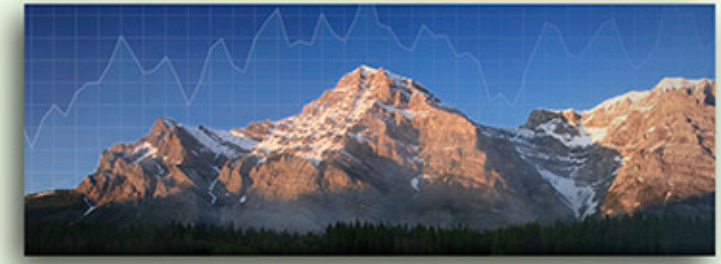
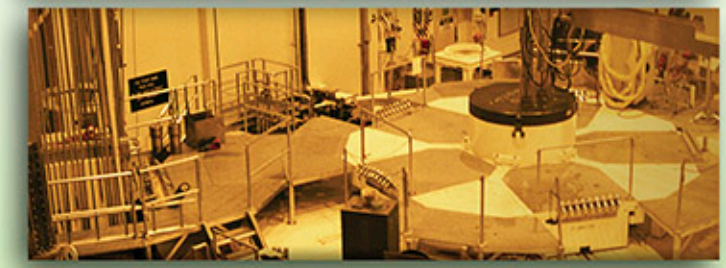



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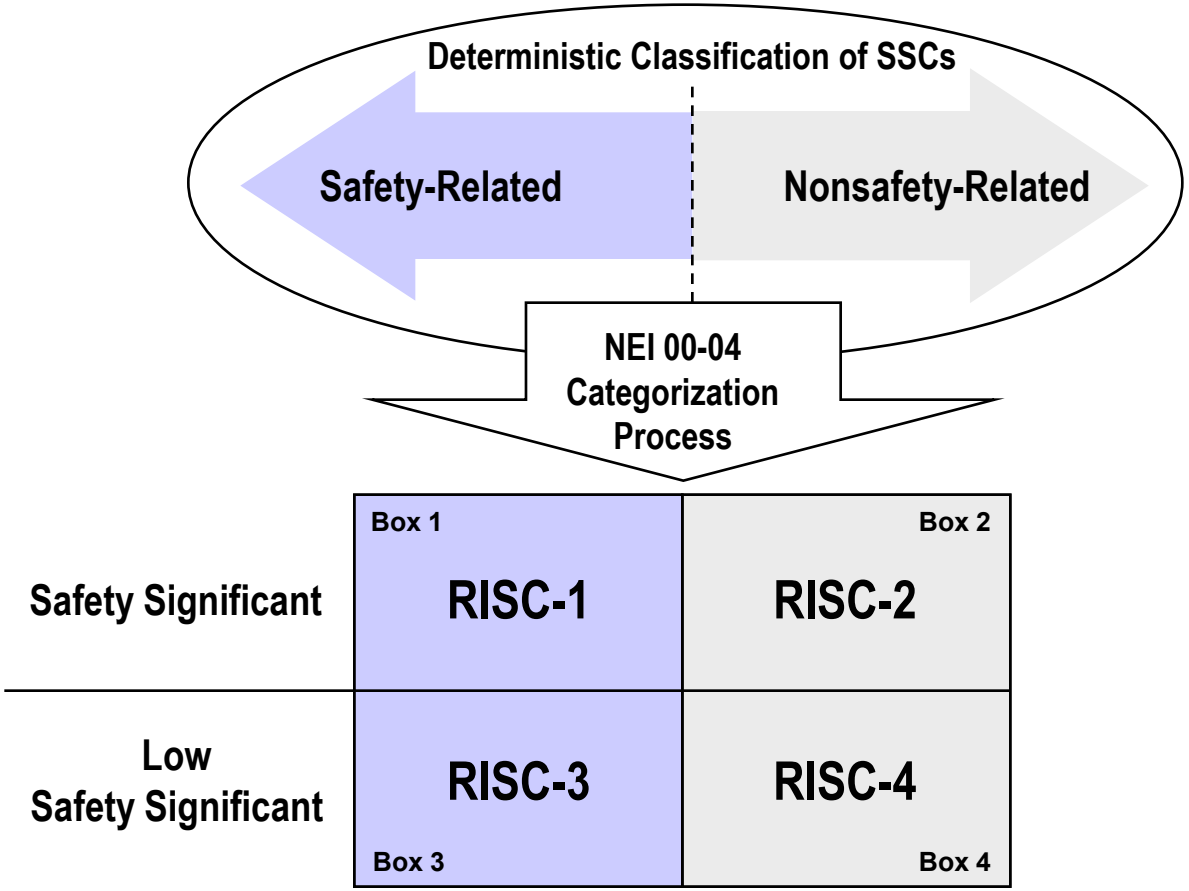
10CFR50.69
Tabletop Exercise for New Build

