# ASME Code Case N752

NRC Public Meeting
Rockville, MD
August 16, 2023


www.epri.com

# Purpose

- To provide some history and context to show that application of ASME Code Case N752 or application of 10CFR50.69 for categorizing pressure boundary components will yield the same results (i.e. HSS versus LSS) from a pressure boundary component perspective

- To describe the Code Case N752 methodology in detail

- To show that application of ASME Code Case N752 for categorizing pressure boundary components, with active functions, will yield the same results or more conservative results as allowed by application of 10CFR50.69

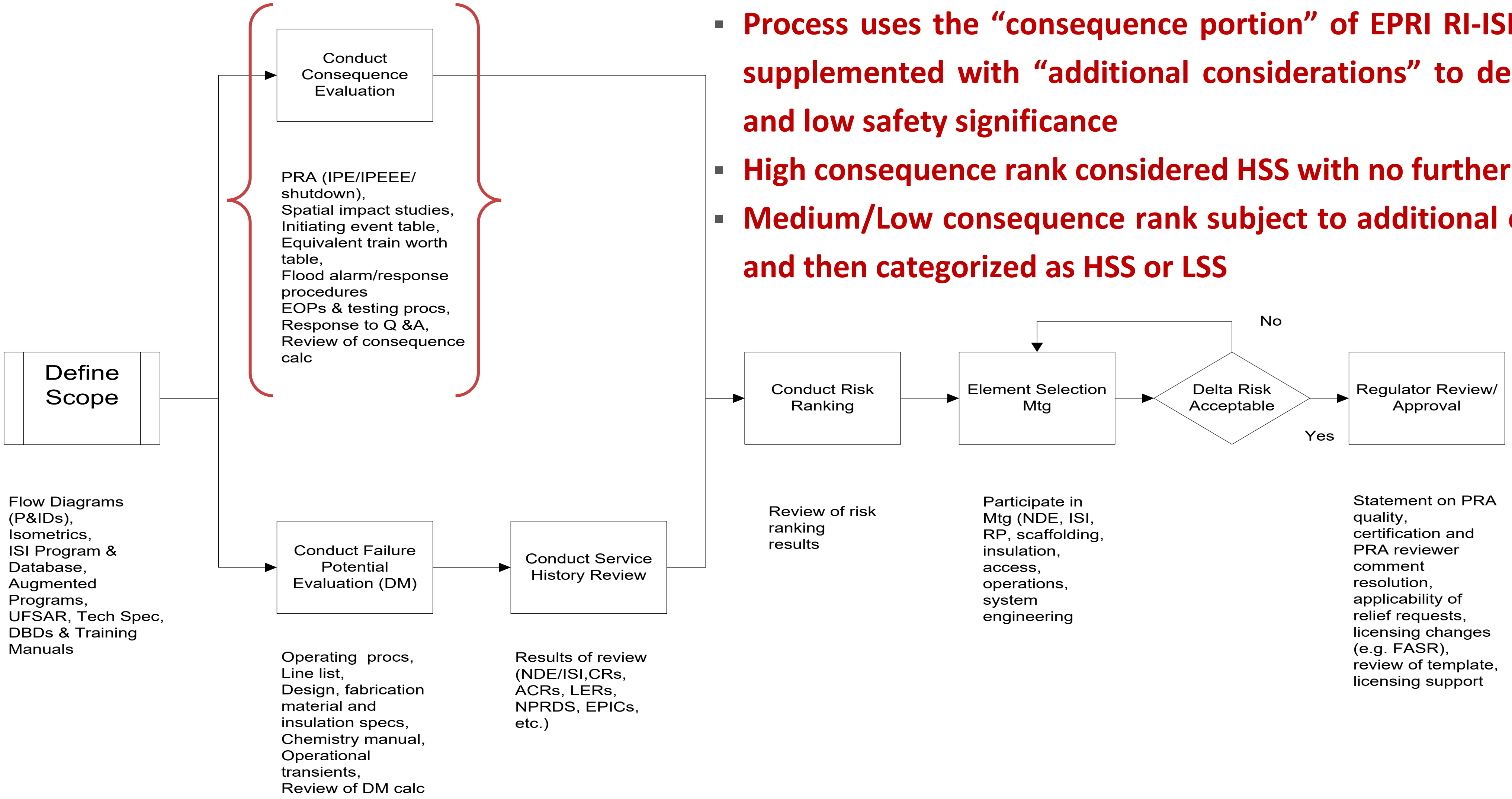
- Discuss NRC inclusion of N752-0, N752-1 into Reg Guide 1.147

- Discuss draft N752-2 NRC ballot input

- Identify and document any action items needed to reach closure

# Process founded on EPRI traditional RI-ISI methodology in TR-112657RevB-A

- **Process uses the "consequence portion" of EPRI RI-ISI methodology supplemented with "additional considerations" to define final high and low safety significance**
- **High consequence rank considered HSS with no further review**
- **Medium/Low consequence rank subject to additional considerations and then categorized as HSS or LSS**



# RI-ISI per TR-112657 Rev B-A

- RI-ISI methodology approved for use on:
  - Partial system application
  - One single system application
  - Application to multiple systems at the same time
  - Application to multiple systems over time

- The RI-ISI results for individual components will not change regardless of the scope, or time phasing, of the RI-ISI application

# NRC approval "Consequence Evaluation" Methodology

- November 9, 1998 - Vermont Yankee (Class 1)
- December 29, 1998 – ANO U2 (Class 1, 2, 3 and NNS)
  - 1997 letter providing eight system evaluations
  - 1998 letter providing service water system evaluation
- October 28, 1999 – EPRI TR-112657 Rev B-A
- September 12, 2000 – JAFitzpatrick (Class 1, 2, 3 and NNS)
- 2000 thru 2008 - ~ 60 additional units (mostly Class 1 and 2)
- April 22, 2009 – ANO-2 RI-RRA
  - 2007 RAI response providing containment spray example
- May 19, 2021 – ANO U1 and U2 RI-RRA
- October 27, 2022 – RI-ISI methodology endorsed in 10CFR50.55a
- ~50 units currently approved to use the RI-RRA methodology to categorize pressure boundary components within their 10CFR50.69 program

-2-

Pursuant to 10 CFR 50.55a(3)(i), the licensee has proposed to implement Code Case N-578[7], *Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method B*, augmented with the more detailed provisions of Reference 8, and other methodology enhancements described in this report, as an alternative to the Code requirements for the examination of Class 1 and 2 piping welds at ANO-2. By letter dated September 30, 1997, the licensee submitted separate risk evaluations for the following systems:

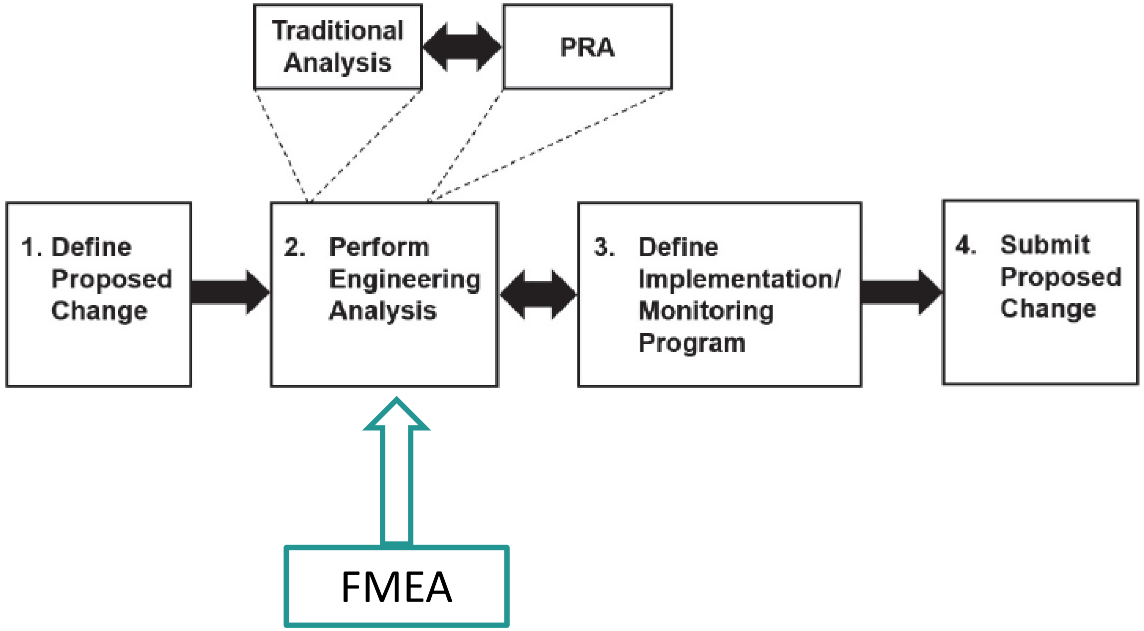
(1) High-Pressure Safety Injection
(2) Reactor Coolant
(3) Chemical and Volume Control
(4) Containment Spray
(5) Low-Pressure Safety Injection and Shutdown Cooling
(6) Emergency Feedwater
(7) Main Feedwater
(8) Main Steam

