SEB Issue List Regarding APR 1400, FSAR 3.4.2 “Analysis Procedures”

Issue #1 (AI 3-79.1)

In addition to the four (4) COL items listed in Sec. 3.4.3 “Combined License Information”, the following additional COL items are to be addressed:

a. The site-specific design of plant grading and drainage.

b. The site-specific flooding hazards from engineered features, such as water tank collapsing, water piping breaking, etc.

c. Any site-specific flood protection measures such levees, seawalls, flood walls, revetments or breakwaters or site bulkheads pursuant to RG 1.102.

d. The site-specific dewatering system if the plant is built below the design basis flood level.

e. To describe the basis for the Probable Maximum Flood (PMF) to determine the maximum site-specific ground water elevation above the grade that may occur from tsunami or hurricane sources.

Response

DCD Tier 2 Table 1.8-2, Section 3.4.1.1, 3.4.1.4, 3.4.2 and 3.4.3 will be revised to incorporate the requested COL items. COL item 3.4(1) currently addresses the intent of item ‘c’ above; therefore, DCD sections 3.4.1.1 and 2.4.10 will be revised to include the clarifying information for that COL item rather than establishing a new COL item.

Impact on DCD

DCD Tier 2 Table 1.8-2, and sections 2.4.10, 3.4.1.1, 3.4.1.4, 3.4.2 and 3.4.3 will be revised as indicated in the attached markup.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specification.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

Table 1.8-2 (3 of 29)

Item No.	Description
COL 3.4(1)	The COL applicant is to provide site-specific information on protection measures for the design-basis flood, as required in Subsection 2.4.10.
COL 3.4(2)	The COL applicant is to provide flooding analysis with flood protection and mitigation features from internal flooding for the CCW Heat Exchanger Building and ESW Building.
COL 3.4(3)	The COL applicant is to confirm that the potential site-specific external flooding events are bounded by design-basis flood values or otherwise demonstrate that the design is acceptable.
COL 3.4(4)	The COL applicant is to identify any site-specific physical models that could be used to predict prototype performance of hydraulic structures and systems.
COL 3.5(1)	The COL applicant is to provide the procedure for heavy load transfer to strictly limit the transfer route inside and outside containment during plant maintenance and repair periods.
COL 3.5(2)	The COL applicant is to perform an assessment of the orientation of the turbine generator of this and other unit(s) at multi-unit sites for the probability of missile generation using the evaluation of Subsection 3.5.1.3.2 to verify that essential SSCs are outside the low-trajectory turbine missile strike zone.
COL 3.5(3)	The COL applicant is to evaluate site-specific hazards induced by external events that may produce more energetic missiles than tornado or hurricane missiles, and provide reasonable assurance that seismic Category I and II structures are designed to withstand these loads.

COL 3.4(5) The COL applicant is to provide the site-specific design of plant grading and drainage.

COL 3.4(6) The COL applicant is to provide the site-specific flooding hazards from engineered features, such as water tank collapsing, water piping breaking, etc.

COL 3.4(7) The COL applicant is to provide the site-specific dewatering system if the plant is built below the design basis flood level.

COL 3.4(8) The COL applicant is to describe the basis for the Probable Maximum Flood (PMF) to determine the maximum site-specific ground water elevation above the grade that may occur from tsunami or hurricane sources.

Item No.	Description
COL 3.6(3)	The COL applicant is to confirm that the bases for the LBB acceptance criteria are satisfied by the final as-built design and materials of the piping systems as site-specific evaluations, and is to provide the information including LBB evaluation report for the verification of LBB analyses.
COL 3.6(4)	The COL applicant is to provide the procedure for initial filling and venting to avoid the known causes for water hammer in DVI line.
COL 3.7(1)	The COL applicant is to determine the site-specific SSE and OBE that are applied to the seismic design of the site-specific seismic Category I and II SSCs and the basis for the plant shutdown. The COL applicant is also to verify the appropriateness of the site-specific SSE and OBE.
COL 3.7(2)	The COL applicant is to confirm that the horizontal components of the SSE site-specific ground motion in the free-field at the foundation level of the structure satisfy a peak ground acceleration of at least 0.1 g.

possible and that could affect safety-related facilities with respect to adjacent water bodies such as streams or lakes for both high and low water levels. Additional site-specific information includes the potential for formation of frazil and anchor ice at the site and the effects of an ice-induced reduction in the capacity of water storage facilities as they affect safety-related structures, systems, and components (SSCs).

2.4.8 Cooling Water Canals and Reservoirs

Site-specific information related to cooling water canals and reservoirs includes the design bases for the capacity and operating plan for safety-related cooling water canals and reservoirs. Site characteristics include the emergency storage evacuation of reservoirs, verified runoff models, flood routing, spillway design, and outlet protection if required.