OUTLINE

10CFR50.69

1. Regulation and Methodology
2. Active Components Risk Classification
3. Passive Components Risk Classification
4. Risk Sensitivity

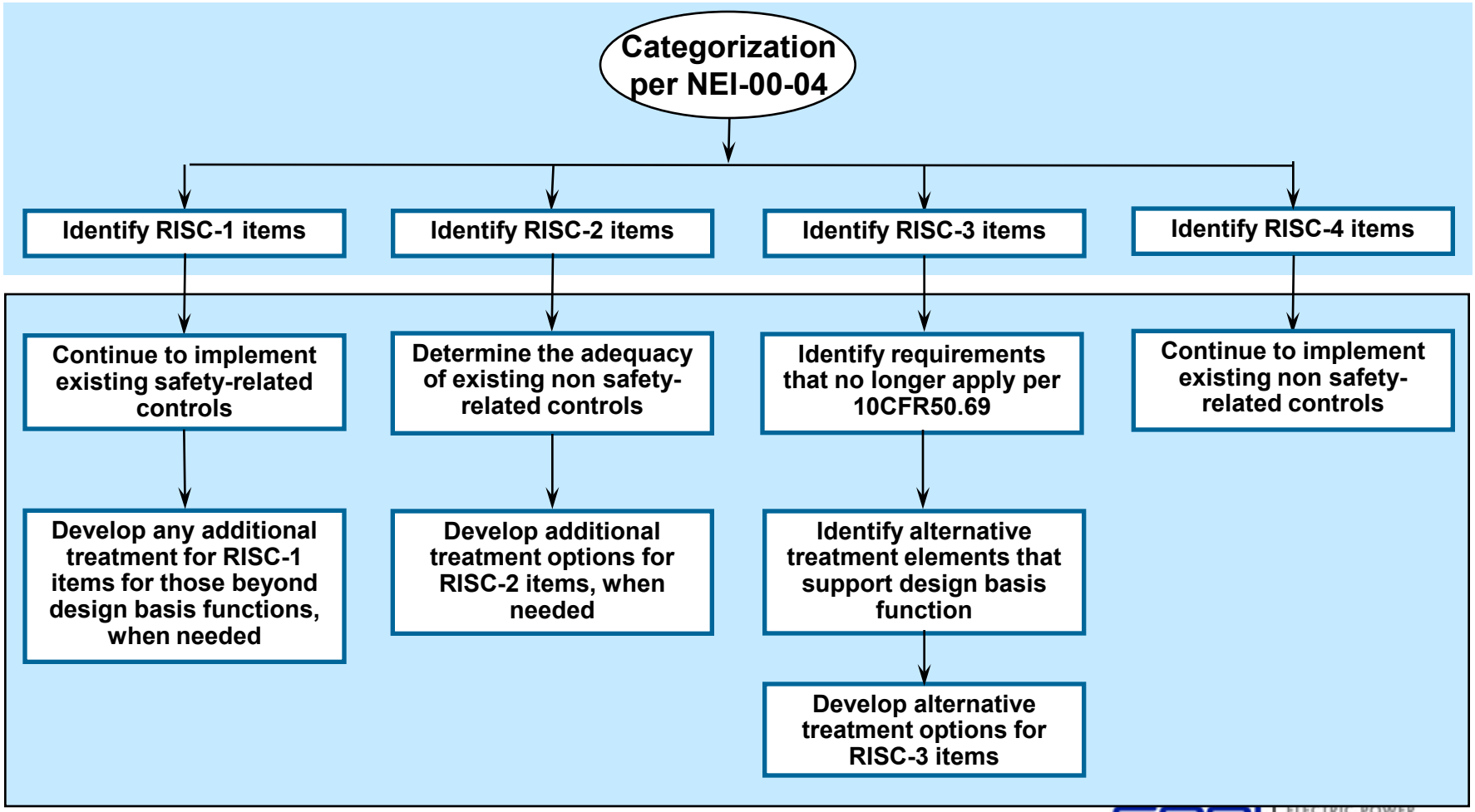
10CFR50.69 Rule



Risk Informed Safety Categorizations (RISC)

- RISC-1: SSCs that are safety-related and perform safety-significant functions
- RISC-2: SSCs that are non-safety-related and perform safety-significant functions
- RISC-3: SSCs that are safety-related and perform low safety-significant functions
- RISC-4: SSCs that are non-safety-related and perform low safety-significant functions

Overview of 10CFR50.69 Implementation



RISC-1 SSCs Treatment

- Applicable special treatment requirements continue to apply to these SSCs
- RISC-1 SSCs may also be credited in performing some beyond design basis function
- The licensee or applicant shall ensure that RISC–1 and RISC–2 SSCs perform their functions consistent with the categorization process assumptions by evaluating treatment being applied to these SSCs to ensure that it supports the key assumptions in the categorization process that relate to their assumed performance.

RISC-2 SSCs Treatment

- Applicable special treatment requirements, if any, continue to apply to these SSCs.