2. J. F. McCann, Entergy Operations, Inc., letter CNRO-2007-00028, to U.S. Nuclear Regulatory Commission, "Request for Alternative ANO2-R&R-004, Revision 1 Response to NRC Request for Additional Information," dated August 7, 2007 (ADAMS Accession No. ML072220160).

# Consequence Evaluation Methodology

N752 I-3.3.1 Failure Modes and Effects Analyses (FMEA)

- Potential failure modes for each system, piping segment, or individual item shall be identified, and their effects shall be evaluated. This evaluation shall consider the following:
  - (a) Pressure Boundary Failure Size.
  - (b) Isolability of the Break.
  - (c ) Indirect Effects.
  - (d) Initiating Events.
  - (e) System Impact or Recovery.
  - (g) System Configuration.

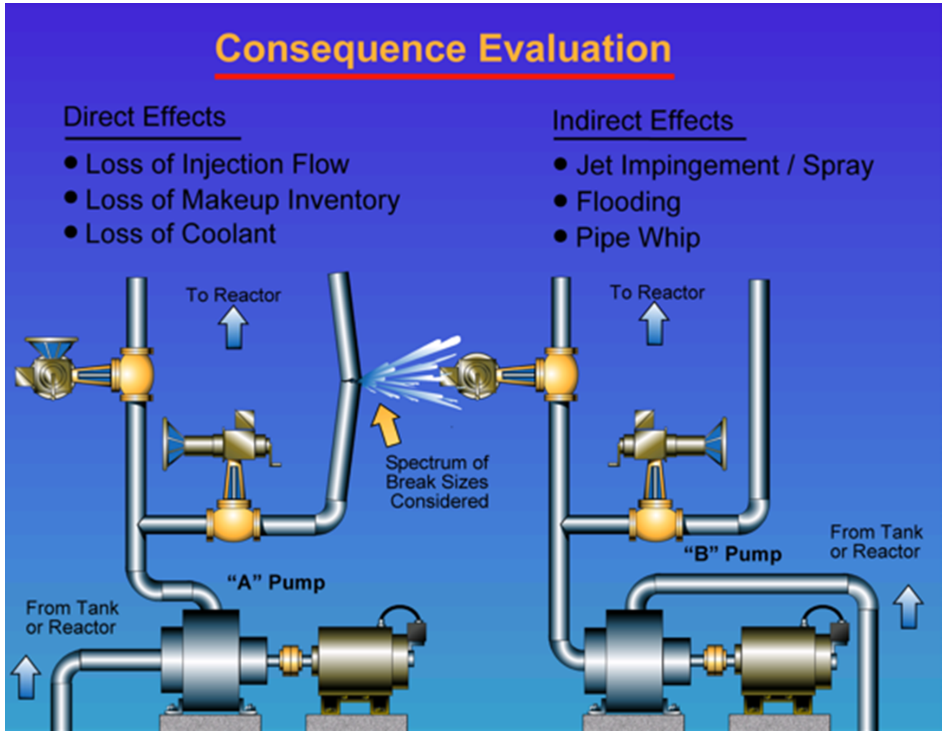


# Consequence Evaluation Methodology

- Each pressure boundary component is postulated to fail with a probability of 1.0 (small, medium and large breaks with the worst impact driving the consequence rank)
- All direct effects of each individual pressure boundary failure need to identified
- All indirect effects of each individual pressure boundary failure need to identified
- Identify when isolability of the break is possible / not possible
- Differentiate between postulated breaks that can cause an initiating event and breaks that can impact the mitigative ability of the plant
- Identify when operator actions can be credited and when they cannot be credited
- Combination events and containment impact
- All of the above is then used to assign a consequence rank based on (CCDP/CLERP)
  - High consequence rank = High Safety Significant (HSS)
  - Medium and Low consequence rank are then subject to "Additional Considerations" to determine LSS or HSS

# Consequence Evaluation Methodology

- All direct effects of each individual pressure boundary failure (PBF) need to be identified
  - PBFs that cause a loss of a flowpath would typically result in loss of one train of a system including the active components in that train For example:
    - The pump in that train will no longer deliver flow
    - A valve designed to open to allow flow would fail to provide that flow

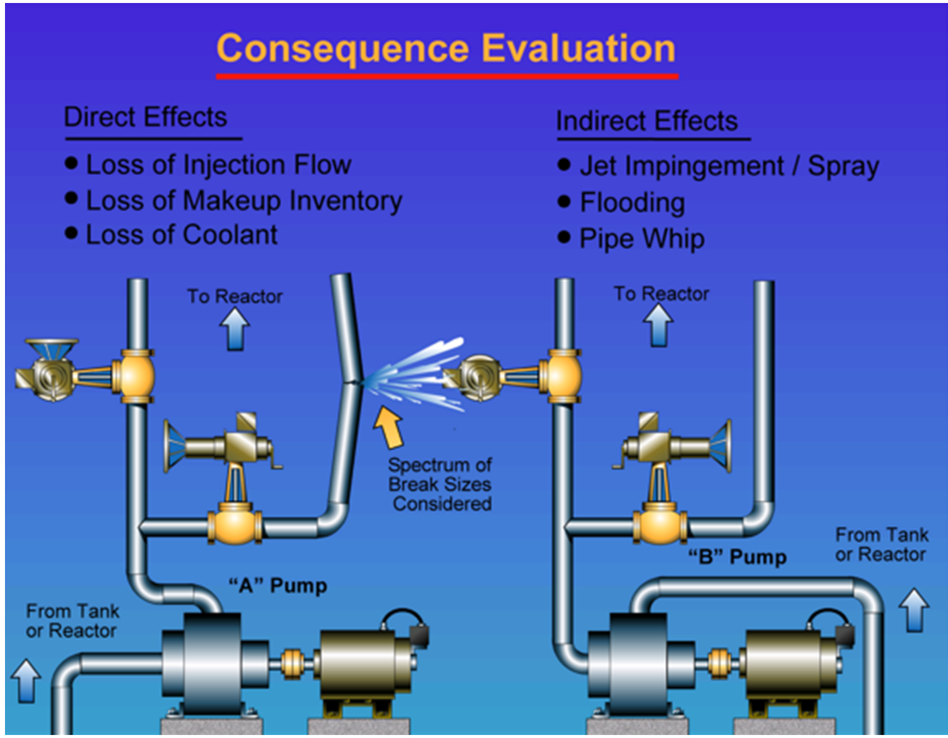


# Consequence Evaluation Methodology

- All indirect effects of each individual pressure boundary failure (PBF) need to identified
  - PBFs that cause a loss of inventory (e.g tank, sump, suppression pool) may fail an entire two train system as well as multiple systems

    For Example

    - Loss of the condensate storage tank will prevent all EFW pumps from delivering flow
    - Loss of the suppression pool will prevent pumps in multiple systems from delivering flow



# Consequence Evaluation Methodology

- All indirect effects of each individual pressure boundary failure (PBF) need to identified
  - PBFs that cause spatial interactions (e.g spray, flooding, jet impingement, pipe whip) may fail other components (active and /or passive) within the system as well as components (active and / passive) in other systems (e.g.
    - Flooding of multiple MCCs in the area of the postulated PBF or in adjacent areas causing the MCCs and supported components to be unavailable
    - Spray / jet impingement of nearby valves that were design to open, fail to open, due to the impact of the spray / jet impingement

# As discussed in the SE on TR-112657RevB-A

- EPRI TR-112657, Rev. B, provides guidance on assigning CCDP consequence categories to segment failures on the basis of the number of available (i.e., unaffected by the rupture) mitigating trains remaining, broad categories of initiating event frequencies, and exposure times.

