Generic Safety Issue 191
Overview of Study
and
Overview of Results

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Public Meeting
Rockville, MD
July 26-27, 2001

Purpose of GSI-191 Study

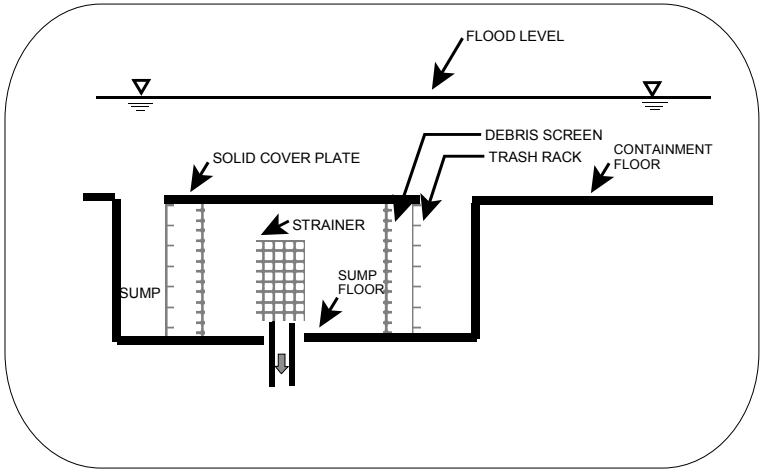
- Determine whether debris accumulation on sump screens will cause loss of net postive suction head (NPSH) margin following a loss-of-coolant accident (LOCA).

- Determine if further action needs to be taken for pressurized water reactors beyond what was done during the resolution of Unresolved Safety Issue A-43.

Description of Safety Concern

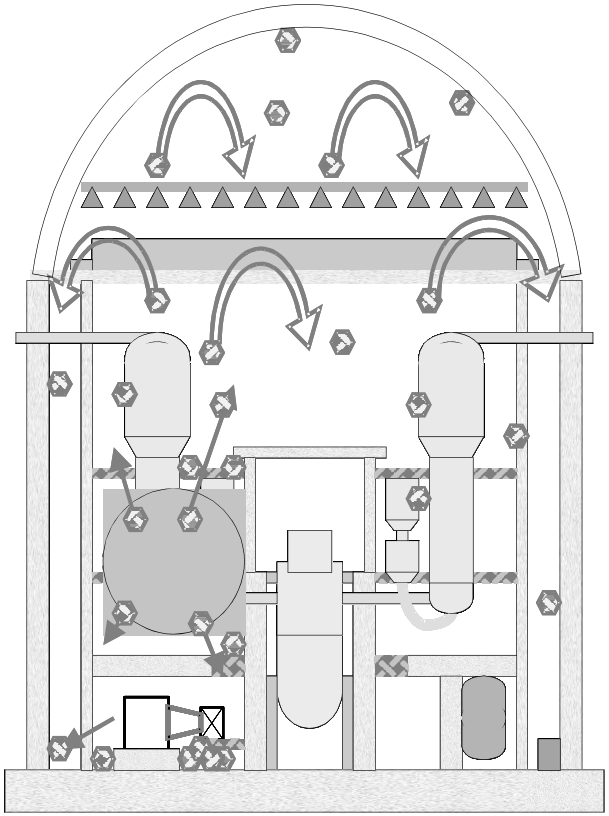
- The Accumulation of Debris on Sump Screens (or Strainers) Will Increase the Resistance Across the Screen (or Strainer) and Thus Reduce the Net Positive Suction Head Available to the Emergency Core Cooling System Pumps Drawing Suction From the Sump.

- The Accumulation of Debris at the Sump Screen May Form Dams That Prevent or Impede the Flow of Water Into the Sump and Thus the Water in the Sump Can Be Drawn Down Which Will Reduce the Net Positive Suction Head Available to the Emergency Core Cooling System Pumps and Effectively Reduce the Water Inventory in the Sump.



If the available net postive suction head for emergency core cooling system pumps is less than the required net postive suction head, then flow of cooling water may be reduced or prevented.

