PRA Quality Requirements for Application of the EPRI RI-ISI Traditional Approach (TR-112657) and PWROG RI-ISI Methodology (WCAP-14572)

This document contains recommended PRA quality requirements when using the EPRI and PWROG RI-ISI methodologies on or after January 1, 2008. These requirements reflect the ASME PRA standard, Regulatory Guide 1.200, Revision 1, and the development and application of the EPRI and PWROG RI-ISI methodologies. As can be seen in the Table that follows, these recommended requirements are a function of the scope of application as well as how directly the PRA results are used.

For the EPRI RI-ISI traditional approach, EPRI TR-112657 describes in detail the use of the plant specific PRA in developing a RI-ISI program. In addition, EPRI TR-112657 provides guidance (e.g. look-up tables) that also acts as a sanity check on the PRA results and their use. For the most part, the plant specific RI-ISI evaluations provide the foundation for the RI-ISI program (e.g. consequence assessment) and the plant-specific PRA is used to calibrate these results (e.g. high versus medium consequence rank) The most important attributes being the definition of conditional core damage probability (CCDP) and conditional large early release probability (CLERP). Finally, because the EPRI traditional RI-ISI approach is an absolute approach, conservatisms in the RI-ISI evaluations (e.g. consequence assessment) or the plant-specific PRA will only result in an increase in the number of inspections. Therefore, generally speaking, a PRA that meets lower capability categories will provide a more conservative RI-ISI program.

For the PWROG RI-ISI methodology, WCAP-14572 describes in detail the use of the plant specific PRA in developing a RI-ISI program. The PRA is used to develop CCDPs, conditional core damage frequencies (CCDFs), CLERPs, and conditional large early release frequencies (CLERFs) that are used as inputs to the risk evaluation. The PWROG RI-ISI methodology is a relative ranking process. In a relative ranking process, over conservatisms have the potential to adversely affect the results. To address this, the PWROG methodology includes sensitivity runs, uncertainty analysis, the use of an integrated decision making panel and a review for risk outliers.

Consequences both without and with operator action are identified. Four risk evaluation cases (CDF and LERF without and with operator action) are developed. The risk metrics from any of the four risk evaluation cases can cause the segment to be selected for inspection. An uncertainty analysis is performed to ensure that no low safety significant segment would move to high safety significance when reasonable variations in the failure probabilities and PRA values are considered. An integrated decision making panel is used. This panel considers the risk metrics, deterministic insights, modeling limitations and other data as part of the categorization process.

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TABLE 1

Recommended Supporting Requirements Versus Scope of RI-ISI Application

Scope of Application	Criterion	Applicable PRA Elements / Requirements
N560 Applications (Examination Category B-J)	All piping located inside containment	As defined for MSPI (e.g. ML043510095 or plant-specific alternative)
	Some piping located outside containment	As defined for MSPI (e.g. ML043510095 or plant-specific alternative) and IE-A-2 & LE-A-2 from RA-Sb-2005
Class 1 Piping (Examination Categories B-F and B-J)	All piping located inside containment	As defined for MSPI (e.g. ML043510095 or plant-specific alternative)
	Some piping located outside containment	As defined for MSPI (e.g. ML043510095 or plant-specific alternative) and IE-A-2 & LE-A-2 from RA-Sb-2005
Class 1 and 2 Applications (Examination Categories B-F, B-J, C-F-1 and C-F-2)	Internal flooding study not used directly	As defined for MSPI (e.g. ML043510095 or plant-specific alternative) and IE-A-2 & LE-A-2 from RA-Sb-2005
	Internal flooding study used directly	As defined for MSPI (e.g. ML043510095 or plant-specific alternative), IE-A-2 & LE-A-2 from RA-Sb-2005 and attached Table 2
Full-scope Applications (Examination Categories B-F, B-J, C-F-1 and C-F-2 and may include Class3 / NSS)	Internal flooding study not used directly	As defined for MSPI (e.g. ML043510095 or plant-specific alternative) and IE-A-2 & LE-A-2 from RA-Sb-2005
	Internal flooding study used directly	As defined for MSPI (e.g. ML043510095 or plant-specific alternative), IE-A-2 & LE-A-2 from RA-Sb-2005 and