- These trains may be parallel system trains or other systems that provide a backup function to the unavailable system and that are unaffected by the direct and indirect consequences of the segment rupture.

- The methodology to assign segment failures to consequence categories is based on the number of unaffected trains available to mitigate an event.

- The specific decision criteria used to determine the consequence category depends on the type of impact the segment failure has on the plant and the reliability of the unaffected trains.

- Given a segment failure and all the associated spatial effects, the CCDP is the probability that the resulting scenario will lead to core damage.

- If the failure of a segment is estimated to lead to a core damage event with a probability greater than 1 E-4, the segment is categorized as High consequence. An estimated CCDP within the range of 1 E-6 to 1 E-4 is categorized as Medium consequence. CCDPs less than 1 E-6 are categorized as Low consequence.

# Results from example provided to NRC - ML072220160

| ID | Description | Spatial Location | Configuration | Initiator | Isolation | System Impacts | Available Backup Trains | Containment | Exposure Time | Table Used (Note 1) | Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CSS-C-01 | Common RWT suction outside | Outside | Demand | Assumed M | No | CSS, HPSI, LPSI | 0 | Unaffected | between test | 2-2 | HIGH |
| CSS-C-02 | Common RWT suction inside | 2040 | Demand | Assumed M | No | CSS, HPSI, LPSI | 0 | Unaffected | between test | 2-2 | HIGH |
| CSS-C-03A | RWT suction A in 2040 | 2040 | Demand | Assumed M | 2CV-5630 | ECCS A or all ECCS | 1 (ECCS B or isolation) | Unaffected | between test | 2-2 | MEDIUM |
| CSS-C-03B | RWT suction B in 2040 | 2040 | Demand | Assumed M | 2CV-5631 | all ECCS & CSS | 0 | Unaffected | between test | 2-2 | HIGH |
| CSS-C-04A | RWT suction A in 2014 | 2014 | Demand | Assumed M | 2CV-5630 | ECCS A or all ECCS | 1 (ECCS B or isolation) | Unaffected | between test | 2-2 | MEDIUM |
| CSS-C-04B | RWT suction B in 2007 | 2007 | Demand | Assumed M | 2CV-5631 | ECCS B or all ECCS | 1 (ECCS A or isolation) | Unaffected | between test | 2-2 | MEDIUM |
| CSS-C-05 | RWT suction B in 2006 | 2006 | Demand | Assumed M | 2CV-5631 | ECCS B or all ECCS | 1 (ECCS A or isolation) | Unaffected | between test | 2-2 | MEDIUM |
| CSS-C-06A | Sump suction A in 2014 | 2014 | Demand | Assumed M | 2CV-5647 | ECCS A or all ECCS | 1 (ECCS B or isolation) | Bypass if Isol fails | all year | 2-2 | HIGH |
| CSS-C-06B | Sump suction B in 2007 | 2007 | Demand | Assumed M | 2CV-5648 | ECCS B or all ECCS | 1 (ECCS A or isolation) | Bypass if Isol fails | all year | 2-2 | HIGH |
| CSS-C-07A | 2P-35A discharge to 2E35A | 2014 | Demand | Assumed M | Trip pump & 2CV-5630 | ECCS A or all ECCS | 1 (ECCS B or isolation) | Unaffected | between test | 2-2 | MEDIUM |
| CSS-C-07B | 2P35B discharge to 2E35B | 2007 | Demand | Assumed M | Trip pump & 2CV-5631 | ECCS B or all ECCS | 1 (ECCS A or isolation) | Unaffected | between test | 2-2 | MEDIUM |

# Results from example provide to NRC - ML072220160

| ID | Description | Spatial Location | Rank |
|---|---|---|---|
| CSS-C-01 | Common RWT suction outside | Outside | HIGH |
| CSS-C-02 | Common RWT suction inside | 2040 | HIGH |
| CSS-C-03A | RWT suction A in 2040 | 2040 | LOW |
| CSS-C-03B | RWT suction B in 2040 | 2040 | HIGH |
| CSS-C-04A | RWT suction A in 2014 | 2014 | LOW |
| CSS-C-04B | RWT suction B in 2007 | 2007 | LOW |
| CSS-C-05 | RWT suction B in 2006 | 2006 | LOW |
| CSS-C-06A | Sump suction A in 2014 | 2014 | HIGH |
| CSS-C-06B | Sump suction B in 2007 | 2007 | HIGH |
| CSS-C-07A | 2P-35A discharge to 2E35A | 2014 | LOW |
| CSS-C-07B | 2P35B discharge to 2E35B | 2007 | LOW |

## 10CFR50.69

**Scope Identification**
Select system and define boundaries for evaluation

↓

**Consequence Evaluation**
Perform FMEA considering Direct & Indirect Effects
Identify Impact Groups: Initiating Event, System/Train, Combination, Containment

↓

**Consequence Categorization**
Determine Consequence Ranking from Quantitative Indices and Consequence Category Tables

↓

**Classification Considerations**
Consider other relevant information, including defense-in-depth principles, for Medium/Low/None consequence categories

↓

**Final Classification Definitions**
HSS – high-safety-significant
LSS – low-safety-significant

↓

**Reevaluation of Risk-Informed Safety Classifications**
Perform Periodic Reviews
Assess Significance of Plant Design Changes and New Technical Information

## N752

**Scope Identification**
Select system and define boundaries for evaluation

↓

**Consequence Evaluation**
Perform FMEA considering Direct & Indirect Effects
Identify Impact Groups: Initiating Event, System/Train, Combination, Containment

↓

**Consequence Categorization**
Determine Consequence Ranking from Quantitative Indices and Consequence Category Tables

↓

**Categorization Considerations**
Consider other relevant information, including defense-in-depth principles, for Medium/Low/None consequence categories

↓

**Final Categorization Definitions**
HSS – high-safety-significant
LSS – low-safety-significant

↓

**Reevaluation of Risk-Informed Categorizations**
Perform Periodic Reviews
Assess Significance of Plant Design Changes and New Technical Information

**Both methodologies use section 3.3, Consequence Evaluation, of EPRI TR-112657, Rev B-A**

# 10CFR50.69

**TABLE I-5**

**QUANTITATIVE INDICES FOR CONSEQUENCE CATEGORIES**

| CCDP (no units) | CLERP (no units) | Consequence Category |
|---|---|---|
| $>10^{-4}$ | $>10^{-5}$ | High |
| $10^{-6} < \text{value} \leq 10^{-4}$ | $10^{-7} < \text{value} \leq 10^{-5}$ | Medium |
| $\leq 10^{-6}$ | $\leq 10^{-7}$ | Low |
| No change to base case | No change to base case | None |

# N752

**Table I-5**
**Quantitative Indices for Consequence Categories**

| CCDP | CLERP | Consequence Category |
|---|---|---|
| $>10^{-4}$ | $>10^{-5}$ | High |
| $10^{-6} < \text{value} \leq 10^{-4}$ | $10^{-7} < \text{value} \leq 10^{-5}$ | Medium |
| $\leq 10^{-6}$ | $\leq 10^{-7}$ | Low |
| No change to base case | No change to base case | None |

**Both methodologies use section 3.3, Consequence Evaluation, of EPRI TR-112657, Rev B-A**

## 10CFR50.69

**TABLE I-2**

**GUIDELINES FOR ASSIGNING CONSEQUENCE CATEGORIES TO FAILURES RESULTING IN SYSTEM OR TRAIN LOSS**

| 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 CT (≤ 1 week) | HIGH | HIGH | MEDIUM* | MEDIUM | LOW* | LOW | LOW | LOW |
| | Short CT (≤ 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 CT (≤ 1 week) | HIGH | MEDIUM* | MEDIUM | LOW* | LOW | LOW | LOW | LOW |
| | Short CT (≤ 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 CT (≤ 1 week) | HIGH | MEDIUM | LOW* | LOW | LOW | LOW | LOW | LOW |
| | Short CT (≤ 1 day) | HIGH | LOW* | LOW | LOW | LOW | LOW | LOW | LOW |

