PERRY NUCLEAR POWR PLANT SAMA REVIEW
AUDIT REPORT

Subject
Audit of the Severe Accident Mitigation Alternatives (SAMA) analysis portion of the Perry Nuclear Power Plant Unit 1 (Perry Plant) License Renewal Application Environmental Report

When
- January 22, 2024, 6:00 am to about Noon Pacific Time (Entrance Meeting, Virtual Tours, and General Topics)
- January 24, 2024, 6:00 am to 1:00 pm Pacific Time
- January 25, 2024, 6:00 am to 1:00 pm Pacific Time
- January 26, 2024, 7:00 am to about 10:00 am Pacific Time (SAMA Alignment Meeting)

SAMA Discussion Participants

Lance Rakovan	U.S. Nuclear Regulatory Commission (NRC)
Elijah Dickson	NRC
Steve Short	NRC/Pacific Northwest National Laboratory (PNNL)
Kim Conway	NRC
Gerry Stirewalt	NRC
Angela Sabet	NRC
Karen Loomis	NRC
Mark Bensi	Energy Harbor Nuclear Corp. (Energy Harbor)/Perry Plant
Ray Fine	Energy Harbor
Ricki Summit	ENERCON
Steven Phillippi	ENERCON
Stacy Burgess	ENERCON
Devon Skelton	Energy Harbor
Tony Mangan	Energy Harbor
Beth Baucon	ENERCON
Neil Johnson	ENERCON
Ben Spiesman	Energy Harbor
Emily Keenan	ENERCON
John Grimm	Energy Harbor
Rachel Turney	ENERCON

Documents Reviewed on the Applicant's Portal
1. "Energy Harbor Perry Nuclear Power Plant SAMA Basis Report Document," Rev. 1, June 8, 2023

2. PRA-PY1-AL-R01, "Perry Nuclear Power Plant Probabilistic Risk Assessment, QU-001 – Quantification Notebook"

3. PRA-PY1-AL-R01, "Perry Nuclear Power Plant Probabilistic Risk Assessment, L2-001 – Level 2 Notebook"

4. PRA-PY1-AL-R01, "Perry Nuclear Power Plant Probabilistic Risk Assessment, Seismic Quantification, Uncertainty, and Sensitivity"

5. EHPP-00227-REPT-001, “Perry Nuclear Power Plant – License Renewal Application – Level 3 PRA Analysis Notebook”

6. “PRA GAP Assessment RG 1.200 vs PRA for Perry Nuclear Power Plant,” Rev. 0, July 30, 2008

7. PWROG-17077-P, Revision 0, “Perry Nuclear Power Plant Focused Peer Review of Internal Events PRA and Seismic PRA”

8. PWROG-17074-P, Revision 0-A, “Perry Nuclear Power Plant Independent Assessment of Internal Events, Internal Flood, and Seismic PRA Facts & Observations Closure”

9. “Perry Nuclear Power Plant Seismic PRA Peer Review Report Using ASME/ANS PRA Standard Requirements,” November 2014

10. “Perry Nuclear Power Plant Internal Flood PRA Peer Review Report Using ASME/ANS PRA Standard Requirements,” August 2012

11. “Perry Nuclear Power Plant Offsite Power Recovery PRA Peer Review Report Using ASME/ANS PRA Standard Requirements,” August 4, 2015

12. File: “PY GAP Assessment 2005-2009 Rev 1 for SAMA 2024.PDF”, undated

13. “Documentation of PNPP PRA Technical Adequacy”, undated

14. “Perry Nuclear Power Plant Evaluation of LERF Model against RG 1.200 and ASME PRA Standard,” November 2011

Discussion

On July 3, 2023 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML23184A081), the NRC received the Energy Harbor application for renewal of operating license for Perry Plant. In support of the application and in accordance with Title 10 of the Code of Federal Regulations (10 CFR) Part 51 and Part 54, Energy Harbor also submitted an environmental report (ER) for Perry Plant.

After a welcome and introductions on Monday (January 22, 2024), the plan and schedule for the audit were discussed. NRC, PNNL, and Energy Harbor/contractor staff involved in the SAMA portion of the audit participated in an Entry Meeting held on Monday, January 22, 2024, which also included other license renewal-related audit team members (non-SAMA related) and associated Energy Harbor/contractor staff.