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		attached Table 2

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-A1	DEFINE flood areas by dividing the plant into physically separate areas where a flood area is viewed as generally independent of other areas in terms of the potential for internal flooding effects and flood propagation.			Fundamental to all capability categories
IF-A1a	DEFINE flood areas at the level of **buildings or portions thereof from which there would be no propagation to other modeled buildings or portions thereof.**	DEFINE flood areas at the level of **individual rooms or combined rooms/halls for which plant design features exist to restrict flooding.**		Cat I - The higher capability categories require further resolution of plants areas/rooms. Cat I does not allow propagation outside of the defined area, including via drains lines or other paths. By not requiring higher resolution per capability Cat II/III, a conservative CCDP would be developed. PWROG methodology reviews & addresses potential over conservatisms.
IF-A1b	For multi-unit sites with shared systems or structures, INCLUDE multi-unit areas, if applicable.			Fundamental to all capability categories
IF-A2	DELETED (moved to IF-C2c)			--
IF-A3	USE plant information sources that reflect the as-built as-operated plant to support development of flood areas.			Fundamental to all capability categories
IF-A4	CONDUCT a plant walkdown(s) to verify the accuracy of information obtained from plant information sources and to obtain or verify: (a) spatial information needed for the development of flood areas, and (b) plant design features credited in defining flood areas. Note: Walkdown(s) may be done in conjunction with the requirements of IF-B3a, IF-C9 and IF-E8.			Fundamental to all capability categories
IF-B1	For each flood area, IDENTIFY the potential sources of flooding [Note 1]. INCLUDE: *(a)* equipment (e.g., piping, valves, pumps) located in the area that are connected to fluid systems (e.g., circulating water system, service water system, component cooling water system, feedwater system, condensate and steam systems) *(b)* plant internal sources of flooding (e.g., tanks or pools) located in the flood area *(c)* plant external sources of flooding (e.g., reservoirs or rivers) that are connected to the area through some system or structure *(d)* in-leakage from other flood areas (e.g., back flow through drains, doorways, etc.)			Fundamental to all capability categories
	NRC Issue: The list of fluid systems should be expanded to include fire protection systems.			

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
	NRC Resolution: For each flood area…INCLUDE (a) equipment (e.g., piping, valves, pumps) located in the area that are connected to fluid systems (e.g., circulating water system, service water systems, …fire protection system…			
IF-B1a	For multi-unit sites with shared systems or structures, INCLUDE any potential sources with multi-unit or cross-unit impacts.			Fundamental to all capability categories
IF-B1b	SCREEN OUT flood areas with none of the potential sources of flooding listed in IF-B1and IF-B1a.			Fundamental to all capability categories
IF-B2	For each potential source of flooding, IDENTIFY the flooding mechanisms that would result in a fluid release. INCLUDE: (a) failure modes of components such as pipes, tanks, gaskets, expansion joints, fittings, seals, etc. (b) human-induced mechanisms that could lead to overfilling tanks, diversion of flow through openings created to perform maintenance; inadvertent actuation of fire suppression system (c) other events resulting in a release into the flood area			Fundamental to all capability categories Note: RI-ISI only applies to piping applications, therefore this SR is only partially applicable (i.e. human induced mechanisms for overfilling tanks is not applicable)
IF-B3	For each source and its identified failure mechanism, IDENTIFY the characteristic of release and the capacity of the source. INCLUDE: (a) a characterization of the breach, including type (e.g., leak, rupture, spray) (b) flow rate (c) capacity of source (e.g., gallons of water) (d) the pressure and temperature of the source			Fundamental to all capability categories
	NRC Issue: It is necessary to consider a range of flow rates for identified flooding sources, each having a unique frequency of occurrence. For example, small leaks that only cause spray are more likely than large leaks that may cause equipment submergence.			
	NRC Resolution: (b) range of flow rates			
IF-B3a	CONDUCT plant walkdown(s) to verify the accuracy of information obtained from plant information sources and to determine or verify the location of flood sources and in-leakage pathways Note: Walkdown(s) may be done in conjunction with the requirements of IF-A4, IF-C9 and IF-E8.			Fundamental to all capability categories
IF-C1	For each defined flood area and each flood source, IDENTIFY the propagation path from the flood source area to its area of accumulation.			Fundamental to all capability categories
	NRC Issue: For a given flood source, there may be multiple propagation paths and areas of accumulation.			
	NRC Resolution: For each defined flood area and each flood source, IDENTIFY the propagation paths from the flood source area to the areas of accumulation.			