## N752

**Table I-2**
**Guidelines for Assigning Consequence Categories to Failures Resulting in System or Train Loss**

| 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 test (1–3 months) | HIGH | HIGH | HIGH | MEDIUM* | MEDIUM | LOW* | LOW | LOW |
| | Long CT (≤ 1 week) | HIGH | HIGH | MEDIUM* | MEDIUM | LOW* | LOW | LOW | LOW |
| | Short CT (≤ 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 test (1–3 months) | HIGH | HIGH | MEDIUM* | MEDIUM | LOW* | LOW | LOW | LOW |
| | Long CT (≤ 1 week) | HIGH | MEDIUM* | MEDIUM | LOW* | LOW | LOW | LOW | LOW |
| | Short CT (≤ 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 test (1–3 months) | HIGH | MEDIUM | MEDIUM | LOW* | LOW | LOW | LOW | LOW |
| | Long CT (≤ 1 week) | HIGH | MEDIUM | LOW* | LOW | LOW | LOW | LOW | LOW |
| | Short CT (≤ 1 day) | HIGH | LOW* | LOW | LOW | LOW | LOW | LOW | LOW |

**Both methodologies use section 3.3, Consequence Evaluation, of EPRI TR-112657, Rev B-A**

# 10CFR50.69 Guidance NEI00-04: 4, SYSTEM ENGINEERING ASSESSMENT

The classification of SSCs having only a pressure retaining function (also referred to as passive components), or the passive function of active components, should be performed using the ASME Code Case N-660, "*Risk-Informed Safety Classification for Use in Risk-Informed Repair/Replacement Activities*" (Ref. 17), or subsequent versions approved by ASME, in lieu of this guidance.

# Example 10CFR50.69 LAR

Passive components and the passive function of active components will be evaluated using the Arkansas Nuclear One (ANO) Risk-Informed Repair/Replacement Activities (RI-RRA) methodology contained in (Reference 6, ML090930246) consistent with the related Safety Evaluation (SE) issued by the Office of Nuclear Reactor Regulation.

- That is, in lieu of ASME Code Case N660, 10CFR50.69 plants are approved to use "ANO-2 RI-RRA" methodology for categorizing pressure boundary components
- ANO-2 RI-RRA methodology approved April 22, 2009, and is founded upon NRC approved EPRI TR-112657 Rev B-A which was approved October 28, 1999
- ANO-2 submitted to NRC an example system (ML072220160) using the RI-RRA methodology as applied to the pressure boundary function only

# 10CFR50.69 Overview

| Element | Categorization Step - NEI 00-04 Section | Evaluation Level | IDP Change HSS to LSS | Drives Associated Functions |
|---|---|---|---|---|
| Risk (PRA Modeled) | Internal Events Base Case – Section 5.1 | Component | Not Allowed | Yes |
| | Fire, Seismic and Other External Events Base Case | | Allowable | No |
| | PRA Sensitivity Studies | | Allowable | No |
| | Integral PRA Assessment – Section 5.6 | | Not Allowed | Yes |
| Risk (Non-modeled) | Fire, Seismic and Other External Hazards – | Component | Not Allowed | No |
| | Shutdown – Section 5.5 | Function/Component | Not Allowed | No |
| Defense-in-Depth | Core Damage – Section 6.1 | Function/Component | Not Allowed | Yes |
| | Containment – Section 6.2 | Component | Not Allowed | Yes |
| Qualitative Criteria | Considerations – Section 9.2 | Function | Allowable[1] | N/A |
| Passive | Passive – Section 4 | Segment/Component | Not Allowed | No |

# NEI 00-04: 10.2, Detailed SSC Categorization

2) Assignment of selected SSCs to a lower classification based on the attributes of the function that the SSC supports. This applies primarily to categorizing selected SSCs on safety-significant functions as low safety-significant. In this case, the potential failure of an SSC is assessed in light of the safety-significant function attributes (e.g., allow flow, prevent flow, prevent fission product releases, etc.). The following criteria can be applied to this process:

- The criterion for assignment of low safety significance for an SSC supporting a safety-significant function is that its failure would not preclude the fulfillment of the safety-significant function. Specific considerations that would permit a low safety significance determination for an SSC supporting a safety-significant function would include, but are not limited to:
  - There is no credible failure mode for the SSC that would prevent a safety-significant function from being fulfilled (e.g., a locked open or locked closed valve, a manually controlled valve, etc.),
  - A failure for the SSC would not prevent a safety-significant function from being fulfilled (e.g., a vent or drain line that is not a significant flow diversion path, SSCs downstream of the first isolation valve from the active pathway of the function, etc.), and
  - Instrumentation that would not prevent a safety-significant function from being fulfilled (e.g., radiation monitors that do not have a direct diagnosis function, etc.).

For SSCs that retain the categorization of the function that they support, no IDP review should be required; there should be no differences from the assessments considered in the initial IDP. For SSCs that are re-categorized to a lower classification (e.g., components in a safety-significant function that are determined to be LSS based on the above considerations), the new categorization and its basis should be presented to another session of the IDP to be re-categorized using the same rigor as described in Section 9. If the SSCs being considered for re-categorization to a lower classification are modeled in the PRA, then the risk sensitivity described in Section 5 would need to be completed prior to presentation to the IDP.

# Example LAR

## 3.1.1 Overall Categorization Process

- However, NEI 00-04 Section 10.2 allows detailed categorization which can result in some components mapped to HSS functions being treated as LSS; and Section 4.0 discusses additional functions that may be identified (e.g., fill and drain) to group and consider potentially LSS components that may have been initially associated with a HSS function but which do not support the critical attributes of that HSS function.

# Possible 10CFR50.69 Results

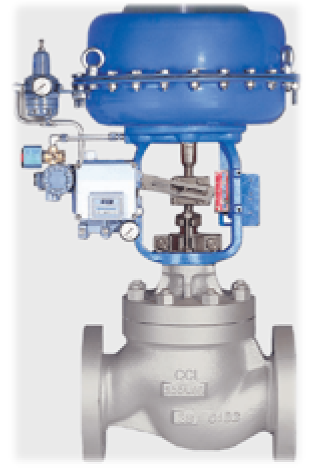
| | Function | | | | Alternate Treatment | |
|---|---|---|---|---|---|---|
| Valve # | Passive | | Active* | | Passive | Active |
| | Rank | Metric | Rank | Metric | | |
| | | | | | | |
| MV1 | HSS | CCDP/CLERP | HSS | FV/RAW | No | No |
| MV2 | LSS | CCDP/CLERP | HSS | FV/RAW | Yes | No |
| MV3 | HSS | CCDP/CLERP | LSS | FV/RAW | No | Yes |
| MV4 | LSS | CCDP/CLERP | LSS | FV/RAW | Yes | Yes |

Glove Valve with Operator

* 10CFR50.69 **does** categorize the active function and allows for changes to the treatment of the active function, if LSS.

# Possible N752 Results

| | Function | | | | Alternate Treatment | |
|---|---|---|---|---|---|---|
| Valve # | Passive | | Active* | | Passive | Active |
| | Rank | Metric | Rank | Metric | | |
| | | | | | | |
| MV1 | HSS | CCDP/CLERP | SR | N/A | No | No |
| MV2 | LSS | CCDP/CLERP | SR | N/A | Yes | No |



Glove Valve with Operator

* N752 **does not** categorize the active function and can not change the treatment of the active function.

