
REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: ER 1-8428
SRP Section: Environmental Report
Application Section: APR1400 Environmental Report
Date of RAI Issued: 03/22/2016

Question No. EIS ACC/SA-6

10 CFR 51.55(a) requires each applicant for a standard design certification under subpart B of 10 CFR Part 52 (i.e., 10 CFR 52.47(b)(2)) to submit with its application a separate document entitled, "Applicant's Environmental Report—Standard Design Certification." The environmental report must address the costs and benefits of severe accident mitigation design alternatives, and the bases for not incorporating severe accident mitigation design alternatives in the design to be certified.

The environmental standard review plan (ESRP) Section 7.2, Severe Accidents, of NUREG 1555 directs the staff to evaluate and independently confirm severe accident risks and analyses presented in an Environmental Report (ER) (i.e., the APR1400 ER, "Applicant's Environmental Report – Standard Design Certification," found under ML15006A038 and the proprietary technical report, "Severe Accident Mitigation Design Alternatives (SAMDA) for the APR1400," under ML15012A105) of accidents involving radioactive material that can be postulated for the plant under review. The scope of this review should include probability-weighted consequence (i.e., risks) analysis for severe accidents, including dose and socioeconomic risk impacts based on plant specific data in sufficient detail to appropriately evaluate the risks for severe accidents.

The staff requires the following additional information in order to complete its review of the environmental impacts of severe accidents and to ensure appropriate documentation of the applicant's assessment in the APR1400 Environmental Report.

Provide a discussion in ER Section 3, Base Risk, about what atmospheric, surface water, and groundwater pathways were applied in the severe accident analysis and what the resulting impacts were from these pathways.

The NRC staff request that any revisions to the ER or supporting technical reports be provided as a markup as part of the response to this RAI.

This RAI is related to the Environmental Audit Information Needs ER-IT-5 (ML15198A023).

Response – (Rev. 1)

The Environmental Reports (ER) Section 3 will be revised to discuss what atmospheric, surface water, and groundwater pathways were applied in the severe accident analysis and what the resulting impacts were from these pathways (see Attachment 1). Markups to add Reference 7 in Section 12 was provided in the AAC/SA-5 response ER markups.

Note: Section 3 of APR1400-E-P-NR-014006-P, Rev. 0, will be revised to include the same information added in Attachment 1.

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

The Environmental Reports (ER) will be revised as shown in Attachment.

APR1400 Applicant's Environmental Report – Standard Design Certification

power events and low-power shutdown events are presented in Tables 1a and 1b, respectively.

Representative releases were determined for each STC. The SAMDA Technical Report (Reference 4) analyzes representative sequences from each STC and develops timing and release characteristic information for representative fission product groups. This information was used to approximate the radiological release plumes used in the Level 3 PRA.

Offsite consequences were calculated from the Level 3 PRA. For each STC, the Level 3 PRA provided values for the conditional offsite dose and conditional offsite property damage that would result if a fission product release with the plume characteristics used to represent the STC occurred. The total expected dose consequence was obtained by multiplying the conditional offsite dose by the expected frequency for each STC and then summing the expected doses for all STCs.

The conditional dose and expected dose for each STC along with the total expected dose are shown in Tables 2a through 2f. Similarly, the total expected property damage was obtained by multiplying the conditional property damage value by the expected frequency for each STC and then summing the expected property damage values for all STCs. The conditional property costs and expected property costs for each STC along with the total expected property costs are shown in Tables 3a through 3f.

Insert text the following text after Insert A from RAI AAS/SA-5.

The principal phenomena considered in WinMACCS are atmospheric transport, mitigative actions based on dose projections, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs. The specific atmospheric, surface water and groundwater pathways inputs to the model for this representative site location are those specified in the Surry site data file documented in the Level 3 analysis (Reference 7) and provided with WinMACCS.

(Appendix A of Reference 4)

The results with respect to the above pathways are documented in the WinMACCS analysis output files (Reference 7).

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Question No. EIS ACC/SA-9

10 CFR 51.55(a) requires each applicant for a standard design certification under subpart B of 10 CFR Part 52 (i.e., 10 CFR 52.47(b)(2)) to submit with its application a separate document entitled, "Applicant's Environmental Report—Standard Design Certification." The environmental report must address the costs and benefits of severe accident mitigation design alternatives, and the bases for not incorporating severe accident mitigation design alternatives in the design to be certified.

