Enhanced Schedule and Plan for US-APWR Strainer Design

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Current Schedule and Plan (1/2)

Current Status and Plan for Sump Strainer Design (based on MHI March 20, 2008 letter) :

- Design of the strainer was described in Sections 6.2 and 6.3 of the DCD.
- Technical information for the strainer's performance was provided in Technical Report (MUAP-08001, Feb. 27, 2008) to respond to the NRC's requested information.
- Additional detail design and structural analysis results were scheduled to be provided by Sept. and Nov. 2008, respectively.
- Confirmatory tests (for chemical effect and debris head loss) results were scheduled to be provided by June 2009.

Current Schedule and Plan (2/2)

NRC March 25, 2008 draft review schedule:

- Phase 2 (draft SER for Chapters 6 and 15) for sump strainer completed by August 2010.
- Draft review schedule does not take into account new information provided by MHI in March 20, 2008 letter.

MHI's plan:

- Although NRC's current draft schedule does not account for this new information, MHI believes new information should take sump strainer issue from the critical path. However, MHI will take further actions to enhance the safety margin and to shorten the schedule.

Updated Schedule

MHI's further response to the NRC draft review schedule:

- All of the committed reports will be submitted by the end of 2008. (6 months earlier than MHI's March 20, 2008 commitment.)

=> Shorter review schedule for Chapters 6 and 15.

Approach to meet the above schedule:

- Further improve the sump strainer design:
  - ✓ Further reduce the use of fibrous insulation
  - ✓ Enlarge the strainer surface area

=> Reduce fibrous debris bed (to be less than 1/8")

=> No further head loss testing expected (bounded by existing test)

Updated Plan (1/2)

Evaluation Area	Original MHI Commitment (March 20, 2008 letter)	Updated Plan
1. Description of Strainer	Sept-2008: Additional detail design information	Sept-2008: Updated and additional detail design information
2. Break Selection	No new assessment*	No new assessment*
3. Debris Generation	No new assessment*	Sept-2008: Re-evaluation
4. Debris Characteristics	No new assessment*	Sept-2008: Re-evaluation
5. Debris Head Loss	[Design Information] Sept-2008: Additional Evaluation [Confirmation Test] Jan-2009: Test Plan Mar-2009: Audit/Observation Jun-2009: Test Results	Sept-2008: Bounding evaluation using existing test data

*: No new assessment from the initial Technical Report (MUAP-08001, Feb. 27, 2008)

Updated Plan (2/2)

Evaluation Area	Original MHI Commitment (March 20, 2008 letter)	Updated Plan
6. Net Positive Suction Head	No new assessment*	Sept-2008: Re-evaluation
7. Downstream Effects	No new assessment*	Dec-2008: Additional Evaluation
8. Upstream Effects	No new assessment*	Sept-2008: Re-evaluation
9. Chemical Effects	[Design Information] Sept-2008: Further Assessment [Confirmation Test] Jun-2008: Test Plan Nov-2008: Audit/Observation Apr-2009: Test Results	[Confirmation Test] Jun-2008: Test Plan Sept-2008: Audit/Observation Nov-2008: Test Results
10. Structural Analysis	Nov-2008: Stress Analysis report	Nov-2008: Stress Analysis report

*: No new assessment from the initial Technical Report (MUAP-08001, Feb. 27, 2008)

Sump Strainer Design (1/4)

Extremely Low Debris Sources

Amount of fibrous and particulate debris is generally lower than operating plants.

- Use of Reflective Metal Insulation (RMI) is maximized, minimal fibrous insulation is used. **(Use of fiber insulation will be reduced further.)**
- Insulation made of Cal-Sil is excluded from containment.
- Only qualified protective coatings permitted in containment.