* SR – safety related

# Common Questions on N752

- Is the approach in N752 probabilistic or deterministic?
  - ***Both, N752 is a risk-informed (not risk based) application consistent with the guidance in RG 1.174***
- Why is CCDP used instead of FV or RAW?
  - ***FV, RRW and RAW are not appropriate for evaluating the risk significance of the pressure boundary failures***
- Can an SSC have a low CCDP and a FV>0.005 or a RAW>2?
  - ***Yes, a component can have a low CCDP (e.g. passive function) and a FV>0.005 for an active function***
- Does use of CCDP as a metric for pressure boundary purposes adequately ensure maintenance of the active function of a component?
  - ***Yes, all safety related maintenance treatment activities for active components remain in effect***
- For a component that has both active and passive functions (e.g. valve), how is the active function of the component considered in the N752 process?
  - ***See previous slides as well as previously provided examples (e.g. ML20217N833 - 1998, ML072220160 - 2007)***
- What role do Tables I-1, I-2, I-3 play in comparison to the role played by Table I-5?
  - **See following slides**

# RI-Categorization Methodology for Pressure Boundary Components

- Mission – develop a RI-categorization methodogly for the pressure boundary function that identifies when it is appropriate to apply alternate (reduced) treatment to the pressure boundary function while maintaining adequate safety (i.e. risk neutrality)

- Context – at the time (mid 1990s), the authors investigated the use of current PRAs (i.e. pre-RG1.200 PRAs) and current means of risk prioritizations (e.g. use of importance measures)
  - Internal event (IE) PRAs do not model pressure boundary failures except for some initiating events
  - Pressure boundary failures not causing an initiating event are typically not modeled

- Conclusions – it became apparent that use of importance measures geared towards active functions were inappropriate for prioritizing activities applied to the pressure boundary function
  - Reg Guide 1.174 does not limit ranking and prioritization to the use of importance measures
  - Methodogly used for pressure boundary categorization has been demonstrated to be consistent and in compliance with Reg Guide 1.174

- The following slides summarize these conclusions

# Fussel-Vesely (FV)* – Active Function

- Measures the amount that the total risk would decrease if a basic event's failure probability were 0 (i.e., extremely reliable, never fails)
- Many examples of successful application of FV to components with active functions (e.g. Maintenance Rule)
  - Valve fails to close, valve fails to open
  - Failure probabilities of 1E-3 to 1E-4
  - A high FV would suggest improving the failure probability from 1E-3 to 1E-4 via better maintenance or design would reduce risk

*** RRW gives the same ranking as FV**



EPRI

# Fussel-Vesely (FV)* – Active Function

- Measures the amount that the total risk would decrease if a basic event's failure probability were 0 (i.e., extremely reliable, never fails)
- Valve fails to close, valve fails to open
  - The active failure probabilities do not include failure of the pressure boundary function, or its contribution to failure of the valve's active function is extremely low (e.g. 1E-10 to 1E-14 from WCAP-14572-A) and there are no other impacts due to the pressure boundary failure (e.g. indirect effects)
  - Even for active functions with a high FV,
    - improving the pressure boundary reliability would have essentially zero effect on reducing risk
    - e.g. improving failure probability from 1E-8 to 1E-10 will have no impact
  - Applying alternate treatment to the pressure boundary will not increase the active functions FV value

*** See next slide**

# Example FV Results

| Basic Event | Description | Prob | FV | FV |
|---|---|---|---|---|
| FEFTDFPTP1 | Turbine-Driven Pump (Standby) Fail to Run During First Hour of Operation | 2.15E-03 | 4.00E-04 | 4.00E-04 |
| FEFTDFPTP2 | Turbine-Driven Pump (Standby) Fail to Run After First Hour of Operation | 3.79E-02 | 1.89E-02 | 1.89E-02 |
| FEFTDFPTPS | Turbine Driven EFW Pump Fails to Start on Demand | 4.66E-03 | 1.81E-03 | 1.81E-03 |
| | | **Total Active Function FV** | 2.11E-02 | 2.11E-02 |
| PBF | Pump pressure boundary failure - added for example only | 1.00E-06 | <1E-6 | |
| PBF | Pump pressure boundary failure - alternate treatment | 3.00E-06 | | <1E-6 |

| | |
|---|---|
| **1** | The active function is HSS |
| **2** | The passive function is LSS using this FV example but could be HSS depending on pressure boundary failure methodology which includes spatial and DID |
| **3** | Improving pressure boundary reliability would have zero effect on reducing risk |
| **4** | Applying alternate treatment to the pressure boundary will not increase FV to an unacceptable value |

# Fussel-Vesely (FV)* – Active Function

- Measures the amount that the total risk would decrease if a basic event's failure probability were 0 (i.e., extremely reliable, never fails)
- Valve fails to close, valve fails to open
  - The active failure probabilities do not include failure of the pressure boundary function which may include other impacts such as indirect effects that fail other equipment
  - As such active functions with a low FV, can be misleading as system redundancy and defense in depth can be challenged by such pressure boundary failures

# Risk Achievement Worth (RAW) – Pressure Boundary

- Use of RAW is generally not an appropriate metric for component failures that result in initiating events
  - initiating events are input as a frequency rather than a probability

- Use of RAW is even less appropriate for components with very low failure rates whose failures result in initiating events. For example, as discussed in NRC approved Topical Report WCAP-14572-A, February 1999, *"Piping failure probabilities are typically very small compared to other component failures modeled in the PSA. When the failure probability is set to 1.0 for the RAW calculation, large RAW values (e.g. 3000) typically result. Therefore, the guideline classifying a segment as high safety-significant for RAW values greater than 2 does not provide meaningful results."*

# Fussel-Vesely (FV)* – Pressure Boundary

- Pressure boundary typically have very low failure rates/probabilities for those breaks of most concern (e.g. large and very large breaks). As such, using relative importance measure such as F-V identifies the vast majority of pressure boundary components as low safety significant. See next slide.
- Differences in failure rates/probabilities of concern for pressure boundary as compared to active functions is quite large (e.g. 5 to 12 orders of magnitude). Which lead to very low safety significance assignment for the vast majority of pressure boundary components, including a large fraction of the reactor coolant pressure boundary. See next slide.

*** RRW gives the same ranking as Fussell-Vesely**

Figure 6 (excerpted from BFN3 RI-ISI Template Submittal [13])

Table 3.7-3
SEGMENT CATEGORIZATION

| System | | # Segs | Consequence category | | | Risk category | | |
|---|---|---|---|---|---|---|---|---|
| | | | High CCDP >1E-004 | Medium CCDP >1E-06, <1E-04 | Low CCDP <1E-06 | High RRW ≥1.005 | Medium RRW ≥1.001, <1.005 | Low RRW <1.001 |
| 001 | MS | 56 | 4 | 38 | 14 | 4 | | 52 |
| 002 | CDW | 36 | | 26 | 10 | | | 36 |
| 003 | FW | 46 | 10 | 31 | 5 | 10 | | 36 |
| 023 | RHRSW | 45 | | 12 | 33 | | | 45 |
| 024 | RCW | 20 | | 18 | 2 | | | 20 |
| 027 | CCW | 3 | | 2 | 1 | | | 3 |
| 063 | SLC | 5 | | 5 | | | | 5 |
| 067 | EECW | 28 | 4 | 7 | 17 | | | 28 |
| 068 | RECIRC | 16 | 16 | | | 9 | 3 | 4 |
| 069 | RWCU | 19 | 2 | 2 | 15 | 1 | | 18 |
| 070 | RBCCW | 17 | | 17 | | | | 17 |
| 071 | RCIC | 12 | | 9 | 3 | | | 12 |
| 073 | HPCI | 11 | 2 | 9 | | | | 11 |
| 074 | RHR | 31 | 6 | 16 | 9 | 3 | | 28 |
| 075 | CS | 15 | 3 | 8 | 4 | 2 | | 13 |
| 078 | FPC | 1 | | | 1 | | | 1 |
| 085 | CRD | 31 | | 7 | 24 | | | 31 |
| | total: | 392 | 47 | 207 | 138 | 29 | 3 | 360 |

Takeaway is that the RRW approach identifies that over 90% of the piping as low safety significant while the CCDP based approach limits low safety significant to 35% of the piping primarily due to defense in depth considerations.