As stated in the audit plan accompanying the December 20, 2023, letter to Rod L. Penfield, Site Vice President (ML23321A047), the goal of this portion of the audit was to review SAMA and postulated accident supporting information to complete the license renewal supplemental environmental impact statement. During the audit, NRC, PNNL, and Energy Harbor/contractor (ENERCON) staff involved in the SAMA review discussed all the SAMA-related audit needs identified in the Audit Plan. Specifically discussed were the audit needs addressing the following topics:

1. The Level 1 internal events Probabilistic Risk Assessment (PRA), with a focus on the limiting cutsets;
2. The Level 2 PRA accident phenomenology model;

3. The treatment of external events;
4. The Level 3 PRA consequence analysis;
5. The identification and screening of potential SAMAs;
6. The cost-benefit analysis of SAMAs; and
7. Potential lower cost alternative SAMAs.

As the result of the audit, NRC/PNNL staff identified requests for confirmation of information (RCIs) and requests for additional information (RAIs) for which further information will be needed on the docket to complete the license renewal supplemental environmental impact statement. The following table summarizes the results of the audit by delineating the SAMA-related audit needs in the audit plan into: 1) those for which information is not needed on the docket; 2) those for which supplemental information is needed on the docket as RCIs; and 3) those for which supplemental information is needed on the docket as RAIs. The results shown in this table were presented to Energy Harbor in the SAMA Alignment Meeting held on January 26, 2024. The RCIs and RAIs are provided in separate sections below.

No closeout meeting was held because the audit is being held open until February 8, 2024.

Audit Need	Part	Subpart	Information Needed on the Docket
SAMA-1	a	i, ii, iii	Not Needed
		iv	Not Needed
	b	i, ii, iii	RCI
	c		Not Needed
	d	i, ii, iii	Not Needed
	e		RAI
	f		Not Needed
	g		Not Needed
SAMA-2	a	all	RAI
	b		Not Needed
	c		Not Needed
	d		Not Needed
	e		RAI
	f		Not Needed
	g	i, ii	RAI
SAMA-3	a	i	RAI
		ii	Not Needed
		iii	RAI
	b	i, ii	RAI
	c	i, ii, iii	RAI
SAMA-4	a		Not Needed
	b		RAI
	c		RAI
	d		RAI
	e		RAI
	f		Not Needed
SAMA-5	a	i	Not Needed
		ii, iii, iv	RAI
	b		Not Needed
	c	i, ii	RAI
	d		RAI

	e		RAI
	f		RAI
SAMA-6	a		RAI
	b		RAI
	c		RAI
	d		RAI
	e		RAI
SAMA-7	a		Not Needed
	b		RAI
SAMA-8			Not Needed
SAMA-9			Not Needed
SAMA-10			Not Needed
SAMA-11			Not Needed
SAMA-13			RAI
SAMA-14			Not Needed

Request for Confirmation of Information (RCI)

SAMA-RCI-1 [Info Need SAMA-1.b]. Section G.1.3 of the ER summarizes the PRA model development and peer review process. It is indicated that in October 2017 a focused-scope peer review was conducted on the resolutions to all Facts and Observations (F&Os) determined to be PRA upgrades concurrently with an F&O closure review conducted on all F&O resolutions determined to be PRA updates. Address the following with respect to the F&O closure process:

i. Please confirm that the F&O closure review was conducted in accordance with NRC letter dated May 1, 2017, "U.S. Nuclear Regulatory Commission Staff Expectations for an Industry Facts and Observations Independent Assessment Process" [ML17121A271], and NRC letter dated May 3, 2017, "U.S. Nuclear Regulatory Commission Acceptance on Nuclear Energy Institute Appendix X to Guidance 05-04, 07-12, and 12-13, Close-Out of Facts and Observations (F&Os)" [ML17079A427]. If the F&O closure review was not conducted in accordance with this guidance, describe the impact of any deviations from this guidance on the SAMA analysis.

ii. Confirm that the F&O closure review scope included all finding-level F&Os (for the internal events, internal flooding, and seismic PRAs), including those finding-level F&Os that are associated with "Met" Supporting Requirements (SRs). If not, discuss the original peer review findings and recommendations for any F&Os that were excluded from the F&O closure review scope, and their associated disposition for the SAMA analysis.

iii. Confirm that the closure review team was provided with a written assessment and justification of whether the resolution of each F&O, within the scope of the independent assessment, constitutes a PRA upgrade or maintenance update, as defined in ASME/ANS RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008, Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," as qualified by RG 1.200, Revision 2, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," (ML090410014). If the written assessment and justification for the determination of each F&O was not performed and reviewed by the F&O closure review team, discuss how this aspect of the F&O closure process

was met consistent with the staff's acceptance as discussed in the May 3, 2017, letter.

