Concerns on RAI Response

- *Use of the simulator for the SGTR MTO analysis was not consistent with the guidance of SRP Section 15.0.1.6.C*
- *Data comparison showed that the calculated operator action times were significantly shorter than that calculated by using the NRC-approved methods for two similar Westinghouse 2-loop plants*
- *Use of the simulator for the MTO analysis was not consistent with the licensing basis as the current basis was changed by adopting the AST methodology that reduced the conservatisms in the current dose analysis*

## Discussion of NRC Concerns on RAI Response

- *Use of the simulator for the SGTR MTO analysis was not consistent with the guidance of SRP Section 15.0.1.6.C*
  - Designed prior to the GDC being issued in 10 CFR 50, Appendix A
  - Not licensed to NUREG-0800, “Standard Review Plan”
  - SGTR MTO evaluation substantiates the licensing basis
  - Simulator was only used to determine operator action times
  - Operator action times were used as inputs to the evaluation method and were not part of the method
  - Methods used provide conservative results

## Discussion of NRC Concerns on RAI Response

- *Data comparison showed that the calculated operator action times were significantly shorter than that calculated by using the NRC-approved methods for two similar Westinghouse 2-loop plants,*
  - Operator action times were recorded for each operating crew instead of being calculated
  - Evaluation performed using each crew's times to ensure that each crew could complete recovery procedures before the water could enter the main steam pipe
  - PINGP has implemented procedural changes in recent years to enhance operator performance
  - Use of operator times based on the recovery procedures to conservatively demonstrate that the steam generator will not be overfilled is consistent with the licensing basis

## Discussion of NRC Concerns on RAI Response

- *Use of the simulator for the MTO analysis was not consistent with the licensing basis as the current basis was changed by adopting the AST methodology that reduced the conservatisms in the current dose analysis*
  - SGTR Radiological Consequence Analyses and SGTR MTO Evaluation are two separate evaluations
  - Consistent with RG 1.183
    - SGTR MTO evaluation was not affected by analyses performed for the AST LAR
    - Acceptable to retain current design and licensing basis for SGTR MTO evaluation

## Conclusion

- SGTR MTO evaluation was not affected by AST analyses
  - No changes to inputs or assumptions used in SGTR MTO evaluation as a result of the AST analyses
- Consistent with RG 1.183, it is considered acceptable to retain current licensing and design basis for SGTR MTO evaluation

# Technical Discussion

## Specific Aspects of the SGTR MTO Evaluation

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## Specific Aspects of the SGTR MTO Evaluation

- The SGTR MTO evaluation is performed to substantiate the licensing basis
- SGTR MTO uses a conservative evaluation methodology coupled with conservative inputs and assumptions to provide conservative results
- SGTR MTO evaluation does not solely rely on the simulator
- Methods, assumptions, inputs and results are summarized on the following slides

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## Specific Aspects of the SGTR MTO Evaluation

### Methods

- Evaluation is based on standard engineering principles:
  - Determine available volume in ruptured SG
  - Determine volume injected into ruptured steam generator
    - Operator action times measured to reach specific steps (SI, Isolate AFW Flow, Break Flow Terminated) in the recovery procedures for each crew
    - Conservative design flow rates used
  - $MTO = \text{Available Volume} - \text{Total volume Injected}$

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# Specific Aspects of the SGTR MTO Evaluation

## Key Assumptions and Inputs

- High Initial SG Level + Instrument Uncertainties
  - Provides for maximum liquid volume; i.e., minimum available volume
- Maximum AFW flow rate
  - Conservative injection rate to ruptured SG
- Maximum SI flow rate
  - Conservative injection rate to RCS

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## Specific Aspects of the SGTR MTO Evaluation

### Key Assumptions and Inputs (continued)

- Flow rate through ruptured SG tube determined based on static differential pressure
  - Results in high flow rate into ruptured SG
  - Two time periods considered
    - Prior to SI and after SI
- No credit for steam release from ruptured SG
  - Provides for minimum margin to overflow
- Timing for Operator Actions
  - Times for each crew performing recovery procedures using plant simulator

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## Specific Aspects of the SGTR MTO Evaluation

### Results:

- Demonstrate each crew can complete required actions in the recovery procedures prior to water level in affected steam generator reaching main steam pipe
- Available margin varies by crew
- Consistent with licensing basis as described in USAR
  - Operators using recovery procedures preclude SG overfill

# Path Forward

- Discussion