- The licensee or applicant shall ensure that RISC–1 and RISC–2 SSCs perform their functions consistent with the categorization process assumptions by evaluating treatment being applied to these SSCs to ensure that it supports the key assumptions in the categorization process that relate to their assumed performance.

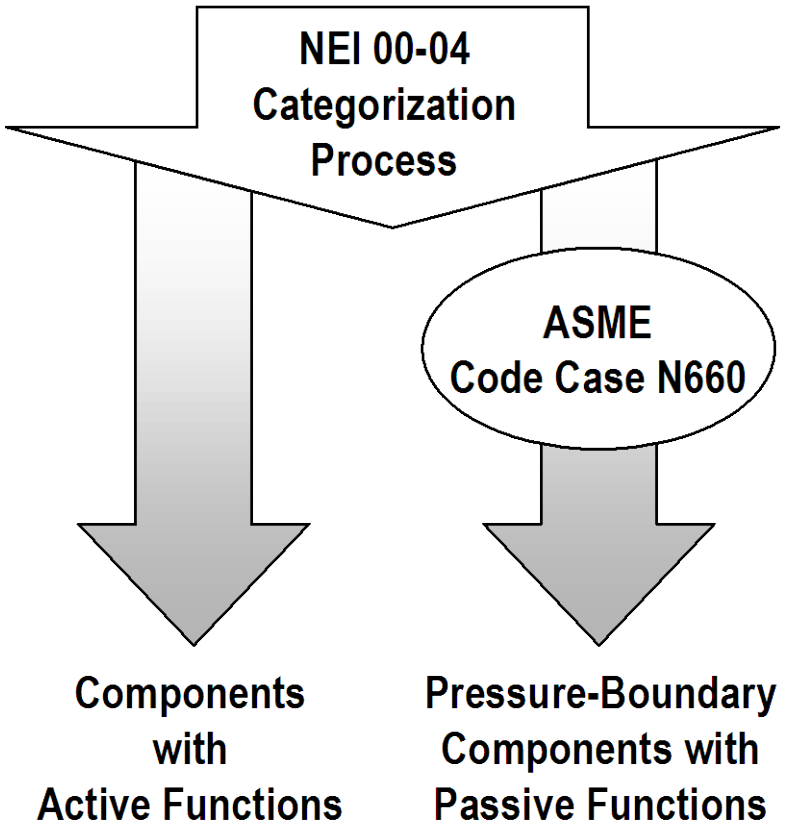
RISC-3 SSCs Treatment

- Once categorized, safety-related components determined to be Low Safety Significant are no longer subject to the special treatment requirements imposed by the following NRC regulations:
  - Quality Assurance requirements as defined in Appendix B,
  - 10CFR Part 21 reporting requirements,
  - Testing, documentation, and margin requirements for EQ purposes (10CFR 50.49),
  - Applicable portions of ASME & IEEE codes and standards (10CFR 50.55a(f), (g) & (h)),
  - Maintenance Rule (10CFR 50.65),
  - Reporting requirement (10CFR 50.72 and 50.73),
  - Portions of Appendix J testing,
  - Seismic qualification with respect to extent of testing and types of analyses (sections of Appendix A to 10CFR Part 100).

RISC-3 SSCs Treatment

- RISC-3 SSCs. The licensee or applicant shall ensure, with reasonable confidence, that RISC-3 SSCs remain capable of performing their safety-related functions under design basis conditions, including seismic conditions and environmental conditions and effects throughout their service life. The treatment of RISC-3 SSCs must be consistent with the categorization process. Inspection and testing, and corrective action shall be provided for RISC-3 SSCs.
  - (i) Inspection and testing. Periodic inspection and testing activities must be conducted to determine that RISC-3 SSCs will remain capable of performing their safety-related functions under design basis conditions; and
  - (ii) Corrective action. Conditions that would prevent a RISC-3 SSC from performing its safety-related functions under design basis conditions must be corrected in a timely manner. For significant conditions adverse to quality, measures must be taken to provide reasonable confidence that the cause of the condition is determined and corrective action taken to preclude repetition.