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-C2	For each defined flood area and each flood source, IDENTIFY plant design features that have the ability to terminate or contain the flood propagation. INCLUDE the presence of : (a) flood alarms, (b) flood dikes, curbs, sumps (i.e., physical structures that allow for the accumulation and retention of water), (c) drains (i.e., physical structures that can function as drains), (d) sump pumps, spray shields, water-tight doors, and (e) blowout panels or dampers with automatic or manual operation capability.			Fundamental to all capability categories
IF-C2a	For each defined flood area and each flood source, IDENTIFY those automatic or operator responses that have the ability to terminate or contain the flood propagation.			Fundamental to all capability categories
IF-C2b	ESTIMATE the capacity of the drains and the amount of water retained by sumps, berms, dikes and curbs. ACCOUNT for these factors in estimating flood volumes and SSC impacts from flooding.			Fundamental to all capability categories
IF-C2c	For each flood area not screened out using the requirements under other Internal Flooding supporting requirements (e.g., IF-B1b and IF-C5), IDENTIFY the SSCs located in each defined flood area and along flood propagation paths that are modeled in the internal events PRA model as being required to respond to an initiating event or whose failure would challenge normal plant operation, and are susceptible to flood. For each identified SSC, IDENTIFY, for the purpose of determining its susceptibly per IF-C3, its spatial location in the area and any flooding mitigative features (e.g., shielding, flood or spray capability ratings). **NRC Issue:** There is circular logic between this SR and IF-C5. This SR requires identifying SSCs for flood areas not screened out in IF-C5. A listed reason for screening a flood area in IF-C5 is that it does not contain SSCs. **NRC Resolution:** For each flood area not screened out using the requirements under IF-B1b…			Fundamental to all capability categories
IF-C3	For the SSCs identified in IF-C2c, IDENTIFY the susceptibility of each SSC in a flood area to flood-induced failure mechanisms. **INCLUDE failure by submergence and spray** in the identification process. EITHER: (a) ASSESS qualitatively the impact of flood-induced mechanisms that are not formally addressed (e.g., using the mechanisms listed under Capability Category III of this requirement), by using conservative assumptions; OR (b) NOTE that these mechanisms are not included in the scope of the evaluation.		For the SSCs identified in IF-C2c, IDENTIFY the susceptibility of each SSC in a flood area to flood-induced failure mechanisms. **INCLUDE failure by submergence, spray, jet impingement, pipe whip, humidity, condensation, temperature concerns, and any other identified failure modes** in the identification process.	Cat II - Capability category II and plant must also be designed to NUREG-0800 sections 3.6.1 and 3.6.2 or equivalent (e.g. EPRI TR-1006837 for RI-BER). BTP MEB 3-1, contained in section 3.6.2 provides specific requirements for Class 1 piping (section B.1.c.(1)), Class 2 and 3 piping (section B.1.c.(2)) and non-nuclear piping (section B.1.c.(3)) and section B.1.c.(4) is applicable to all classes of piping. If not, capability category III is required.

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
	NRC Issue: For Cat II, it is not acceptable to just note that a flood-induced failure mechanism is not included in the scope of the internal flooding analysis. Some level of assessment is required.			
	NRC Resolution: Cat I: INCLUDE failure of submergence and spray in the identification process. EITHER: (a) ASSESS… by using conservative assumptions; OR (b) NOTE that these mechanisms are not included in the scope of the evaluation. Cat II: INCLUDE failure by submergence and spray in the identification process. ASSESS qualitatively the impact of flood-induced mechanisms that are not formally addressed (e.g., using the mechanisms listed under Capability Category III of this requirement), by using conservative assumptions.			
IF-C3a	In applying SR IF-C3 to determine susceptibility of SSCs to flood-induced failure mechanisms, TAKE CREDIT for the operability of SSCs identified in IF-C2c with respect to internal flooding impacts only if supported by an appropriate combination of: (a) test or operational data (b) engineering analysis (c) expert judgment.			Fundamental to all capability categories
IF-C3b	No requirement for inter-area propagation given that flood areas are independent (see SR IF-A1a).	IDENTIFY inter-area propagation through the normal flow path from one area to another via drain lines; and areas connected via back flow through drain lines involving failed check valves, pipe and cable penetrations (including cable trays), doors, stairwells, hatchways, and HVAC ducts. INCLUDE potential for structural failure (e.g., of doors or walls) due to flooding loads.	IDENTIFY inter-area propagation through the normal flow path from one area to another via drain lines; and areas connected via back flow through drain lines involving failed check valves, pipe and cable penetrations (including cable trays), doors, stairwells, hatchways, and HVAC ducts. INCLUDE potential for structural failure (e.g., of doors or walls) due to flooding loads**, and the potential for barrier unavailability, including maintenance activities.**	Cat I – higher capability categories are not required as the flood areas are defined as independent per SR IF-A1a. For Cat I, SR IF-A1a does not allow propagation outside of the defined area, including via drain lines or other paths. If additional specificity is required (e.g. individual rooms are defined, then CAT II is required. It is noted that ISI has limited or negligible ability to impact maintenance induced unavailability of barriers and vice versa.
	NRC Issue: Both a Capability Category II and III PRA should include the potential for maintenance-induced unavailability of barriers.			
	NRC Resolution: Cat II, III: IDENTIFY inter-area… INCLUDE potential for structural failure (e.g., of doors or walls) due to flooding loads and the potential for barrier unavailability, including maintenance activities.			