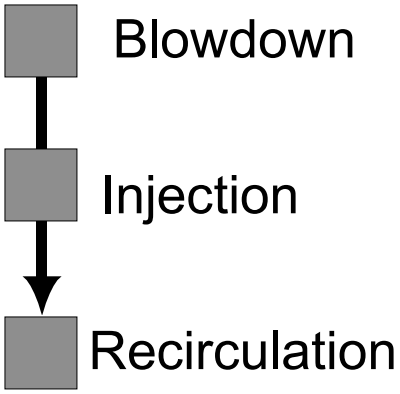
Basics of Postulated Accident



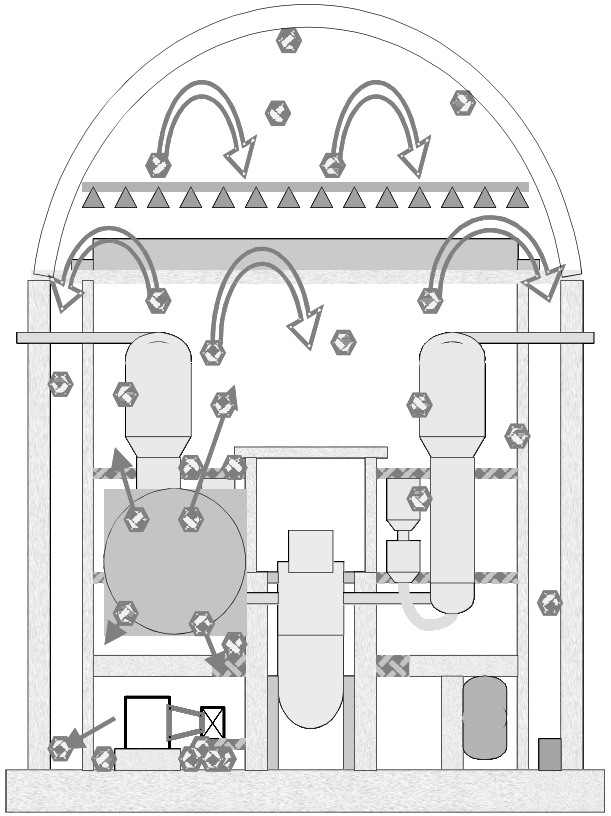
Postulated Accidents

- Large Loss of Coolant Accident
- Medium Loss of Coolant Accident
- Small Loss of Coolant Accident