Scope of Components Categorized Under 10CFR50.69



N660 is being superseded by draft Code Case N752 as used by ANO, Unit 2

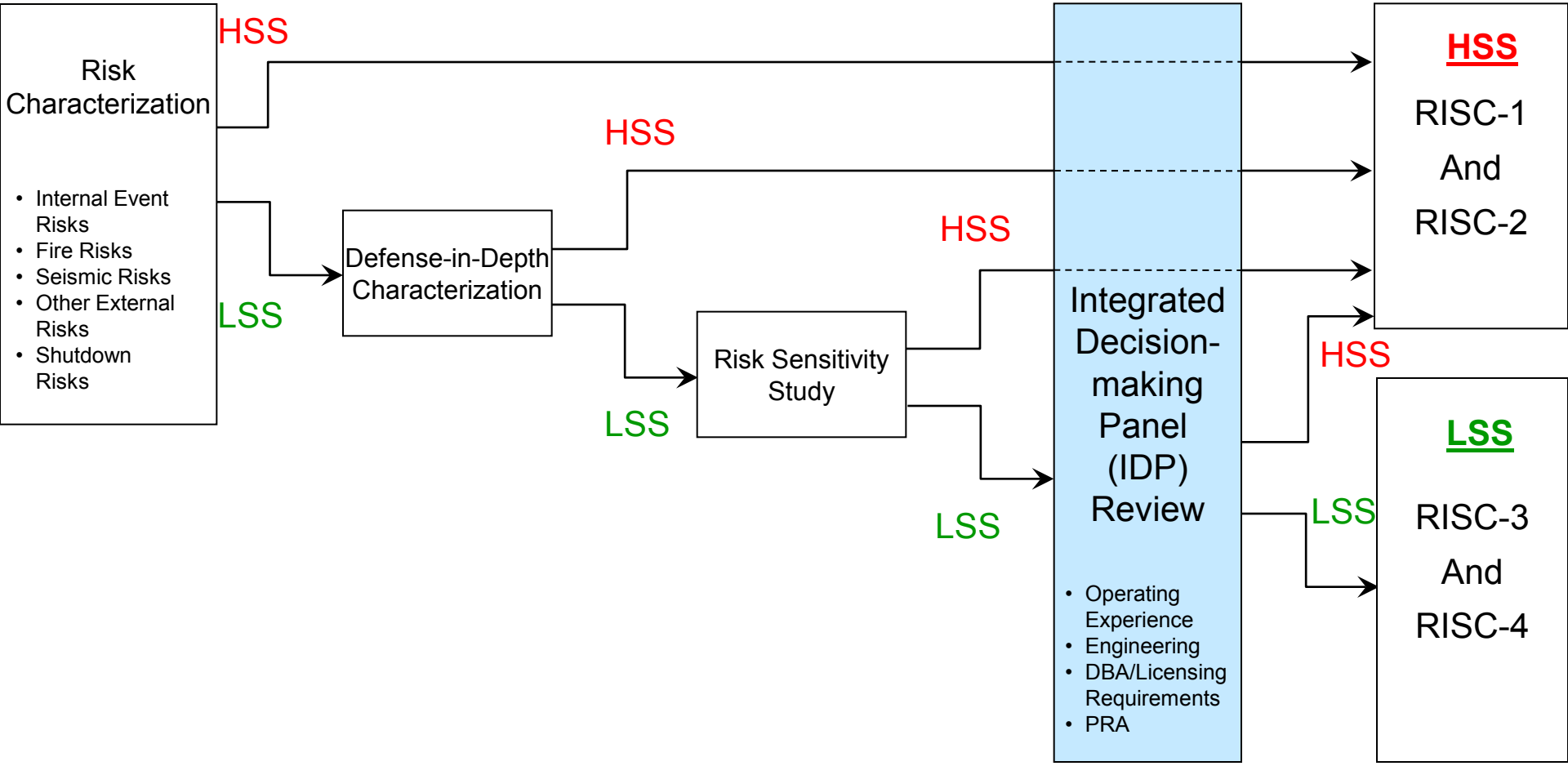
NEI 00-04

- The categorization process described in NEI 00-04 utilizes a series of evaluations to determine the proper risk-informed safety classification for structures, systems, and components (SSCs)

NEI 00-04

- The overall process involves the following:
  - A risk characterization of the safety significance of all SSCs in a plant system
  - A defense-in-depth characterization to assure adequate redundancy and diversity for design bases events are maintained
  - An integrated risk sensitivity study to assure any potential increases in risk are small
  - Presentation of the results of these evaluations to an integrated decision-making panel (IDP) that determines the final categorization of the SSCs

NEI 00-04 Risk-Informed Categorization



NEI 00-04 – Active Components

- Internal Event Risks:
  - a PRA with appropriate technical capability for the categorization of SSCs relative to internal events, at-power risks.
  - importance measures related to core damage frequency (CDF) and large early release frequency (LERF) identify the safety-significant functions (RISC-1 or -2).
  - sensitivity studies (e.g., human reliability, common cause failures, and no maintenance plant configuration)
    - SSCs initially identified as LSS exceeding thresholds
    - this information is provided to the IDP for consideration

NEI 00-04 – Active Components

- Internal Fire Risks:
  - FIVE may be used:
    - system functions that are involved in the mitigation of any unscreened fire scenario are safety-significant
    - screened scenarios reviewed to identify any system functions that would result in a scenario being unscreened, if that system function was not credited
  - Fire PRA may be used:
    - importance measures used to identify the safety-significant functions (RISC-1 or -2), unless
    - fire risk contribution is shown to be sufficiently small (in comparison to the internal events risk) as to make the overall safety significance low (RISC-3 or -4)
    - sensitivity studies are also used (similar to internal events)