Avoid Using Problematic Chemicals and Substances

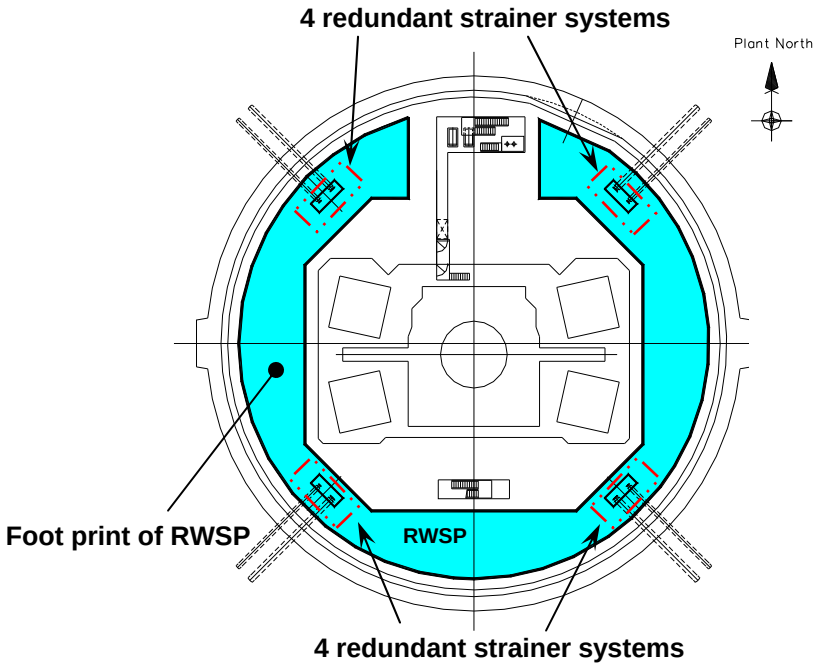
New plant can reduce the use of aluminum and other chemical species (such as NaOH).

- Sodium Tetra-borate (NaTB) used as a buffer agent.
- Interior concrete walls are lined with steel.

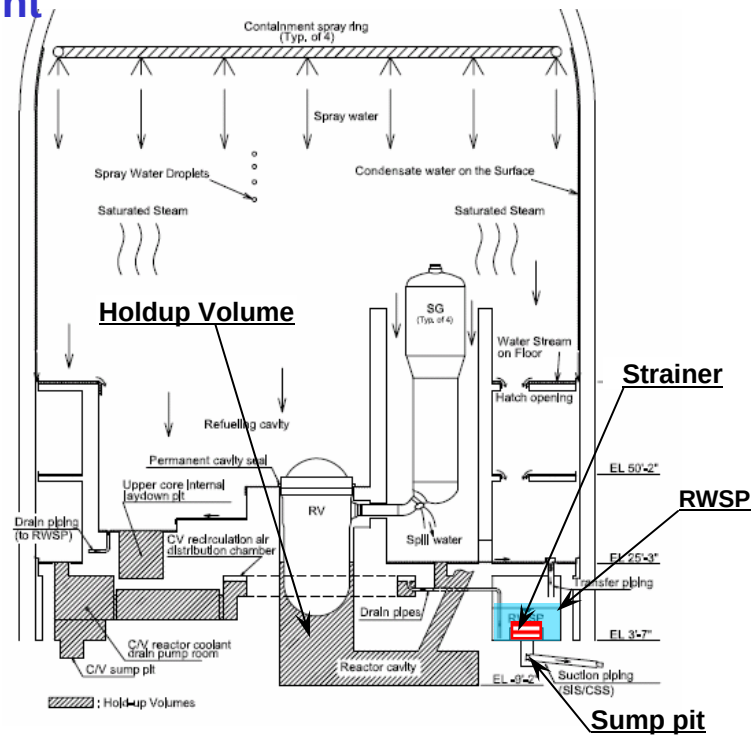
Sump Strainer Design (2/4)

Robust Arrangement of Strainer Systems

- 4 redundant passive strainer systems, with 2,150(ft^2) of surface area of each, are located in RWSP. (The surface area will be enlarged further.)
- Initial water volume of RWSP is 651,000 gallons. No switch over to recirculation required.
- Large foot-print of RWSP allows enlarging each strainer, without impact to equipment or usable space in containment



Plan view RWSP



Section view of Containment

Sump Strainer Design (3/4)

Conservative Evaluations

US-APWR applies more conservative assumptions than operating plants in the following evaluation areas :

Debris Generation

- All RMI installed on a Reactor Coolant Pipe (31') is considered to fail.
- 10D is assumed for failure of protective coatings.

Debris Transportation

- 100 % Fiber and Latent Debris transport is assumed.

Debris Head Loss

- 66% of all debris assumed on one of two available trains.

NPSH Evaluation

- Containment overpressure is NOT credited in the evaluation.

Sump Strainer Design (4/4)

Summary of Strainer Design

- The US-APWR sump strainer system will be a robust and conservative design that will incorporate recent lessons learned.
- Presence of potentially harmful chemicals inside containment will be minimal.
- Confirmatory chemical effects test and evaluations will be performed but are not expected to impact the design.
- MHI intends to make the identified design changes to enhance safety margin and permit shortening the strainer review schedule.