# Use of CCDP / CLERP

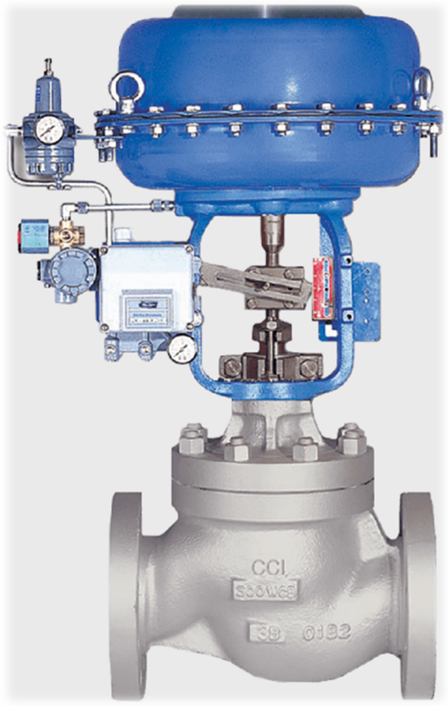
- Use of the CCDP and CLERP metrics avoids these identified concerns.
- Uncertainties associated with pressure boundary very low failure probabilities are eliminated since failure is assumed (i.e. a failure probability of 1.0 is used).
- Use of the CCDP and CLERP metrics which includes identifying <u>all active functions</u> that are <u>not</u> impacted by the postulated pressure boundary failure identifies pressure boundary components as important from a defense in depth perspective if there is limited or no redundancy given the postulated pressure boundary failure even if the postulated pressure boundary failure's overall contribution to risk (CDF/LERF) is very, very low.

# N752 is more restrictive than a 50.69 Application

- N752 applies to components having only a ***pressure retaining*** function (i.e., ***passive*** function). It also applies to the ***passive*** function of components that also have an ***active function*** (e.g., valves and pumps).

- Case N-752 does **<u>not</u>** change treatment on the ***active*** functions of components.

| N752 | Function | | Alternate Treatment | |
|---|---|---|---|---|
| Valve # | Passive | Active* | Passive | Active |
| | Rank | Rank | | |
| | | | | |
| MV1 | HSS | SR | No | No |
| MV2 | LSS | SR | Yes | No |




<u>Glove Valve with Operator</u>

<u>Centrifugal Pump with Motor</u>

| 50.69 | Function | | Alternate Treatment | |
|---|---|---|---|---|
| Valve # | Passive | Active* | Passive | Active |
| | Rank | Rank | | |
| | | | | |
| MV1 | HSS | HSS | No | No |
| MV2 | LSS | HSS | Yes | No |
| MV3 | HSS | LSS | No | Yes |
| MV4 | LSS | LSS | Yes | Yes |

# What role do Tables I-1, 2, 3 play in comparison to the role played by Table I-5?

As some background, section I-3.3.2 of ASME Code Case N-752 was developed from section I-3.1.2 of ASME Code Case N-660 which was approved by ASME in 2002 and accepted in Regulatory Guide 1.147 in 2005. These tables are the same in both ASME Code Case N-660 and ASME Code Case N-752. At that time, the ASME/ANS PRA Standard had not been developed and Regulatory Guide 1.200 did not exist. As such, there was some concern with the level of robustness of some plant-specific PRAs. Tables I-1, I-2 and I-3 of ASME Code Case N-660 were developed as a means to "calibrate" plant-specific results as well as assuring adequate levels of defense in depth. Examples of how each of the tables are used is provided as follows with the understanding that ASME Code Case N-660 is from 2002:

# What role do Tables I-1, 2, 3 play in comparison to the role played by Table I-5?

Example 1:

The segment has a postulated pipe break that results in small LOCA but does not disable any backup trains and has a PRA calculated CCDP of 1E-07 (i.e. low consequence rank per Table I-5). The user would have to compare that result to Table I-1 which recommends that small LOCAs be assigned either a high or medium consequence rank. The user would then be required to develop the technical basis (i.e. additional defense in depth) on why a low consequence rank is justifiable or assign the postulated failure to a high consequence rank unless a medium consequence rank could be justified.

# What role do Tables I-1, 2, 3 play in comparison to the role played by Table I-5?

Example 2:

The segment has a postulated pipe break in a system designed to respond to a reactor trip (anticipated event), with all year exposure time (standby system that is tested only once per year), that also fails all other systems used to respond to a reactor trip, except one backup train, results in a PRA calculated CCDP of 1E-07 (i.e. low consequence rank per Table I-5). The postulated break does not cause an initiating event and only causes system/train loss. The user would have to compare that result to Table I-2 which recommends that for postulated breaks designed to respond to a reactor trip with only one backup train for those conditions and all year exposure time be assigned a high consequence rank. The user would then be required to develop the technical basis (i.e. additional defense in depth) on why a low consequence rank is justifiable or assign the postulated failure to a high consequence. Note: I-3.3.2(b) also states “Additionally, for defense-in-depth purposes, all postulated failures leading to zero defense (i.e., no backup trains) shall be assigned a high consequence.” This is required regardless of any PRA calculations using Table I-5.

# What role do Tables I-1, 2, 3 play in comparison to the role played by Table I-5?

Example 3:

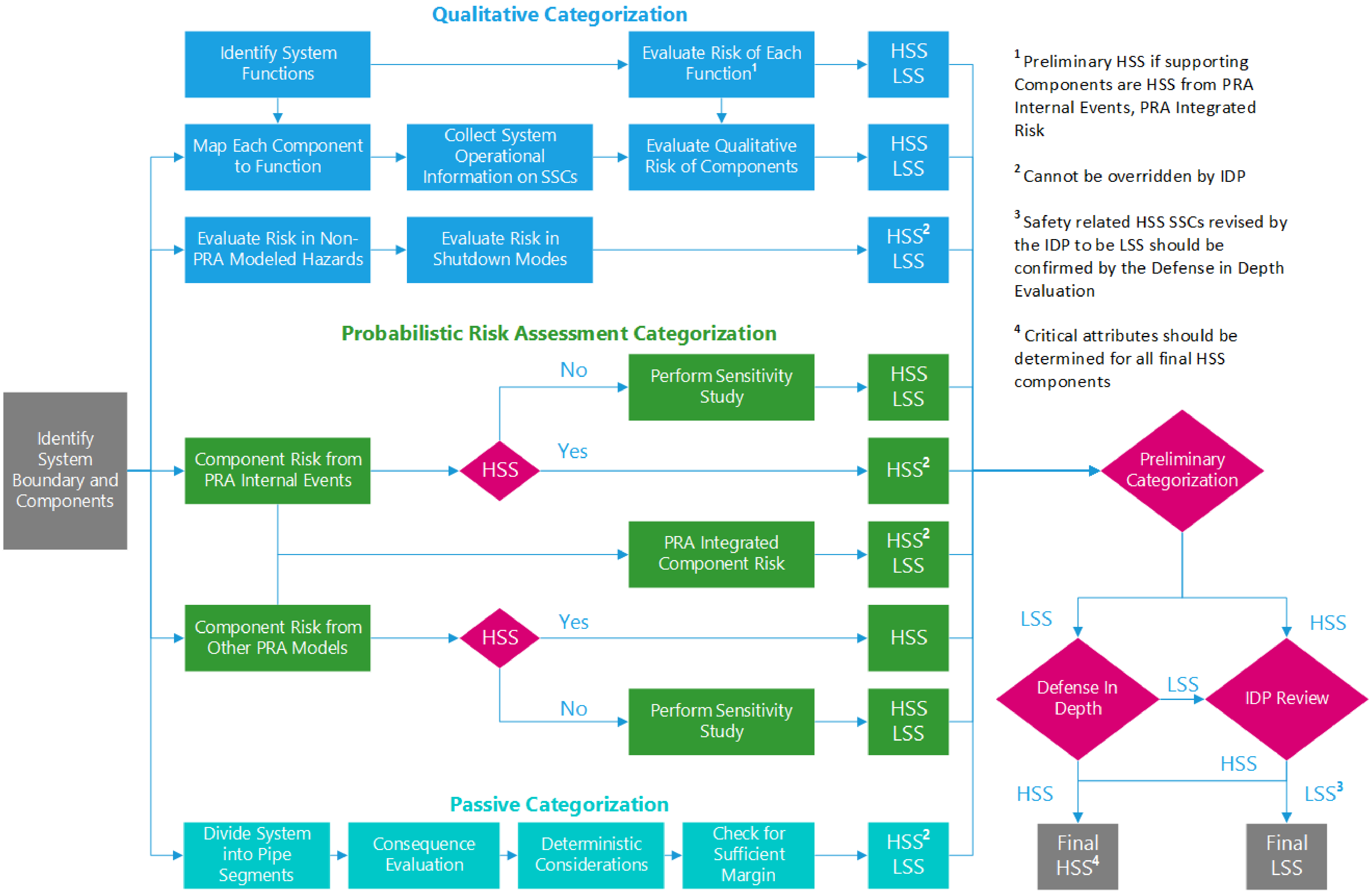
The segment has a postulated pipe break that results in small LOCA as well as disabling all but one backup train results in a CCDP of 1E-07 (i.e. low consequence rank per Table I-5). The postulated break causes an initiating event and causes loss of a system/train. The user would have to compare that result to Table I-3 which recommends that small LOCAs with only one backup train available be assigned a high consequence rank. The user would then be required to develop the technical basis (i.e. additional defense in depth) on why a low consequence rank is justifiable or assign the postulated failure to a high consequence rank.