NEI 00-04 – Active Components

- Seismic Risks:
  - "Seismic Margins" may be used:
    - SSCs in the success path(s) are defined as safety significant
  - Seismic PRA may be used:
    - importance measures used to identify the safety-significant functions (RISC-1 or -2), unless
    - seismic risk contribution is shown to be sufficiently small (in comparison to the internal events risk) as to make the overall safety significance low (RISC-3 or -4)
    - sensitivity studies are also used (similar to internal events)
    - Note: "inherent seismic robustness should be maintained"

NEI 00-04 – Active Components

- Other External Risks (High Winds, External Floods, etc.):
  - Screening analyses may be used:
    - Need to reflect the as-built / as operated plant
  - External Hazard PRA may be used:
    - importance measures used to identify the safety-significant functions (RISC-1 or -2), unless
    - risk contribution is shown to be sufficiently small (in comparison to the internal events risk) as to make the overall safety significance low (RISC-3 or -4)
    - sensitivity studies are also used (similar to internal events)

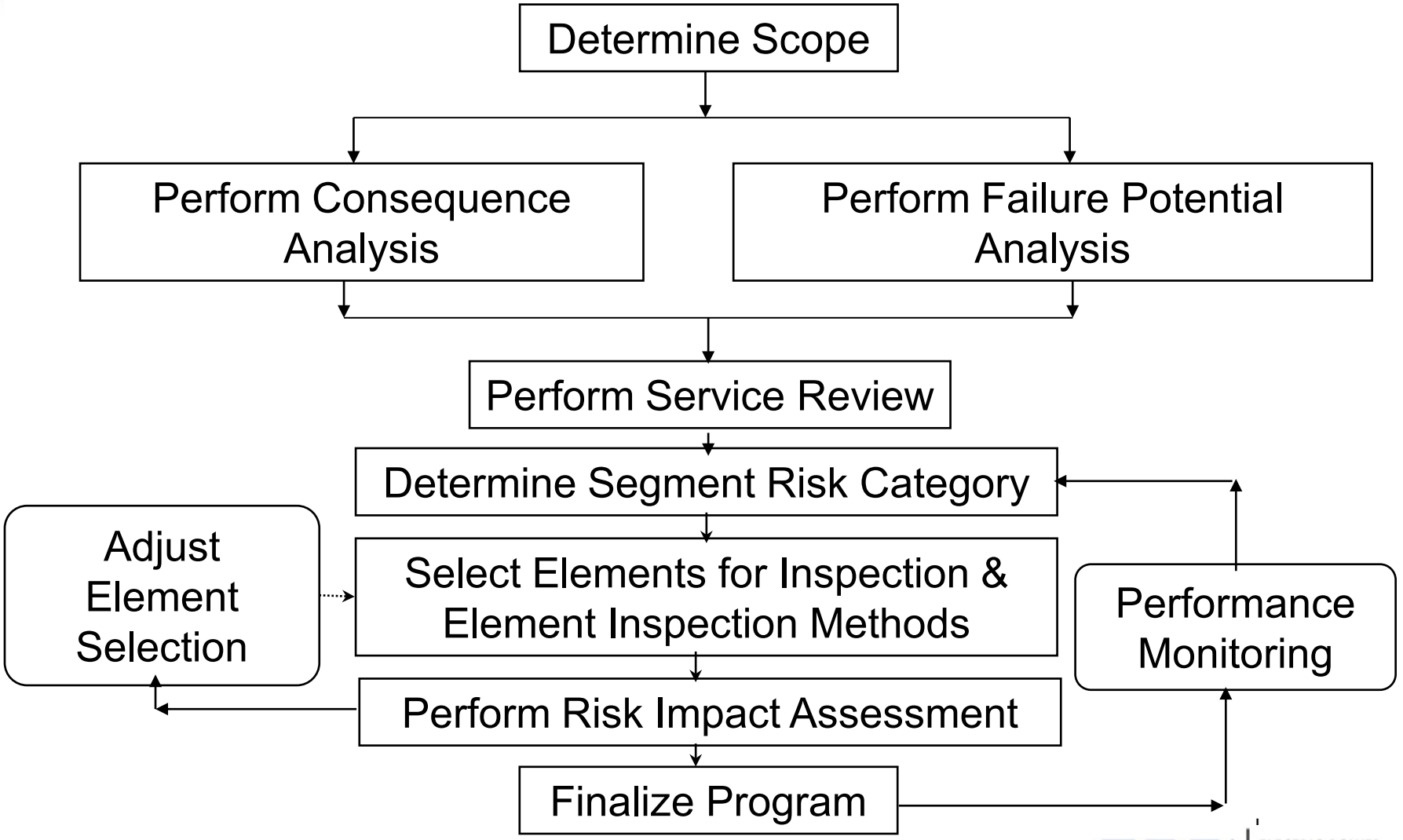
NEI 00-04 – Passive Components

- ASME Code Case N660
  - originally developed to support the ANPR:
  - based on the EPRI RI-ISI methodology (consequence portion)
  - not tested out prior to approval
  - excess conservatism / lack of clarity