Requests for Additional Information (RAIs)

1) Info Need SAMA-1

REQUIREMENT: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the Perry Plant SAMA analysis, NRC staff evaluates the applicant's total contribution to CDF estimates based on the PRA models.

ISSUE: The requested information is needed for the NRC staff to reach a conclusion on the sufficiency of the applicant's PRA models for supporting the SAMA evaluation.

REQUEST: Provide a breakdown of the contribution to internal events, including internal flooding, core damage frequency (CDF) by initiating events. Confirm that the total CDF is the same as that reported in the ER. Additionally, provide the contribution to CDF from station blackout events and anticipated transients without scram (ATWS) events.

2) Info Need SAMA-2

REQUIREMENT: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the Perry Plant SAMA analysis, NRC staff evaluates the applicant's treatment of accident propagation and radionuclide release in the Level 2 PRA model.

ISSUE: The requested information is needed in order for the NRC staff to reach a conclusion on the adequacy of the applicant's Level 2 PRA model for supporting the SAMA evaluation.

REQUEST: Provide the following information relative to the Level 2 PRA analysis.

Section 4.15.3.1 and Attachment G of the ER state that the NEI 05-01-A guidance was used in developing the SAMA analysis. Section 3.2 of NEI 05-01-A specifies the information that is to be provided in the ER regarding the Level 2 PRA model and analysis. Some of this information is not provided in the ER. Provide the following information relative to the Level 2 PRA analysis. The requested information is needed for the NRC staff to reach a conclusion on the adequacy of the applicant's Level 2 PRA model for supporting the SAMA evaluation.

a. [Info Need SAMA-2.a.] Section G.1.3 summarizes the PRA model development and peer review process, which for the Level 2 analysis only addresses (partially) large early release. The ER provides no description of the Level 2 analysis that was developed and applied to produce the results for the containment event tree (CET) end points or source term categories and release categories reported in the ER. Address the following:

    i. Explain how the Level 2 post-core damage accident response analysis is linked to the Level 1 PRA model, including addressing how the Level 1 core damage

sequences were binned into plant damage states (PDSs), describing each of the PDSs, and providing the results of this binning process.

ii. Summarize the CET(s) developed to produce results for each of the CET end states or source term categories (STCs) reported in the ER and the process for progressing each PDS through the CET(s). Include in the response a description of the modeled branch points (both system failures and phenomenological).

iii. Provide the modular accident analysis program (MAAP) radioisotope groupings, MACCSs radioisotope groupings, and the mapping of the MAAP groupings to the MACCS groupings. In the response, identify the version of MAAP used in the Level 2 analysis and, if an outdated version, discuss the impact on the SAMA analysis of software revisions.

iv. Table G1.4-9 identifies 10 release categories and the source term categories binned into each. Define each of the release categories in terms of the characteristics (e.g., timing and magnitude of release) that are used to perform the binning and justify that the binning is reasonable. In the response, provide the basis for why three of the release categories are not used.

v. Describe the logic used in the selection of the representative MAAP case for each release category, or source term category, and provide justification that the selected cases are reasonable for the SAMA analysis (e.g., does not underestimate the estimated benefits of SAMAs).

vi. Summarize the independent and/or peer reviews performed to provide confidence in the Level 2 analysis, summarize the results of these reviews, and summarize any unresolved independent/peer review comments and their impact on the SAMA analysis.

vii. Table G1.3-1 reports a total large early release frequency (LERF) of 9.73E-06 per year for the PRA-PY1-AL-R01 PRA model used in the SAMA analysis, which includes internal events, including internal flooding, and seismic events. As a comparison, table G2-2 reports a total LERF of 5.38E-06 per year from the Level 2 analysis developed for the SAMA analysis. Explain the reasons for this difference and provide an assessment of the impact of this difference on the SAMA analysis.

b. [Info Need SAMA-2.e.]. Table G1.4-7 states that the MAAP runs were limited to a maximum plume duration of one day (88,400 seconds). Identify the source term categories in which the release fractions have not plateaued and are still increasing by the end of the MAAP run time. For each of these source term categories, identify those in which the MAAP run times are less than 48 hours after the time of declaration of general emergency. For each of the identified source term categories, provide an assessment of the impact on the SAMA analysis from extending the run time to 48 hours after declaration of a general emergency.