The final design will be simple, robust, and less sensitive to debris.

Overall Schedule

Evaluation Area	Updated Plan
1. Description of Strainer	Sept-2008: Updated and additional detail design information
2. Break Selection	No new assessment*
3. Debris Generation	Sept-2008: Re-evaluation
4. Debris Characteristics	Sept-2008: Re-evaluation
5. Debris Head Loss	Sept-2008: Bounding evaluation
6. Net Positive Suction Head	Sept-2008: Re-evaluation
7. Downstream Effects	Dec-2008: Additional Evaluation
8. Upstream Effects	Sept-2008: Re-evaluation
9. Chemical Effects	[Confirmation Test] Jun-2008: Test Plan Sep-2008: Audit/Observation Nov-2008: Test Results
10. Structural Analysis	Nov-2008: Stress Analysis report

*: No new assessment from the initial Technical Report (MUAP-08001, Feb. 27, 2008)

Key Technical Issues

US-APWR addresses key technical issues:

- **Debris generation and transport**
  - **Reducing debris load and making conservative transport assumptions**
- **Head loss testing**
  - **Expected to be bounded by existing tests**
- **Chemical effects**
  - **Confirmatory testing to be performed**
- **Downstream effects**
  - **Ex-vessel: Supplemental response to be submitted**
  - **In-vessel: Consistent with TR-WCAP-16793-NP**

Chemical Effect Test (1/2)

Purpose

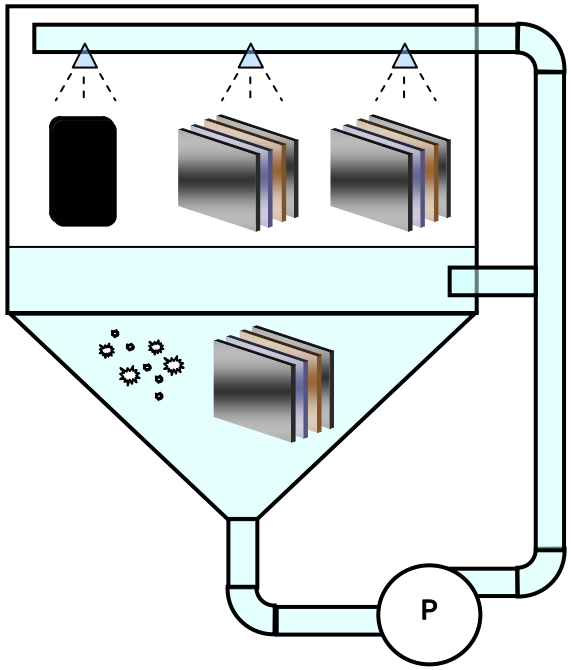
- Determine the characteristics and quantify the chemical precipitants expected during post-LOCA condition of the US-APWR.
- Confirm chemical impacts on downstream long term core cooling.

Test Plan

- The test plan will be available to the NRC in June 2008.
- NUREG/CR6914 will be used to establish the test plan.

Chemical Effect Test (2/2)

Evaluation of Chemical Impurities *



ICET based chemical effect test
NUREG-CR6914

*Corrosion or dissolution of system materials in containment, and its precipitate

- ✓ **Composition of chemical impurities determined by chemical effects testing will be applied to confirm the US-APWR design.**
- ✓ **Chemical precipitant properties and their effect on long term cooling will be evaluated.**

Downstream Effects (1/2)

- **The US-APWR core cooling flow features are very similar to the existing PWR plants.**
- **Impact on downstream components (including fuel) will be reduced by less debris compared with operating plants.**
- **Initial Technical Report "MUAP-080001 (R0) US-APWR Sump Strainer Performance" will be supplemented with additional details in the following areas:**

1. **Pump rotor dynamic stability and wear**
2. **Throttle valve and other mechanical components wear**
3. **System effects**
4. **In-vessel evaluation will be bounded by TR-WCAP-16793-NP**

Downstream Effects (2/2)

- System design features have the capability to address outcome of in-vessel effects issues.
- MHI will continue to carefully follow the resolution of the downstream effects issues and evaluate new information in a timely manner.

Summary

- MHI has presented an updated plan for submitting additional information to the NRC.
- MHI has used a robust simple design to enhance the safety margin and to shorten the schedule.
- Additional level of detail consistent with NRC expectations will be submitted.
- All activities will be finalized by the end of 2008.

=> Shorter review schedules for Chapters 6 and 15 are warranted.