- ASME Code Case N752 (draft):
  - removes excess conservatisms
  - greater clarity and explicit reference to EPRI TR-112657
  - ANO, Unit 2 - RI- Repair / Replacement Activities relief request
  - NRC approval obtained in 2009

- Also foundation for WCAP-16308

EPRI RI-ISI Methodology



Risk Matrix

Consequence Evaluation

Failure Potential Assessment ***(Degradation Mechanism)***

DEGRADATION CATEGORY Pipe Rupture Potential	CONSEQUENCE CATEGORY CCDP and CLERP Potential			
	NONE	**LOW**	**MEDIUM**	**HIGH**
HIGH	LOW (Cat. 7)	MEDIUM (Cat. 5)	HIGH (Cat. 3)	HIGH (Cat. 1)
MEDIUM	LOW (Cat. 7)	LOW (Cat. 6)	MEDIUM (Cat. 5)	HIGH (Cat. 2)
LOW	LOW (Cat. 7)	LOW (Cat. 7)	LOW (Cat. 6)	MEDIUM (Cat. 4)

Consequence Evaluation

Goal: To assign a consequence rank to each location within the piping system.

Parameters:

- Break size (small, large, worst case)
- Isolability of the break (success and failure)
- Direct effects (flow diversion)
- Indirect effects (spatial, inventory loss)
- Containment performance
- Recovery

Consequences Ranking - Numerical Criteria

Consequence Category	Corresponding CCDP Range	Corresponding CLERP Range
High	CCDP > 1E-4	CLERP > 1E-5
Medium	1E-6 < CCDP ≤ 1E-4	1E-7 < CLERP ≤ 1E-5
Low	CCDP ≤ 1E-6	CLERP ≤ 1E-7

Consequence Impact Groups & Configurations

CONSEQUENCES		
Impact Group	**Configuration**	**Description**
Initiating Event	Operating	A PBF occurs in an operating (pressurized) system resulting in an initiating event
Loss of Mitigating Ability	Standby	A PBF occurs in a standby system and does not result in an initiating event, but degrades the mitigating capabilities of a system or train. After failure is discovered, the plant enters the Allowed Outage Time defined in the Technical Specification
	Demand	A PBF occurs when system/train operation is required by an independent demand
Combination	Operating	A PBF causes an initiating event with an additional loss of mitigating ability (in addition to the expected mitigating degradation due to the initiator)
Containment	Any	A PBF, in addition to the above impacts, also affects containment performance

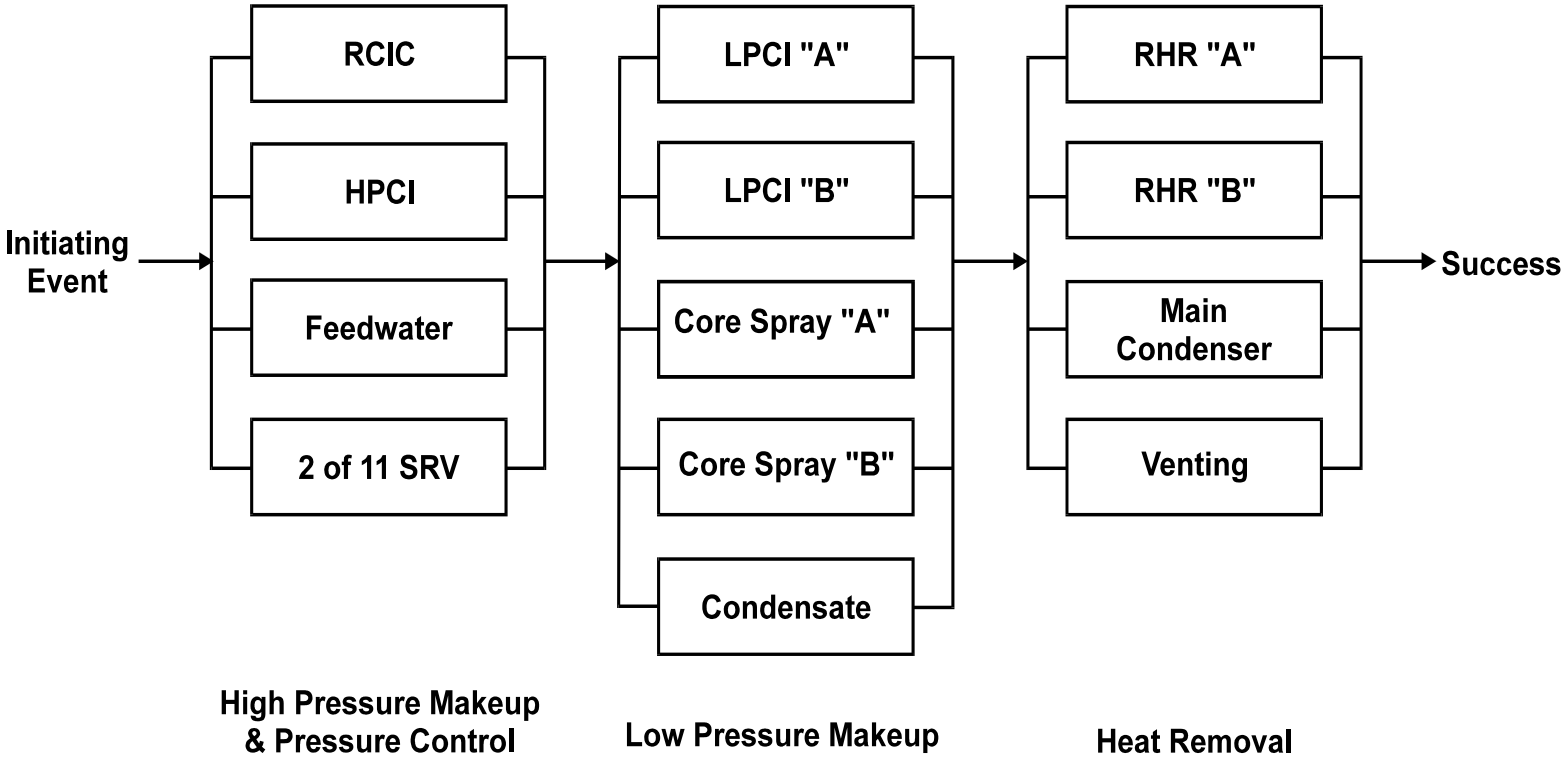
Initiating Event Impact Group (PS example)