c. [Info Need SAMA-2.g]. Tables G1.4-10 and G1.4-11 of the ER provide the MACCS2 results for each of the release categories. Address the following with respect to the results in this table:

i. The break outside containment release category shows zero population dose risk and zero economic cost risk because the internal events, including internal flooding, and seismic CDFs are zero. However, estimates of population dose (person rem) and offsite economic cost are provided for both hazards. Explain why there are no CDFs for this release category.

ii. Estimates of population dose (person rem) and offsite economic cost are provided for both hazards for the M/L release category, yet the estimates of population dose risk and economic cost risk are zero because the CDFs are zero. However, Table G1.4-9 explains that the M/L release category is not used. Clarify this anomaly between the two tables and, if this release category is used, explain why there are no CDFs for this release category.

3) Info Need SAMA-3

REQUIREMENT: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the Perry Plant SAMA analysis, NRC staff evaluates the applicant's treatment of external events in the PRA models.

ISSUE: The requested information is needed in order for the NRC staff to reach a conclusion on the sufficiency of the applicant's PRA models for supporting the SAMA evaluation.

REQUEST: Provide the following information with regard to the treatment and inclusion of external events in the SAMA analysis.

Section 4.15.3.1 and Attachment G of the ER state that the NEI 05-01-A guidance was used in developing the SAMA analysis. Section 3.1.2 of NEI 05-01-A specifies the information that is to be provided in the ER regarding the treatment and inclusion of external events in the SAMA analysis. Some of this information is not provided in the ER. Provide the following information relative to the treatment and inclusion of external events in the SAMA analysis. The requested information is needed for the NRC staff to reach a conclusion on the adequacy of the applicant's analyses that support the SAMA evaluation.

a. [Info Need SAMA-3.a.iii.] Provide a breakdown of the contribution to seismic CDF by initiating events and provide a description of the dominant initiating events. Confirm that the total seismic CDF is the same as that reported in the ER.

b. [Info Need SAMA-3.b.] Section G.1.2 explains that the Perry Plant IPEEE utilized the FIVE methodology to assess fire risk and that the resultant fire CDF estimated using this methodology is 3.1E-05 per year. Both Section G.1.2 and Table 4.15-2 explain that fire risk was not addressed in the SAMA assessment. Address the following with respect to the fire analysis:

   i. Provide a breakdown of the contribution to the Perry Plant individual plant examination for external events (IPEEE) fire CDF by initiating events and provide a description of the dominant initiating events.

   ii. The IPEEE fire CDF is significantly higher than the internal events, including internal flooding, CDF and about twice the seismic CDF yet the contribution from

fire events is not included in the assessment of the benefits of each SAMA. This results in a potential significant underestimate of the calculated benefits of each SAMA. Provide a revised SAMA analysis that explicitly accounts (e.g., external events multiplier) for the contribution to the calculated benefits of each SAMA from the potential reduction in fire risk.

c. [Info Need SAMA-3.c.] Section G.1.2 explains that other external events such as high winds, floods, aircraft accidents, hazardous materials, and turbine missiles were assessed in the Perry Plant IPEEE and that there are no significant events of concern. However, the ER provides no evaluation of relevant plant-specific assessments that have been conducted since the IPEEE. Address the following:

   i. Summarize the screening assessment in the IPEEE that addresses these other external hazards and which was used as the basis for the ER conclusion. In the response, discuss the screening criteria used in the IPEEE and its applicability to the SAMA analysis, and, specifically, whether changes to the plant, the plant site, or the area surrounding the plant site made since the IPEEE have impacted the conclusions of the IPEEE.

   ii. Following the accident at the Fukushima Dai-ichi nuclear power plant, Energy Harbor (formerly FirstEnergy Nuclear Operating Company) responded to an NRC 10 CFR 50.54(f) request for information. This response included a reevaluation of the external flood hazards, the development of mitigating strategies for external floods, and a focused evaluation of the external flooding mechanisms for which the reevaluated flooding hazards is not bounded by the current design basis. Energy Harbor's mitigation strategies assessment (MSA) included addressing the following flood mechanisms: probable maximum storm surge, SRF, and LIP (ML19323F020). This focused evaluation was a deterministic (that is, not a probabilistic) evaluation. Provide a discussion of these external flood hazards and the associated impact on Perry Plant to support the conclusion that they would not impact the SAMA analysis, such as not contributing to an external events multiplier nor leading to any cost-beneficial SAMAs. In the response address the status of implementation of the flooding mitigation strategies identified in the MSA and its impact on the SAMA analysis.