# What role do Tables I-1, 2, 3 play in comparison to the role played by Table I-5?

With the significant increases in PRA Technical Adequacy over the years, in particular in the US, consideration was given to revising ASME Code Case N-752 to eliminate Table I-1, I-2 and I-3 and allow plants with robust peer reviewed PRAs to use Table I-5 directly. However, because the ASME Code is an international code and not all countries follow the ASME/ANS PRA standard, those changes were not made. Further, leaving those requirements in place for US users of ASME Code Case N-752 provides an additional layer of confidence that the ASME Code Case N-752 process will produce technically robust results and is consistent with risk-informed decision-making philosophy. That the ASME Code Case N-752 process provides technical robust results is further supported by the technology's endorsement by several standards development organizations, technical support organizations, as well as several international regulatory bodies.

# More Recent Input

- Can the results from the 50.69 active categorization influence the passive categorization?
  - **No, as described in previous slides and illustrated in next slide.**
  - **50.69 Active categorization and 50.69 Passive categorization are independent activities**




[1] Preliminary HSS if supporting Components are HSS from PRA Internal Events, PRA Integrated Risk

[2] Cannot be overridden by IDP

[3] Safety related HSS SSCs revised by the IDP to be LSS should be confirmed by the Defense in Depth Evaluation

[4] Critical attributes should be determined for all final HSS components

# More Recent Input

- Is the "system" evaluation in 50.69 different than for N-752?
  - **The evaluation methodology for pressure boundary components is identical, however, the scope of application can be different.**
  - **The 50.69 passive component risk categorization “equals” the N-752 passive component risk categorization (e.g. HSS or LSS), regardless of the number of components being categorized.**
    - **Whether a 1,000-component system is categorized in 50.69, or a single pipe run is categorized in N752 – the HSS/LSS result will be the same for any particular component**

# ASME Code Case N752

- ASME SXI Approved March 27, 2019

**2. Standards Committee Ballot History**

Ballot#: 18-3566RC1 Please click on the Ballot# button to view comments / negatives for this ballot.
Ballot Level: Standards Committee
Final Record Status: Approved
Date Opened: 03/11/19
Date Closed: 03/27/19
Record Status Date: 04/17/2019
Description:
BPV XI Recirculation Ballot for Record #06-250

Voting Results:
BPV XI

34 Approved (ArmentroutV, BallJ, BamfordW, BensonM, BoughmanJ, BrownST, ChanTL, CipollaR, CordesD, DoH, DyleR, FarrellE, FerlisiM, GerlachE, GriesbachT, HakiiJ, HallM, KulatS, LeeD, LindbergJ, LofthusG, MalikowskiH NavratilG, NormanS, O'SullivanJ, PalmNA, ParkG, RobertsA, ScarthD, SpannerJ, SwayneR, TillyD, WaskeyD, WeicksJ)
1 Disapproved (FisherP)
0 Disapproved w/out Comment
0 Abstain
0 Not Voting
4 Not Returned (DavisD,HenryD,LamondD,SchaafF)

Total # of Votes: 39

Use of N752 was also approved by NRC at ANO Units 1 and 2 – May 19, 2021

# ASME Code Case N752-1

- ASME SXI Approved January 6, 2021

**2. Standards Committee Ballot History**

Ballot#: 20-3750RC1 Please click on the Ballot# button to view comments / negatives for this ballot.
Ballot Level: Standards Committee
Final Record Status: Approved
Date Opened: 12/21/20
Date Closed: 01/06/21
Record Status Date: 01/06/2021
Description:
BPV XI Recirculation Ballot - Record 20-2400

Voting Results:
BPV XI
Record 20-2400
35 Approved (BallJ, BrownCt, ChanTL, CipollaR, CordesD, DoH, FarrellE, FerlisiM, GriesbachT, HakiiJ, HallM, HenryD, HolstonW, KulatS, LamondD, LindbergJ, LofthusG, MalikowskiH, McCrackenS, NormanS, NoveC, NuofferT, NygaardJ, O'SullivanJ, PalmNA, ParkG, RobertsA, ScarthD, SwayneR, TakayaS, VetterD, VoT, WaskeyD, WeicksJ, WeisMa)
0 Disapproved
0 Disapproved w/out Comment
0 Abstain
0 Not Voting
5 Not Returned (BamfordW,BoughmanJ,BrownST,FisherP,SchaafF)

Total # of Votes: 40

# ASME Code Cases N752-0, N752-1

**U.S. NUCLEAR REGULATORY COMMISSION**

**DRAFT REGULATORY GUIDE, DG-1406**

***Proposed Revision 21 to Regulatory Guide RG 1.147***

**Issue Date: January 2023**
**Technical Lead: Bruce Lin**

| | | |
|---|---|---|
| 2021 | 0 | N-561-4, N-562-4, N-597-5, N-661-5, N-752-1[3], N-754-2, N-766-4, N-770-7[2], N-786-4, N-789-4, N-809-1, N-813-1[2], N-847-1, N-853-1, N-865-2, N-871-1[3], N-880-1, N-882-1, N-897[2], N-911, N-912, N-913 |

1 Annulled.
2 This Code Case is not acceptable for use (See RG 1.193)
3 This Code Case will be considered in future revision to this RG.

DG-1406, Appendix A, Page A-1

| Code Case Number | Approval Date | Table Where Code Case Is Listed |
|---|---|---|
| N-751 | 8/3/06 | Table 2 |
| N-752-1 | 4/12/21 | Pending |

# N752-0, N752-1

- Discussion

- Path Forward

# Draft N752-2 – NRC Ballot Input

- 1 - The NRC staff notes that the Case continues to include wording for Class 1 items. The inclusion of wording for Class 1 that does not clearly state the prohibition only of using the Case on Class 1 items will only increase the chance for errors in use of the Case in the future. The wording of Footnote 3 should be deleted.
- 2 – The NRC staff does not agree with the wording to change the Case from Systems to Items. While items may be identified by the Case for recategorization, the process of classification should be consistent with applications of piping segments of approved risk informed processes (e.g. RI-ISI and 10 CFR 50.69 applications).
  - **Note: NRC has on a plant-specific and generic basis approved application of RI-ISI to a portion of a system. That is, RI-ISI can be applied to a subset of a Class 1 system, to a subset of a Class 2 system.**
  - **Note: Whether the code case categorization scope is a system or a single item, the process is consistent with the use of segments as described in Rev 0. The impact of the pressure boundary failure on the entire plant is assessed for any item/segment under consideration.**
- 3 – The NRC staff does not agree that the proposed technical basis is adequate to justify the removal of personnel requirements with expertise in PRA, operations, design, and safety analysis to perform characterization for the Case. NRC staff notes that generic approval of this Case would allow implementation of 10 CFR 50.69 like reduction in requirements without an independent NRC review of the PRA process used. The inclusion of these personnel expertise requirements is a basis for the NRC approval of earlier versions of this Case and previous similar cases.
- 4 – The NRC staff disagrees with the wording change to the required update to the PRA on implementing this Case. The proposed change to address the issue at the subgroup level also recommended that the NRC could establish a condition of every 2 refueling outages. The NRC staff believes the Case implementation requirement was acceptable in the earlier version of this Case.
- 5 – The NRC staff has found an insufficient technical basis to support the use of EPRI report 3002015999, Enhanced Risk-Informed Categorization Methodology for Pressure Boundary Components in other risk informed categorization activities (ADAMS Accession No. ML23090A163). Therefore, at this time, NRC staff finds EPRI report 3002015999 should not be allowed to be used in part or as a technical basis for actions associated with this code case without regulatory review.