Design Basis Initiating Event Category	Initiating Event	Initiating Event Frequency (1/Yr.)	CDF due to Initiating Event (1/yr.)	Corresponding CCDP	Consequence Category
II	Reactor Trip	2	1E-6	5E-7	LOW
	Turbine Trip	1	1E-6	1E-6	LOW
	Loss of PCS	3E-1	9E-7	3E-6	MEDIUM
III	Loss of SW Train	8E-2	2E-6	3E-5	MEDIUM
	LOSP	5E-2	2E-6	4E-5	MEDIUM
IV	SLB	1E-3	1E-9	1E-6	MEDIUM
	Small LOCA	5E-3	2E-6	4E-4	HIGH
	Medium LOCA	1E-3	2E-6	2E-3	HIGH
	Large LOCA	1E-4	1.5E-6	1.5E-2	HIGH

Loss of Mitigating Ability Impact Group

Affected Systems		Number of Unaffected Backup Trains							
Frequency of Challenge	**Exposure Time to Challenge**	**0.0**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**>=3.5**
Anticipated (DB Cat II)	All Year	HIGH	HIGH	HIGH	HIGH	MEDIUM	MEDIUM	LOW*	LOW
	Between tests (1-3 months)	HIGH	HIGH	HIGH	MEDIUM*	MEDIUM	LOW*	LOW	LOW
	Long AOT (<=1 week)	HIGH	HIGH	MEDIUM*	MEDIUM	LOW*	LOW	LOW	LOW
	Short AOT (<=1 day)	HIGH	MEDIUM*	MEDIUM	LOW*	LOW	LOW	LOW	LOW
Infrequent (DB Cat. III)	All Year	HIGH	HIGH	HIGH	MEDIUM	MEDIUM	LOW*	LOW	LOW
	Between tests (1-3 months)	HIGH	HIGH	MEDIUM*	MEDIUM	LOW*	LOW	LOW	LOW
	Long AOT (<=1 week)	HIGH	MEDIUM*	MEDIUM	LOW*	LOW	LOW	LOW	LOW
	Short AOT (<=1 day)	HIGH	MEDIUM	LOW*	LOW	LOW	LOW	LOW	LOW
Unexpected (DB Cat. IV)	All Year	HIGH	HIGH	MEDIUM	MEDIUM	LOW*	LOW	LOW	LOW
	Between tests (1-3 months)	HIGH	MEDIUM	MEDIUM	LOW*	LOW	LOW	LOW	LOW
	Long AOT (<=1 week)	HIGH	MEDIUM	LOW*	LOW	LOW	LOW	LOW	LOW
	Short AOT (<=1 day)	HIGH	LOW*	LOW	LOW	LOW	LOW	LOW	LOW