   iii. NRC RIS 2015-06, while not requiring regulatory action, identified several instances in which nuclear power plants were determined to not conform with their tornado-generated missile licensing basis. Discuss whether there are any changes to the Perry Plant site or surrounding environment that would change the conclusions of the IPEEE regarding tornado-generated missiles and which could impact the SAMA analysis.

d. [Info Need SAMA-3.a.i] In response to NRC information requests to address near-term task force recommendations following the accident at the Fukushima Daiichi Nuclear Power Plant, and in response to Generic Issue (GI)-199, new seismic hazard curves have been developed for each nuclear power plant site. Reference these updated seismic hazard curves for the Perry Plant site and discuss if these updated seismic hazard curves are incorporated in the Perry Plant seismic PRA model. If not, provide a discussion of the impact of this updated information on the SAMA analysis.

4) Info Need SAMA-4

REQUIREMENT: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs, if not previously considered, in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the Perry Plant SAMA analyses, NRC staff evaluates the applicant's analysis of accident consequences in the Level 3 PRA.

ISSUE: The requested information is needed in order for the NRC staff to reach a conclusion on the sufficiency of the applicant's Level 3 PRA model for supporting the SAMA evaluations.

REQUEST: Please provide the following information regarding the Level 3 PRA used in the SAMA analysis.

Section 4.15.3.1 and Attachment G of the ER state that the NEI 05-01-A guidance was used in developing the SAMA analysis. Section 3.4 of NEI 05-01-A specifies the information that is to be provided in the ER regarding the Level 3 PRA model and analysis. Some of this information is not provided in the ER. Provide the following information relative to the Level 3 PRA analysis. The requested information is needed for the NRC staff to reach a conclusion on the adequacy of the applicant's Level 3 PRA model for supporting the SAMA evaluation.

a. [Info Need SAMA-4.b.] Table G1.4-4 provides the estimated core inventory input to the Level 3 analysis. Clarify whether adjustments of the core inventory values are necessary to account for differences between fuel cycles expected during the period of extended operation and the fuel cycle upon which the Level 3 analysis is based (e.g., to account for any changes in future planned fuel management practices or fuel design).

b. [Info Need SAMA-4.c.] Section G.1.4.2.6 indicates that meteorological data for the years 2019 through 2021 were used in the consequence analysis. Specify the sources of the data and, if the plant meteorological tower data was not used, provide justification not using it. Discuss how data from this data set (e.g., temperature, wind speed, wind direction, precipitation) were selected as input to the MACCS code and explain why the selected data is reasonable for the SAMA analysis (e.g., does not underestimate the estimated benefits of SAMAs), or alternatively provide the results of a sensitivity analysis. Discuss the extent to which there was missing data and how missing data was accounted for in the SAMA evaluation.

c. [Info Need SAMA-4.d.] Section G.1.4.2.1 identifies the Ohio Department of Development (OHDD, 2022) and the Center for Rural Pennsylvania (CRPA, 2022) as the sources for the population projection to the year 2046. A review of this data indicates the population for most counties surrounding the Perry Plant decline between 2020 and 2050, and for some counties the decline is substantial. Because the proposed period of extended operation for Perry Plant is from 2026 to 2046, using the projected population in 2046 may underestimate the estimated benefits of SAMAs during the early years of the extended operating period. Discuss the impact of this potential non-conservatism on the SAMA evaluation.

d. [Info Need SAMA-4.e.] Section G.1.4.2.1 states that transient population was not included in the SAMA evaluation because it was assumed to be negligible. Discuss the impact on the SAMA evaluation of this non-conservative assumption.

5) Info Need SAMA-5

REQUIREMENT: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the Perry Plant SAMA analysis, NRC staff evaluates the applicant's basis for the selection and screening Phase I SAMA candidates.

ISSUE: The requested information is needed in order for the NRC staff to reach a conclusion on the adequacy of the applicant's Phase I SAMA selection and screening process for the SAMA evaluation.

REQUEST: Provide the following information with regard to the selection and screening of Phase I SAMA candidates.