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-C3c	PERFORM any necessary engineering calculations for flood rate, time to reach susceptible equipment, and the structural capacity of SSCs in accordance with the applicable requirements described in Table 4.5.3-2(b).			Fundamental to all capability categories
IF-C4	DEVELOP flood scenarios (i.e., the set of information regarding the flood area, source, flood rate and source capacity, operator actions, and SSC damage that together form the boundary conditions for the interface with the internal events PRA) by examining the equipment and relevant plant features in the flood area and areas in potential propagation paths, giving credit for appropriate flood mitigation systems or operator actions, and identifying susceptible SSCs.			Fundamental to all capability categories
IF-C4a	For multi-unit sites with shared systems or structures, INCLUDE multi-unit scenarios.			Fundamental to all capability categories
IF-C5	SCREEN OUT ***flood areas*** where flooding of the area does not cause an initiating event or a need for immediate plant shutdown, AND either of the following applies: *(a)* the flood area (including adjacent areas where flood sources can propagate) contains no mitigating equipment modeled in the PRA; OR *(b)* the flood area has no flood sources sufficient (e.g., through spray, immersion, or other applicable mechanism) to cause failure of the equipment identified in IF-C2c. DO NOT USE failure of a barrier against inter-area propagation to justify screening (i.e., for the purposes of screening, do not credit such failures as a means of beneficially draining the area) JUSTIFY any other qualitative screening criteria.			Fundamental to all capability categories
IF-C5a	SCREEN OUT ***flood areas*** where flooding of the area does not cause an initiating event or a need for immediate plant shutdown, AND the following applies: The flood area contains flooding mitigation systems (e.g., drains or sump pumps) capable of preventing unacceptable flood levels, and the nature of the flood does not cause equipment failure (e.g., through spray, immersion, or other applicable failure mechanisms). DO NOT CREDIT mitigation systems for screening out flood areas unless there is a definitive basis for crediting the capability and reliability of the flood mitigation system(s).			Fundamental to all capability categories
IF-C6	USE potential human mitigative actions as additional criteria for screening out ***flood areas*** if all the following can be shown: *(a)* flood indication is available in the control room *(b)* the flood sources in the area can be isolated ***(c)*** **the time to the damage of safe shutdown equipment is significantly greater than the**	USE potential human mitigative actions as additional criteria for screening out ***flood areas*** if all the following can be shown: *(a)* flood indication is available in the control room (b) the flood sources in the area can be isolated **(c) the mitigative action can be performed with high reliability for the worst flooding**	**DO NOT SCREEN OUT *flood areas* based on reliance on operator action to prevent challenges to normal plant operations.**	Cat II – higher capability category are not required as the CAT II requirements assure high reliability for these actions. EPRI TR-112657, Rev B-A provides additional guidance. PWROG methodology evaluates consequences without and with operator action.