The environmental standard review plan (ESRP) Section 7.2, Severe Accidents, of NUREG 1555 directs the staff to evaluate and independently confirm severe accident risks and analyses presented in an Environmental Report (ER) (i.e., the APR1400 ER, "Applicant's Environmental Report – Standard Design Certification," found under ML15006A038 and the proprietary technical report, "Severe Accident Mitigation Design Alternatives (SAMDA) for the APR1400," under ML15012A105) of accidents involving radioactive material that can be postulated for the plant under review. The scope of this review should include probability-weighted consequence (i.e., risks) analysis for severe accidents, including dose and socioeconomic risk impacts based on plant specific data in sufficient detail to appropriately evaluate the risks for severe accidents.

The staff requires the following additional information in order to complete its review of the environmental impacts of severe accidents and to ensure appropriate documentation of the applicant's assessment in the APR1400 Environmental Report.

Provide a discussion in ER Section 3, Base Risk, on the analytical process used for determining the risks from severe accidents. While Section 4 of APR1400-K-P-NR-013901-P Revision 1, "SAMDA ANALYSIS," contains information about the process, this document is not referenced in the ER as to where this information can be found.

The NRC staff request that any revisions to the ER or supporting technical reports be provided as a markup as part of the response to this RAI.

This RAI is related to the Environmental Audit Information Needs ER-TI-8 (ML15198A023).

Response – (Rev. 1)

The Environmental Reports (ER) Section 3 will be revised to provide a clear reference to where the analytical process is developed (see Attachment).

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

The Environmental Reports (ER) will be revised as shown in Attachment.

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3. BASE RISK

Base risk is defined as the maximum possible averted risk. The first step in determining base risk is to develop and quantify a Level 1 and Level 2 probabilistic risk assessment (PRA) model for at-power internal events. The results of the model provide risk measured as core damage frequency (CDF) and the characteristics of any expected radionuclide release following a severe accident.

Determination of base risk, as well as the overall SAMDA evaluation process, is detailed in Reference 7 and described below.

The PRA also includes internal fire, internal flooding, and low-power and shutdown (LPSD) events. Risk from other external events such as high winds and seismic events was determined to be negligible.

Reference 4

The CDFs were determined in the Level 1 PRA as follows:

- At-power internal event PRA = 1.3×10^{-06} per year
- Internal flooding events = 4.2×10^{-07} per year
- Fire-induced accident sequences = 2.1×10^{-06} per year
- LPSD internal event accident sequences = 2.9×10^{-06} per year
- LPSD flood events = 1.8×10^{-08} per year
- LPSD fire = 1.7×10^{-06} per year

The total CDF is 8.5×10^{-06} per year.

Using the results of the Level 1 PRA, the second step in determining base risk is to identify the characteristics of any expected radionuclide release following a severe accident and then to quantify the expected frequency of release. The Level 2 PRA model categorizes the releases into 21 source term categories (STCs). STCs are distinguished by the magnitude of fission products released, the timing of the fission product release, and the pathway for the release. STC definitions are provided in Table 1a. Risk contributions for each STC for at-

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1. NEI 05-01, "Severe Accident Mitigation Alternatives (SAMA) Analysis – Guidance Document," Rev. A, Nuclear Energy Institute, November 2005.
2. NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," U.S. Nuclear Regulatory Commission, 1997.
3. Bureau of Labor Statistics, Producer Price Index for the Commodity of Electric Power, Producer Price Index – Commodities: Series Id: WPU054, 2013/1993. Available at http://data.bls.gov/timeseries/WPU054?data_tool=XGtable; retrieved October 26, 2014.
4. APR1400-E-P-NR-14006-P, "Severe Accident Mitigation Design Alternatives for APR1400," Rev. 0, Korea Electric Power Corporation and Korea Hydro & Nuclear Power Co., Ltd., December 2014.
5. NUREG-1555, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan," Section 7.3, "Severe Accident Mitigation Alternatives," Rev. 1, U.S. Nuclear Regulatory Commission, July 2007.
6. APR1400-E-N-NR-14001-P, "Design Features to Address GSI-191," Rev. 0, Korea Electric Power Corporation and Korea Hydro & Nuclear Power Co., Ltd., December 2014.

7. APR1400-K-P-NR-13901-P, "SAMDA Analysis," Rev. 1, Korea Electric Power Corporation and Korea Hydro & Nuclear Power Co., Ltd., December 2014.

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