Section 4.15.3.1 and Attachment G of the ER state that the NEI 05-01-A guidance was used in developing the SAMA analysis. Sections 5 and 6 of NEI 05-01-A specifies the information that is to be provided in the ER regarding the selection and screening of Phase I SAMA candidates. Some of this information is not provided in the ER. Provide the following information relative to the Phase I SAMA analysis. The requested information is needed for the NRC staff to reach a conclusion on the adequacy of the applicant's analyses that support the SAMA evaluation.

a. [Info Need SAMA-5.a.ii.] The ER does not explain how the selected set of Phase I SAMA candidates address or mitigate the major risk contributors in the Level 1 (i.e., CDF) and Level 2 PRA analysis. Provide the following:

    1. A description of how the dominant risk contributors at Perry Plant, including dominant sequences and cutsets from the PRA (e.g., equipment failures, operator actions, initiators, phenomenology) identified through importance analyses, were used to identify potential plant specific SAMAs for Perry Plant; define and justify the rationale for the cutoff value used to determine what is a "dominant" risk contributor,

    2. A listing and description of equipment failures and human actions (including probability and risk reduction worth for each) that have the greatest potential for reducing risk at Perry Plant based on importance analysis and cutset screening, and

    3. For each dominant contributor identified in the previous bullet, provide a cross-reference to the Phase I SAMA(s) evaluated in the ER that address that contributor, and

    4. If a SAMA candidate was not identified for a dominant risk contributor, justify why SAMAs to reduce the risk of this contributor are not considered.

b. [Info Need SAMA-5.a.iii.] Section 4.15.3.1 explains that the initial listing of potential SAMAs was developed using, in part, available generic industry identification of SAMAs. The cited reference for the generic industry SAMAs is Section C.1.4 of NUREG-1437, Revision 0. This reference does not identify potential SAMA candidates. Address the following:

1. Explain how Section C.1.4 of NUREG-1437, Revision 0, was used to identify generic industry SAMAs and provide the identified SAMA candidates developed from this reference.

2. Explain how the list of generic BWR enhancements identified in NEI 05-01, Rev. A was considered in the identification of Phase I SAMA candidates. If not considered, provide an assessment of the applicability of these generic enhancements to Perry Plant, including the results of a Phase I and Phase II SAMA analysis as applicable.

c. [Info Need SAMA-5.a.iv.] Based on the Phase I SAMA identification process described in the ER, risk insights and potential plant improvements from the Perry Plant Individual Plant Examination (IPE) and IPEEE do not appear to have been fully considered. For example, several potential plant improvements were identified in the IPE submittal to NRC (ML20102A255) and in the IPEEE submittal to NRC (ML20115J969). Additionally, while the IPEEE did not identify any fire-related plant improvements, it did identify several risk-significant fire areas/compartments (i.e., those that exceeded the fire CDF screening criteria of 1.0E-06 per year). Provide the following:

1. An assessment of the insights and potential plant improvements from the Perry Plant IPE and IPEEE and disposition these for the SAMA analysis,

2. Identify and describe the new Phase I SAMA candidates (e.g., those that mitigate fire risk, those from the IPE and IPEEE that have not been implemented) generated from this assessment,

3. Address a SAMA to install incipient detection and/or suppression in the Division 2 Switchgear Room and Main Control Room and a SAMA to upgrade the alternate shutdown panel(s) to include additional system controls, and

4. As applicable, provide a description of and results for a Phase I and Phase II SAMA assessment of each new Phase I SAMA candidate.

d. [Info Need SAMA-5.c.] Section G.2.3 explains that the Phase I SAMA screening process used 50% of the maximum benefit when screening on excess implementation costs. This is stated to be based on a review of the risk contributions for CDF and LERF from any single SAMA. Detailed benefit analysis is not performed on all Phase I SAMA candidates. According to Table G2-5, the Phase I SAMA candidates that were screened using the 50% maximum benefit, but which would not have screened using the maximum benefit, are SAMA 6, “Install Curbs for Switchgear Rooms,” and SAMA 7, “Enhance DC Power for Internal Flooding.” Address the following:

i. Describe the review process used to make the determination that no single SAMA would be expected to result in a 50 percent risk reduction. Justify that this process considered the major risk contributors to the Level 1 CDF and Level 2 PRA analysis (see RAI 5.a.ii).

ii. If the use of 50 percent of the maximum benefit cannot be justified, provide a Phase II assessment for SAMA 6 and SAMA 7.

e. [Info Need SAMA-5.d.] Table G2-5 identifies SAMA 5, “Install Flood Doors for Switchgear Rooms,” as having a maximum benefit that exceeds the estimated implementation cost and

so it is specified to be retained for the Phase II assessment. However, Table G2-6 determines the final outcome of the screening analyses is to screen this SAMA. The reason given is that it has a negative cost benefit based on implementation cost and maximum benefit, which is contradictory to the cost-benefit results reported in Table G2-5. Justify the screening of SAMA 5 or provide a Phase II assessment for this SAMA.