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
	expected time for human mitigative actions to be performed, for the worst flooding initiator	**initiator. High reliability is established by demonstrating, for example, that the actions are procedurally directed, that adequate time is available for response, that the area is accessible, and that there is sufficient manpower available to perform the actions.**		
IF-C7	SCREEN OUT ***flood sources*** if it can be shown that: (a) the flood source is insufficient (e.g., through spray, immersion, or other applicable mechanism) to cause failure of equipment identified in IF-C2c; OR (b) the area flooding mitigation systems (e.g., drains or sump pumps) are capable of preventing unacceptable flood levels and nature of the flood does not cause failure of equipment identified in IF- C2c (e.g., through spray, immersion, or other applicable failure mechanism); OR (c) the flood only affects the system that is the flood source and the systems analysis addresses this per SY-A13 and SY-A14 and need not be treated as a separate internal flooding initiating event.			Fundamental to all capability categories

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-C8	USE potential human mitigative actions as additional criteria for screening out ***flood sources*** if all the following can be shown: *(a)* flood indication is available in the control room, *(b)* the flood source can be isolated, and ***(c)*** **the time to the damage of safe shutdown equipment is significantly greater than the expected time for human mitigative actions to be performed, for the worst flood from that source.**	USE potential human mitigative actions as additional criteria for screening out ***flood sources*** if all the following can be shown: *(a)* flood indication is available in the control room, *(b)* the flood source can be isolated, and *(c)* **the mitigative action can be performed with high reliability for the worst flood from that source. High reliability is established by demonstrating, for example, that the actions are procedurally directed, that adequate time is available for response, that the area is accessible, and that there is sufficient manpower available to perform the actions.**	**DO NOT SCREEN OUT *flood sources* based on reliance on operator action to prevent challenges to normal plant operations.**	Cat II – higher capability category are not required as the CAT II requirements assure high reliability for these actions. EPRI TR-112657, Rev B-A provides additional guidance. PWROG methodology evaluates consequences without and with operator action.
IF-C9	CONDUCT plant walkdown(s) to verify the accuracy of information obtained from plant information sources and to obtain or verify: (a) SSCs located within each defined flood area (b) flood / spray / other applicable mitigative features of the SSCs located within each defined flood area (e.g., drains, shields, etc.) (c) pathways that could lead to transport to the flood area Note: Walkdown(s) may be done in conjunction with the requirements of IF-A4, IF-B3a and IF-E8.			fundamental to all capability categories
IF-D1	For each flood scenario, IDENTIFY the corresponding plant initiating event group identified per Table 4.5.7-1 and the scenario-induced failures of SSCs required to respond to the plant initiating event. INCLUDE the potential for a flooding-induced transient or LOCA. If an appropriate plant initiating event group does not exist, CREATE a new plant initiating event group in accordance with the applicable requirements of Table 4.5.1-2(b).			fundamental to all capability categories
	NRC Issue: IF-D1 incorrectly references Table 4.5.7-1 when it should cite Table 4.5.1-2(b). Note that IF-D2 was deleted in Addendum B.			
	NRC Resolution: …IDENTIFY the corresponding plant initiating event group identified per Table 4.5.1-2(b)…			

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-D2	DELETED			--
IF-D3	GROUP flooding scenarios identified in IF-C4 only when the following is true: *(a)* scenarios can be considered similar in terms of plant response, success criteria, timing, and the effect on the operability and performance of operators and relevant mitigating systems; or *(b)* scenarios can be subsumed into a group and bounded by the worst-case impacts within the "new" group.	GROUP flooding scenarios identified in IF-C4 only when the following is true: *(a)* scenarios can be considered similar in terms of plant response, success criteria, timing, and the effect on the operability and performance of operators and relevant mitigating systems; or *(b)* scenarios can be subsumed into a group and bounded by the worst case impacts within the "new" group. **AVOID subsuming scenarios into a group unless:** **(i) the impacts are comparable to or less than those of the remaining scenarios in that group,** **AND** **(ii) it is demonstrated that such grouping does not impact significant accident sequences.**	GROUP flooding scenarios identified in IF-C4 only when the following is true: *(a)* scenarios can be considered similar in terms of plant response, success criteria, timing, and the effect on the operability and performance of operators and relevant mitigating systems; or *(b)* scenarios can be subsumed into a group and bounded by the worst case impacts within the "new" group. **DO NOT ADD scenarios to a group and DO NOT SUBSUME scenarios into a group unless the impacts are comparable to those of the remaining scenarios in that group.**	Cat I - The higher capability categories require further resolution. By not requiring higher resolution, a conservative CCDP would be developed which would only result in conservative CCDP/CLERPs. PWROG methodology reviews & addresses potential over conservatisms. It is noted that in these groupings the sum of their frequencies will be retained for use in the quantification step.
	NRC Issue: The action verb AVOID is ambiguous.			
	NRC Resolution: Cat II: DO NOT SUBSUME scenarios into a group…			
IF-D3a	GROUP OR SUBSUME the flood initiating scenarios with an existing plant initiating event group, if the impact of the flood (i.e., plant response and mitigating system capability) is the same as a plant initiating event group already considered in the PRA in accordance with the applicable requirements of Table 4.5.1-2(b).		DO NOT GROUP AND DO NOT SUBSUME flood initiating scenarios with other plant initiating event groups.	Cat I / II – subsuming these scenarios into existing plant initiating events will not impact the RI-ISI application or results. This information could be extracted, as needed.
IF-D4	For multi-unit sites with shared systems or structures, INCLUDE multi-unit impacts on SSCs and plant initiating events caused by internal flood scenario groups.			Fundamental to all capability categories