Accident Progression

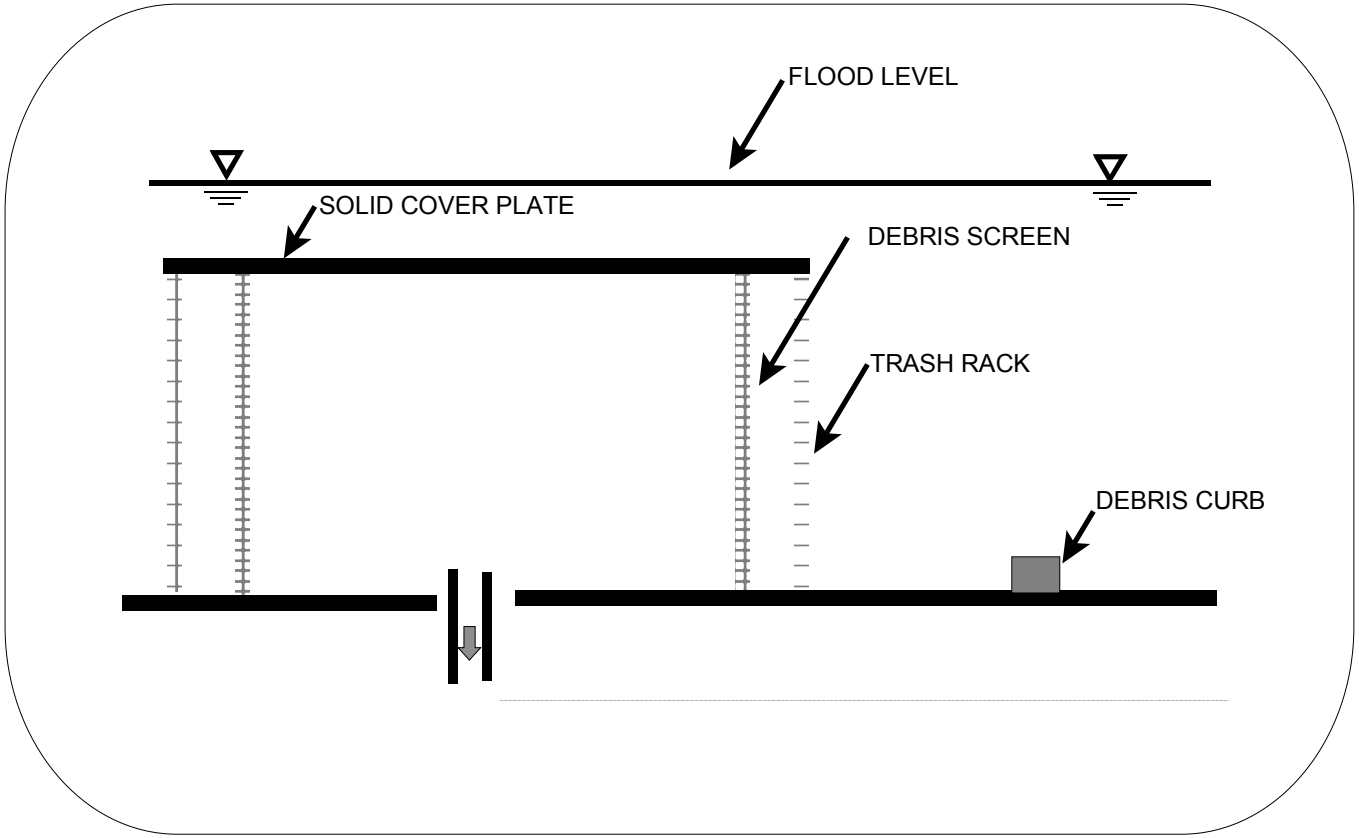


Basics of Debris Accumulation on Sump



- Identify Debris Sources
- Estimate Amount of Debris Generated
- Estimate Amount of Debris Transported
- Estimate Head Loss Caused by Debris
- Compare Head Loss to NPSH Margin
- Compare Head Loss to Height of Pool

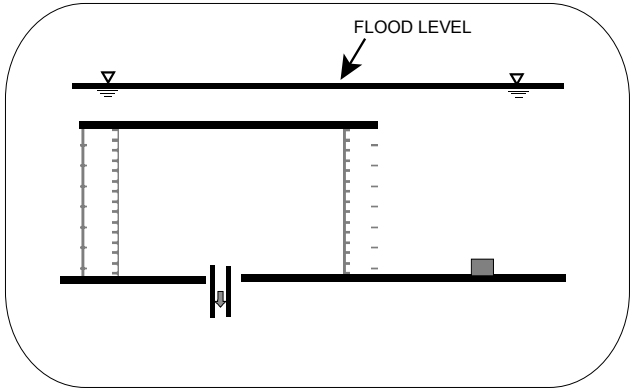
Description of an Emergency Sump



Definition of Sump Failure

- Fully Submerged Sump Screens

$$\Delta H_{screen} \geq NPSH_{margin}$$

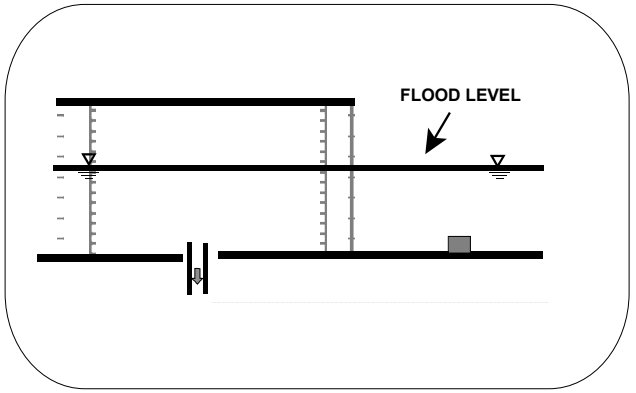


- Partially Submerged Sump Screens

$$\Delta H_{screen} \geq NPSH_{margin}$$

or

$$\Delta H_{screen} \geq \text{½ of pool height}$$



Sump failure is not synonymous with pump failure.

Preliminary Findings

- Some PWRs could lose NPSH margin, based on parametric calculations assuming LLOCA, MLOCA, and SLOCA

The 69 parametric cases developed for the GSI-191 parametric evaluation provide a reasonable representation of operating PWRs, so the results form a credible technical basis for making a determination of whether sump blockage is a generic concern for PWRs.