f. [Info Need SAMA-5.e.] Table G2-5 identifies SAMA 14, "Add Alternative Containment Spray (L2 only)," as having a maximum benefit that exceeds the estimated implementation cost and so it is specified to be retained for the Phase II assessment. However, Table G2-6 determines the final outcome of the screening analyses is to screen this SAMA based on a qualitative assessment that it would have negligible/limited benefits. It is unclear to the NRC staff that this is the case, especially if uncertainties/sensitivities are considered. Provide further justification for the screening of SAMA 14 or provide a Phase II assessment for this SAMA.

g. [Info Need SAMA-5.f.] Table G2-5 provides the estimated implementation cost for each SAMA candidate that was not previously screened in the SAMA analysis. Describe the cost estimating process and bases used to develop the implementation cost estimate for each SAMA candidate, including specifying what costs are included in the estimate (e.g., procurement, installation). Additionally, discuss any conservatisms in the cost estimates (e.g., cost estimate did not include the cost of replacement power during extended outages required to implement the modifications, cost estimate did not include contingency costs associated with unforeseen implementation obstacles).

6) Info Need SAMA-6

REQUIREMENT: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the Perry Plant SAMA analysis, NRC staff evaluates the applicant's cost-benefit analysis of Phase II SAMAs.

ISSUE: The requested information is needed in order for the NRC staff to reach a conclusion on the acceptability of the applicant's cost estimations for individual SAMAs and cost-benefit evaluation.

REQUEST: Provide the following information with regard to the Phase II cost-benefit evaluations.

Section 4.15.3.1 and Attachment G of the ER state that the NEI 05-01-A guidance was used in developing the SAMA analysis. Sections 7 and 8 of NEI 05-01-A specifies the information that is to be provided in the ER regarding the Phase II cost-benefit and sensitivity evaluations. Some of this information is not provided in the ER. Provide the following information relative to the Phase II SAMA analysis and sensitivity evaluations. The requested information is needed for the NRC staff to reach a conclusion on the adequacy of the applicant's analyses that support the SAMA evaluation.

a. [Info Need SAMA-6.a.] Section G.3 indicates that the conversion factor for assigning monetary value to onsite and off-site exposures used in the SAMA analysis is $2,000 per person-rem. While this value is used in the NEI 05-01, Revision A, guidance, its basis is from NUREG-1530 (ADAMS Accession Number ML063470485). NUREG-1530, "Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy," was

updated to Revision 1 in 2022 (ML22053A025). The dollar per person-rem conversion factor from this updated NUREG is to be used in regulatory applications that require the determination of the monetary valuation of the consequences associated with radiological exposures, including SAMA assessments associated with environmental analyses. Section 6 of NUREG-1530, Revision 1, provides a best estimate value, low value, and high value in 2014 dollars and specifies that sensitivity analyses should be performed to evaluate the impact of using this range of values. Section 7 of this NUREG provides the method that is to be used to update the dollar per person-rem conversion factor from 2014 to current year dollars. Discuss the impact on the Phase I and Phase II SAMA evaluation from applying the NUREG-1530, Revision 1, guidance.

b. [Info Need SAMA-6.b.] The Phase II evaluations of SAMA 11, "Add Alternate Emergency Diesel Generator Room Cooling," and SAMA 17, "Increase Capacity of Relays," reported in Section G.2.4.1 and G.2.4.2, respectively, only provide the results by release category for CDF and population dose risk. Provide the similar results for offsite economic cost risk.

c. [Info Need SAMA-6.c] Section G.3.3.3 of the ER on total averted occupational exposure costs and Section G.3.4 on averted onsite costs state that the estimates of these parameters include consideration of "at-power internal events, internal flooding events, and fires, along with low-power shutdown (LPSD) internal events, internal flooding events, and fire events." Clarify this statement by explaining what was considered and explain specifically how fire events and LPSD events are explicitly considered in the determination of SAMA benefits.

d. [Info Need SAMA-6.d.] Section G.3 indicates that the SAMA analysis was performed assuming a 7 percent discount rate. NEI 05-01, Revision A, specifies that a sensitivity analysis should be performed assuming a 3 percent discount rate. This NEI 05-01 guidance reflects NRC guidance in Section 4.3.5 of NUREG/BR-0058, Revision 4 (ML042820192), which reflects guidance provided in Office of Management and Budget Circular A-4 on regulatory analysis (https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/). Discuss the impact on the Phase I and Phase II SAMA evaluation from assuming a 3 percent discount rate.