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-D5	DETERMINE the flood initiating event frequency for each flood scenario group by using the applicable requirements in Table 4.5.1-2(c).			Fundamental to all capability categories. This requirement includes the retention (i.e. total frequency of the group versus dominant frequency) of all summed frequencies for all scenarios addressed by the flood scenario group.
IF-D5a	In determining the flood initiating event frequencies for flood scenario groups, USE **one of the following**: *(a)* generic operating experience *(b)* pipe, component, and tank rupture failure rates from generic data sources *(c)* **a combination of (a) or (b) above with** engineering judgment.	**GATHER plant-specific information on plant design, operating practices and conditions that may impact flood likelihood (i.e., material condition of fluid systems, experience with water hammer, and maintenance induced floods).** In determining the flood initiating event frequencies for flood scenario groups, USE **a combination of** *(a)* generic **and plant-specific** operating experience, *(b)* pipe, component, and tank rupture failure rates from generic data sources **and plant-specific** experience, **and** *(c)* engineering judgment **for consideration of the plant-specific information collected**,		For EPRI methodology Cat II/III – EPRI TR-112657, EPRI TR-102266 and ERPI TR-1012302 provide acceptable ways of meeting this requirement. In lieu of the above, conservative / bounding values may be used For PWROG methodology Cat I – Purpose of RI-ISI is to develop an alternative ISI program. Primary focus is on piping failures. PWROG methodology defines how the piping failure frequencies or probabilities are developed.
IF-D6	INCLUDE consideration of human-induced floods during maintenance through application of generic data.		EVALUATE plant-specific maintenance activities for potential human-induced floods using human reliability analysis techniques. NOTE: This would require consideration of errors of commission. Table 4.5.5 does not at this time provide specific requirements related to errors of commission.	Need not be met – The purpose of RI-ISI is to develop an alternative ISI program (i.e. periodic NDE on piping). Implementation of a periodic NDE will not impact (negatively or positively) maintenance activities.

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-D7	SCREEN OUT flood scenario groups if (a) the quantitative screening criteria in IE-C4, as applied to the flood scenario groups, are met, OR (b) the internal flooding initiating event affects only components in a single system, AND it can be shown that the product of: • the frequency of the flood and • the probability of SSC failure given the flood is two orders of magnitude lower than: • the product of the non-flooding frequency for the corresponding initiating event in the PRA and • the random (non-flood-induced) failure probability of the same SSCs that are assumed failed by the flood. If the flood impacts multiple systems, DO NOT screen on this basis.			Fundamental to all capability categories
IF-E1	For each flood scenario, REVIEW the accident sequences for the associated plant initiating event group to confirm applicability of the accident sequence model. If appropriate accident sequences do not exist, MODIFY sequences as necessary to account for any unique flood-induced scenarios and/or phenomena in accordance with the applicable requirements described in para. 4.5.2.			Fundamental to all capability categories
IF-E2	DELETED (moved to IF-C3c)			--
IF-E3	MODIFY the systems analysis results obtained by following the applicable requirements described in para 4.5.4 to include flood-induced failures identified by IF-C3.			Fundamental to all capability categories
IF-E3a	SCREEN OUT a flood area if the product of the sum of the frequencies of the flood scenarios for the area and the bounding conditional core damage probability (CCDP)is less than 10^{-9}/reactor yr. The bounding CCDP is the highest of the CCDP values for the flood scenarios in an area.		LIMIT THE USE OF quantitative screening of flood areas.	Need not be met
IF-E4	If additional analysis of SSC data is required to support quantification of flood scenarios, PERFORM the analysis in accordance with the applicable requirements described in para. 4.5.6.			Fundamental to all capability categories
IF-E5	If additional human failure events are required to support quantification of flood scenarios, PERFORM any human reliability analysis in accordance with the applicable requirements described in Tables 4.5.5-2(e) through Table 4.5.5-2(h).			Fundamental to all capability categories
IF-E5a	For all human failure events in the internal flood scenarios, INCLUDE the following scenario-specific impacts on PSFs for control room and ex-control room actions as appropriate to the HRA methodology being used: *(a)* additional workload and stress (above that for similar sequences not caused by internal floods) *(b)* cue availability *(c)* effect of flood on mitigation, required response, timing, and recovery activities (e.g., accessibility restrictions, possibility of physical harm) *(d)* flooding-specific job aids and training (e.g., procedures, training exercises)			Fundamental to all capability categories
IF-E6	PERFORM internal flood sequence quantification in accordance with the applicable requirements described in para. 4.5.8.			Fundamental to all capability categories