- The parametric calculations are not suitable for making a determination of NPSH margin loss due to debris accumulation at a specific PWR. They are suitable for drawing generic conclusions

Description of Work

Data Sources

- Containment and Sump Survey
- Phenomena Identification and Ranking Table Panel
- Two Volunteer Plants
- Generic Letter 97-04 Responses
- Individual Plant Evaluations
- Emergency Operating Procedures
- Updated Final Safety Analysis Reports
- MELCOR and RELAP Calculations

Testing

- Debris Transport
  - Large and Small Open Flume
  - Circular Tank
- Debris Generation
  - Jet Impact
  - Calcium Silicate

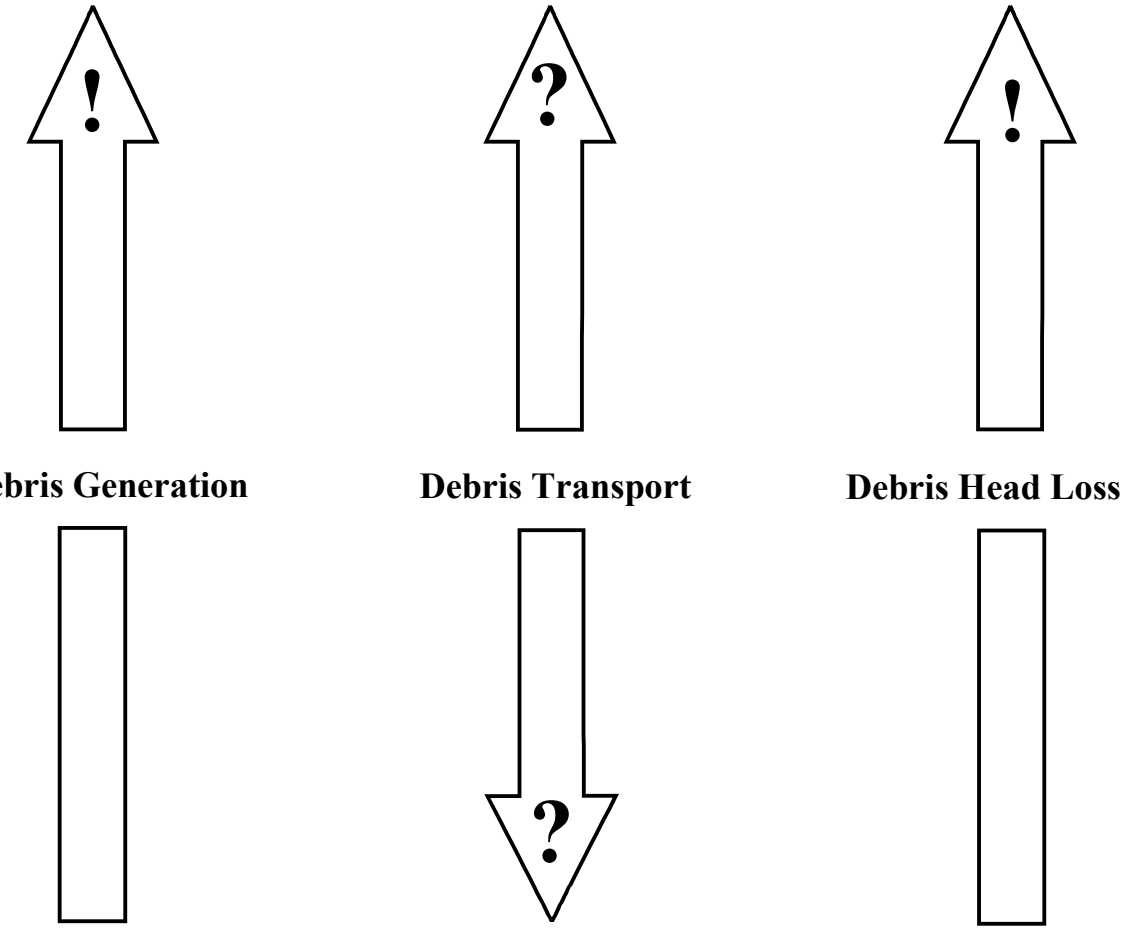
Calculations

(End Products)

- GSI-191 Parametric Evaluation
- GSI-191 “Generic” Risk Estimates

➽ Work to assess risk is ongoing and should be completed in August 2001.

Description of Work



Documentation of Work

Technical Letter Reports

(Available to Public)

- Phenomena Identification and Ranking Table for Debris Transport in Ice Condenser Containments
- Phenomena Identification and Ranking Table for Debris Transport in Large Dry Containments
- GSI-191 Parametric Evaluation

NUREG/CRs

(To Be Published in CY 2002)

- GSI-191 Parametric Evaluation
- GSI-191 Risk Estimates
- GSI-191 Containment and Sump Survey
- GSI-191 Debris Generation and Debris Transport Tests
- GSI-191 Review of Sump Blockage Tests and Analyses