# Draft N752-2

- 1 - The NRC staff notes that the Case continues to include wording for Class 1 items. The inclusion of wording for Class 1 that does not clearly state the prohibition only of using the Case on Class 1 items will only increase the chance for errors in use of the Case in the future. The wording of Footnote 3 should be deleted.

**-1000 SCOPE AND RESPONSIBILITY**

**-1100 Scope**

This Case provides a process for determining the Risk-Informed Categorization and Treatment for repair/replacement activities on Class 2 and Class 3 items [3] except for the following:

(a) that portion of the Class 2 feedwater system [> NPS 4 (DN 100)] of pressurized water reactors (PWRs) from the steam generator, including the steam generator, to the outer containment isolation valve

(b) piping within the break exclusion region [> NPS 4 (DN 100)] for high energy piping systems(4) as defined by the Owner

(3) The Owner shall not use this Case for piping that has been optionally classified Class 1 or classified Class 1 exempt, until that piping is reclassified non-Class 1 in accordance with the applicable change-control process.

# Draft N752-2

- 2 – The NRC staff does not agree with the wording to change the Case from Systems to Items. While items may be identified by the Case for recategorization, the process of classification should be consistent with applications of piping segments of approved risk informed processes (e.g. RI-ISI and 10 CFR 50.69 applications).

Pursuant to 10 CFR 50.55a(z)(1), Entergy proposes to implement ASME Code Case N-752 as an alternative to the ASME Code requirements specified in Section 3. Code Case N-752 provides a process for determining the risk-informed categorization and treatment requirements for Class 2 and 3 pressure retaining items or the associated supports as delineated in Section 1. Code Case N-752 may be applied on a system basis or on individual items within selected systems. Code Case N-752 does not apply to Class 1 items.

In addition to the above, Entergy will also revise applicable ANO-1 and ANO-2 licensing basis documents (e.g., Safety Analysis Report), as appropriate, to identify systems, subsystems, or individual items that have been categorized as LSS and address alternative treatment requirements. Changes to licensing basis documents will be performed in accordance with 10 CFR 50.59.

RI-ISI can be applied to a subset of a Class 1 system, to a subset of a Class 2 system

Application to Individual Items Within a System

The risk-informed methodology of Code Case N-752 may be applied on a system basis or on individual items within selected systems. Paragraph -1100 of Code Case N-752 states: "This Case may be applied on a system basis, including all pressure retaining items and their associated supports, or on individual items categorized LSS within the selected systems." While this is the case, the risk-informed methodology is, in actuality, applied to the pressure boundary function of the individual components within the system. The risk-informed methodology contained in Code Case N-752 requires that the component's pressure boundary function be assumed to fail with a probability of 1.0, and all impacts caused by the loss of the pressure boundary function be identified. This would include identifying impacts of the pressure boundary failure on the component under evaluation, identifying impacts of the pressure boundary failure of the component on the system in which the component resides, as well as identifying impacts of the pressure boundary failure of the component on any other plant SSC. This includes direct effects (e.g. loss of the flow path) of the component failure and indirect effects of the component failure (e.g. flooding, spray, pipe whip, loss of inventory). This comprehensive assessment of total plant impact caused by a postulated individual component failure is then used to determine the final consequence ranking. As such, the final consequence rank of the individual component would be the same regardless of whether the entire system or only the individual component is subject to the risk-informed methodology.

# Draft N752-2

- *The risk-informed methodology of Code Case N-752 may be applied on a system basis or on individual items within selected systems.  Paragraph -1100 of Code Case N-752 states:  "This Case may be applied on a system basis, including all pressure retaining items and their associated supports, or on individual items categorized LSS within the selected systems."  While this is the case, the risk-informed methodology is, in actuality, applied to the pressure boundary function of the individual components within the system.  The risk-informed methodology contained in Code Case N-752 requires that the component's pressure boundary function be assumed to fail with a probability of 1.0, and all impacts caused by the loss of the pressure boundary function be identified.  This would include identifying impacts of the pressure boundary failure on the component under evaluation, identifying impacts of the pressure boundary failure of the component on the system in which the component resides, as well as identifying impacts of the pressure boundary failure of the component on any other plant SSC.  This includes direct effects (e.g. loss of the flow path) of the component failure and indirect effects of the component failure (e.g. flooding, spray, pipe whip, loss of inventory).  This comprehensive assessment of total plant impact caused by a postulated individual component failure is then used to determine the final consequence ranking.  As such, the final consequence rank of the individual component would be the same regardless of whether the entire system or only the individual component is subject to the risk-informed methodology.*

# Draft N752-2

- 3 – The NRC staff does not agree that the proposed technical basis is adequate to justify the removal of personnel requirements with expertise in PRA, operations, design, and safety analysis to perform characterization for the Case. NRC staff notes that generic approval of this Case would allow implementation of 10 CFR 50.69 like reduction in requirements without an independent NRC review of the PRA process used. The inclusion of these personnel expertise requirements is a basis for the NRC approval of earlier versions of this Case and previous similar cases.

- *Per previous email correspondences, the authors offered to make this change and requested discussion on the other proposed responses.*

# Draft N752-2

- 4 – The NRC staff disagrees with the wording change to the required update to the PRA on implementing this Case. The proposed change to address the issue at the subgroup level also recommended that the NRC could establish a condition of every 2 refueling outages. The NRC staff believes the Case implementation requirement was acceptable in the earlier version of this Case.

- *As discussed at various SXI meetings, there is agreement that the PRA needs to be periodically updated but this requirement, and its periodicity, is not within the purview of ASME SXI.*

# Draft N752-2

- 5 – The NRC staff has found an insufficient technical basis to support the use of EPRI report 3002015999, Enhanced Risk-Informed Categorization Methodology for Pressure Boundary Components in other risk informed categorization activities (ADAMS Accession No. ML23090A163). Therefore, at this time, NRC staff finds EPRI report 3002015999 should not be allowed to be used in part or as a technical basis for actions associated with this code case without regulatory review.

- *3002015999 is not used in the Case. It is only provided as a reference. However, it is agreed that this report can be struck, as a reference, from the code case.*

# Draft N752-2

- Discussion

- Path Forward

# Summary

- As shown in the previous slides, application of ASME Code Case N752 or application of 10CFR50.69 for categorizing pressure boundary components will yield the same results (i.e. HSS versus LSS) from a pressure boundary component perspective

- Application of N752 is identical or more conservative than application of 10CFR50.69

- The Consequence Evaluation methodology has previously been approved by NRC:
  - November 9, 1998 - Vermont Yankee (Class 1)
  - December 29, 1998 – ANO U2 (Class 1, 2, 3 and NNS)
  - October 28, 1999 – EPRI TR-112657 Rev B-A
  - September 12, 2000 – JAFitzpatrick (Class 1, 2, 3 and NNS)
  - 2000 thru 2008 - ~ 60 additional units (mostly Class 1 and 2)
  - April 22, 2009 – ANO-2 RI-RRA
  - May 19, 2021 – ANO U1 and U2 RI-RRA
  - October 27, 2022 – RI-ISI methodology endorsed in 10CFR50.55a
  - 50 units currently approved to use the RI-RRA methodology to categorize pressure boundary components within their 10CFR50.69 program

- What are the next steps forward in gaining N752 acceptance (i.e.. RG1.147 and near-term relief requests)

# Questions?

- Action Items