Simplified Success Criteria for LOCA or Transient With PCS Initially Available



Passive Categorization Example

Table 1: Vogtle Unit 1 Consequence Assessment Summary											
ID	Description	Spatial Location	Configuration	Initiator	Isolation	System Impacts	Available Backup Trains	Containment	Exposure Time	Table Used	Rank
1CS-029B	CS train A 2" line from segment CS-029A to manual valve 152 (lc; pipe class change) and the 1" vent line which intersects the 2" line and is isolated by manual valve X-808 (nc)	RD-76	Standby/ Demand	LOCA Demand	Watertigh t Room	None	All	No Impact	Between Test		Low
1CS-030	CS train B 10" RWST suction line from MOV HV9017B to 14"-14"-10" tee	RD-77	Standby/ Demand	LOCA Demand	Watertigh t Room	None	All	No Impact	Between Test		Low
1CS-031	CS trains A and B 14" RWST suction line from the 14"-14"-10" tee to the 24" RWST suction line common to the CS, RHR and the charging pump systems	RD-77 ?	Standby/ Demand	LOCA Demand	LO 207	Loss of RWST outside RD-77	None	No Impact	Between Test		High
1CS-032	CS trains A and B 1" vent line from pipe segment CS-031 to manual valve X-017 (nc)	??	Standby/ Demand	LOCA Demand	LO 207	Small Line	1 assume	No Impact	Between Test		Medium
1CS-033A	CS train A 12" sump suction line from 12"-12"-10" tee to MOV HV9003A	RD-76 RD-79 RC-105 RC-134	Standby/ Demand	LOCA Demand	HV 9017A	None or Loss of Sump if unisolated	All or 1 Train	No Impact	Between Test		Medium
1CS-033B	CS train A 1" bypass line from pipe segment CS-033A to manual valve 115 (nc)	RC-134	Standby/ Demand	LOCA Demand	HV 9017A	None or Loss of Sump if unisolated	All or 1 Train	No Impact	Between Test		Medium

Additional Considerations

- (i) Failure of the SSC will significantly increase the frequency of an initiating event, including those initiating events originally screened out in the PRA.
- (ii) Failure of the SSC will compromise the integrity of the reactor coolant pressure boundary. It is expected that a sufficiently robust categorization process would result in the reactor coolant pressure boundary being categorized as HSS [RISC-1].
- (iii) Failure of the SSC will fail a safety function, including SSCs that are assumed to be inherently reliable in the PRA (e.g., piping and tanks) and those that may not be explicitly modeled (e.g., room cooling systems, and instrumentation and control systems). For example, it is expected for PWRs that a sufficiently robust categorization process would categorize high energy ASME Section III Class 2 piping of the main steam and feedwater systems as HSS or MSS.
- (iv) The SSC supports important operator actions required to mitigate an accident, including the operator actions taken credit for in the PRA.
- (v) Failure of the SSC will result in failure of safety significant SSCs (e.g., through spatial interactions).
- (vi) Failure of the SSC will impact the plant's capability to reach and/or maintain safe shutdown conditions.

Additional Considerations

(vii) The SSC is a part of a system that acts as a barrier to fission product release during severe accidents. It is expected that a sufficiently robust categorization process would result in fission product barriers (e.g., the containment shell or liner) being categorized as at least MSS [RISC-1].

(viii) The SSC is depended upon in the Emergency Operating Procedures or the Severe Accident Management Guidelines.

(ix) Failure of the SSC will result in unintentional releases of radioactive material even in the absence of severe accident conditions.

(x) The SSC is relied upon to control or to mitigate the consequences of transients and accidents.

Integrated Decision-Making Panel (IDP)

- What it is
  - panel composed of knowledgeable plant personnel whose expertise represents the important process and functional elements of the plant organization, such as:
    - operations,
    - engineering (e.g., design, systems, electrical, I&C including information technology, nuclear risk management),
    - industry operating experience,
    - licensing,
    - maintenance, and
    - additional plant personnel or external consultants, as necessary, to assist in the resolution of issues

Integrated Decision-Making Panel (IDP)

- What it does
  - uses the information and insights compiled in the initial categorization process and combines that with "other information" to finalize the categorization of functions/SSCs
  - "other information" consists of:
    - design bases,
    - defense-in-depth, and
    - safety margins

Integrated Decision-Making Panel (IDP)

- Key considerations
  - precise makeup of the panel is up to the licensee
  - training to provide a level of knowledge sufficient to evaluate and approve SSC categorizations using both probabilistic and deterministic information
  - the integrated decision process should, where possible, apply objective decision criteria and minimize subjectivity
  - differing opinions should be documented and resolved, if possible
  - the decisions of the IDP, including the basis, should be documented and retained as quality records

Sensitivity Studies For Internal Events PRA

1. Increase all human error basic events to their 95th percentile value
2. Decrease all human error basic events to their 5th percentile value
3. Increase all component common cause events to their 95th percentile value
4. Decrease all component common cause events to their 5th percentile value
5. Set all maintenance unavailability terms to 0.0
6. Any applicable sensitivity studies identified in the characterization of PRA adequacy

Closing Remarks

10CFR50.69

1. Regulation and Methodology
2. Active Components Risk Classification
3. Passive Components Risk Classification
4. Risk Sensitivity