e. [Info Need SAMA-6.e.] NEI 05-01, Revision A, specifies that a sensitivity analysis is to be performed that assesses the impact of PRA model uncertainties on the SAMA analysis. While Section G.1.4.3 of the ER discusses the assessments and results of several sensitivity analysis cases on WinMACCS input parameters, a sensitivity analysis is not provided in the ER that addresses PRA model uncertainties. For this sensitivity analysis, NEI 05-01, Revision A, specifies the development of an uncertainty factor derived from the ratio of the 95th percentile to the mean estimate for internal events CDF and multiplying this ratio by the base case benefit results. Discuss the impact on the Phase I and Phase II SAMA evaluation from consideration of CDF uncertainty. In the response provide the 5th, 95th, mean, and median results of the internal events, including internal flooding, CDF, and the seismic CDF.

7) Info Need SAMA-7

REQUIREMENT: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant. As part of its review of the Perry Plant

SAMA analysis, NRC staff considers additional SAMAs that may be more effective or have lower implementation costs than the other SAMAs evaluated by the applicant.

ISSUE: The requested information is needed in order for the NRC staff to reach a conclusion on the adequacy of the applicant's determination of cost-beneficial SAMAs.

REQUEST: For certain SAMAs considered in the Perry Plant ER, there may be lower cost or more effective alternatives that could achieve much of the risk reduction. In this regard, provide an evaluation of the following SAMA.

Section 4.15.3.1 and Attachment G of the ER state that the NEI 05-01-A guidance was used in developing the SAMA analysis. Section 2 of NEI 05-01-A notes that potentially cost-beneficial SAMAs are most likely to be procedure changes and minimal hardware changes. As part of its review of the Perry Plant SAMA analysis, the NRC staff considers additional SAMAs that may be more effective or have lower implementation costs than the other SAMAs evaluated by the applicant. The requested information is needed for the NRC staff to reach a conclusion on the adequacy of the applicant's analyses that support the SAMA evaluation.

[Info Need SAMA-7.b.] All the SAMAs identified in the ER involve procurement and installation of new systems and none of the SAMAs consider procedure and training improvements that is typically a much lower cost alternative. As an example, during the audit the NRC staff reviewed the "SAMA Basis Report Document." Table A2-2 of this document identifies SAMA 29 to identify procedure enhancements or simple modifications to improve the timing/reliability of human failure events in the internal flooding PRA. Table A2-3 of this same document explains that the risk reduction benefit of this SAMA is bounded by SAMA-6, "Install Curbs for Switchgear Rooms," which was evaluated in Section G.2.3 of the ER. Table G2-5 of the ER screens SAMA-6 because the implementation cost of $500K is greater than the benefit of $434.6K. However, procedure enhancements would be expected to be significantly less than $500K, so it appears that procedure enhancements were not considered and could potentially be cost-beneficial for the same risk reduction benefit as determined for SAMA-6. Another example from Table A2-3 is SAMA 106 to develop procedures to repair or replace failed 4-KV breakers. This table explains that the risk reduction benefit of this SAMA is bounded by SAMA-17, "Increase Capacity of Relays," which was evaluated in Section G.2.4 of the ER. Table G2-11 of the ER evaluates SAMA-17 to have an averted cost benefit of $1.676 million, which is less than the estimated implementation cost of $6.892 million. However, procedures to repair or replace failed 4-KV breakers would be expected to be less than $6.892K, so it appears that procedure enhancements were not considered and could potentially be cost-beneficial for the same risk reduction benefit as determined for SAMA-17.

Discuss the possibility of SAMAs to improve procedure and training enhancements generally as a lower cost alternative to making plant modifications. In the response specifically address the potential for procedure enhancements as alternatives to SAMA-6 and SAMA-17. As applicable, provide the results of Phase I and II SAMA assessments for identified procedure enhancement SAMAs.

8) Info Need SAMA-13

REQUIREMENT: Applicants for license renewal are required by 10 CFR 51.53(c)(3)(ii)(L) to consider SAMAs if not previously considered in an environmental impact assessment, related supplement, or environmental assessment for the plant.

ISSUE: The requested information is needed in order for the NRC staff to reach a conclusion on the adequacy of the applicant's determination of source terms used in the SAMAs.

REQUEST: Section G.1.4.2.8 of the ER provides the core inventory used in the SAMA analysis. Provide the citation for the licensing basis document where this core inventory is reported and provide justification for any deviations between this document and that reported in the ER.