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-E6a	INCLUDE, in the quantification, the combined effects of failures caused by flooding and those coincident with the flooding due to independent causes including equipment failures, unavailability due to maintenance, and other credible causes.			Fundamental to all capability categories
	NRC Issue: This supporting requirement should indicate the need to adjust the definition of common-cause failure groups while doing the internal flooding analysis.			
	NRC Resolution: INCLUDE, in the quantification,… due to causes independent of the flooding including unavailability due to maintenance, common-cause failures and other credible causes.			
IF-E6b	INCLUDE, in the quantification, both the direct effects of the flood (e.g., loss of cooling from a service water train due to an associated pipe rupture) and indirect effects such as submergence, jet impingement, and pipe whip, as applicable.			Fundamental to all capability categories
IF-E7	For each flood scenario, REVIEW the LERF analysis to confirm applicability of the LERF sequences. If appropriate LERF sequences do not exist, MODIFY the LERF analysis as necessary to account for any unique flood-induced scenarios or phenomena in accordance with the applicable requirements described in para. 4.5.9..			Fundamental to all capability categories
IF-E8	CONDUCT walkdown(s) to verify the accuracy of information obtained from plant information sources and to obtain or verify inputs to: (a) engineering analyses (b) human reliability analyses (c) spray or other applicable impact assessments (d) screening decisions Note: Walkdown(s) may be done in conjunction with the requirements of IF-A4, IF-B3a, and IF-C9.			Fundamental to all capability categories
IF-F1	DOCUMENT the internal flooding analysis in a manner that facilitates PRA applications, upgrades, and peer review.			Fundamental to all capability categories

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TABLE 2
ASME PRA Supporting Requirements
Internal Flooding

Supporting Requirement (SR)	Capability Category I	Capability Category II	Capability Category III	Assessment
IF-F2	DOCUMENT the process used to identify flood sources, flood areas, flood pathways, flood scenarios, and their screening, and internal flood model development and quantification. For example, this documentation typically includes: *(a)* flood sources identified in the analysis, rules used to screen out these sources, and the resulting list of sources to be further examined *(b)* flood areas used in the analysis and the reason for eliminating areas from further analysis *(c)* propagation pathways between flood areas and key assumptions, calculations, or other bases for eliminating or justifying propagation pathways *(d)* accident mitigating features and barriers credited in the analysis, the extent to which they were credited, and associated justification *(e)* key assumptions or calculations used in the determination of the impacts of submergence, spray, temperature, or other flood-induced effects on equipment operability *(f)* screening criteria used in the analysis *(g)* flooding scenarios considered, screened, and retained *(h)* description of how the internal event analysis models were modified to model these remaining internal flooding scenarios *(i)* flood frequencies, component unreliabilities/unavailabilities, and HEPs used in the analysis (i.e., the data values unique to the flooding analysis) *(j)* calculations or other analyses used to support or refine the flooding evaluation *(k)* results of the internal flooding analysis, consistent with the quantification requirements provided in HLR QU-D			Fundamental to all capability categories
IF-F3	Document the key assumptions and key sources of uncertainty associated with the internal flooding analysis.			Fundamental to all capability categories
	NRC Issue: All the sources of uncertainty and assumptions that can impact the risk profile of the base PRA need to be documented; see definition of key source of uncertainty for definition of source of uncertainty.			
	NRC Resolution: DOCUMENT the assumptions and sources of uncertainty associated…			

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