2.4.9 Channel Diversions

Site-specific information related to channel diversions includes the potential for upstream diversion or rerouting of the source of cooling water with respect to seismic, topographical, geologic, and thermal evidence in the region. Alternative safety-related cooling water sources in the event are to be described if available.

2.4.10 Flooding Protection Requirements

Site-specific information related to flooding protection requirements includes the static and dynamic consequences of all types of flooding on each pertinent safety-related facility, including the various types of flood protection used such levees, seawalls, flood walls, revetments or breakwaters or site bulkheads pursuant to RG 1.102 and the emergency procedures to be implemented (where applicable).

2.4.11 Low Water Considerations

Site-specific information related to low water considerations includes low flow in rivers and streams; low water resulting from surges, seiches, or tsunamis; historical low water; future controls; plant requirements; and heat sink dependability requirements.

3.4 Water Level (Flood) Design

All seismic Category I structures, systems, and components (SSCs) are designed to withstand the effects of flooding due to natural phenomena or onsite equipment failures without loss of the capability to perform their safety-related functions.

The potential causes of external flooding include probable maximum precipitation, potential dam failures, and high groundwater and outdoor tank failures, and extreme sea waves such as storm surges, seiches, tsunamis, high tides, etc., as described in Section 2.4.

This analysis includes a site description and elevations of safety-related structures and equipment; evaluations of penetrations in seismic Category I structures; and the effects of flooding due to postulated pipe failures, operation of fire protection systems, and failures of non-seismic and non-tornado protected tanks, vessels, and piping.

3.4.1 Flood Protection and Evaluation

3.4.1.1 Design Bases

such levees, seawalls, flood walls, revetments or breakwaters or site bulkheads pursuant to RG 1.102

The design basis flood level at the reactor site will be determined in accordance with NRC RG 1.59 (Reference 1) and ANSI/ANS 2.8 (Reference 2). Because the design basis flood level of the APR1400 standard design is at least 0.3 m (1 ft) below the plant grade as specified in Table 2.0-1, all safety-related SSCs located on the dry site as defined in NRC RG 1.102 (Reference 3) are protected from an external flood event.

The COL applicant is to provide site-specific information on protection measures for the design basis flood, as described in Subsection 2.4.10 (COL 3.4(1)).

All seismic Category I structures are designed to withstand the static and dynamic forces due to the maximum groundwater level, which is 0.61 m (2 ft) below the plant grade as provided in Table 2.0-1.

The COL applicant is to provide the site-specific design of plant grading and drainage (COL 3.4(5)).

The systems in the emergency diesel generator building to be protected from flooding are Class 1E emergency diesel generator system, and the emergency diesel generator fuel oil storage and transfer system. The components to be protected from flooding are diesel generator, diesel fuel oil transfer pump, and exhaust fan.

d. Site-specific safety structures

The COL applicant is to provide flooding analysis with flood protection and mitigation features from internal flooding for the CCW Heat Exchanger Building and ESW Building (COL 3.4(2)).

Tables 3.4-1 and 3.4-2 provide the locations of safety-related SSCs and a comparison of the maximum internal flood elevation in the vicinity of the components. Figures 3.4-1 through 3.4-7 provide the locations of watertight doors and flood barriers in the auxiliary building.

The COL applicant is to provide the site-specific flooding hazards from engineered features, such as water tank collapsing, water piping breaking, etc. (COL 3.4(6)).

3.4.1.4 <u>Evaluation of Ext</u>

External flooding is evaluated based on flooding sources such as natural phenomena and the failure of onsite tanks or large buried pipes. The maximum water level and flow velocity of an individual flood event are determined to estimate flood loads on seismic Category I structures and the watertightness of the structures during an external flood event. Seismic Category I structures are designed for the design basis flood level and the maximum groundwater level defined in Table 2.0-1.

The COL applicant is to confirm that the potential site-specific external flooding events are bounded by design basis flood values or otherwise demonstrate that the design is acceptable (COL 3.4(3)).

No permanent dewatering systems are necessary to maintain safe and acceptable groundwater levels.

The COL applicant is to provide the site-specific dewatering system if the plant is built below the design basis flood level (COL 3.4(7)).

d. Firefighting equipment represents internal flooding sources from at least the nearest two fire hose stations that could reach the fire zone. The discharge rate is for firefighting equipment is assumed to be 0.044 m^3/s (700 gpm).

Based on flooding sources, the worst-case flooding scenario is rupture of a 0.10 m (4 in) fire protection system line in the general access area. The flood water is drained to lower elevations through the drain system and openings. The potential flood level at this elevation is assumed as 0.15 m (6 in) from the bottom El. 174 ft 0 in.

The safety-related equipment and components are located above the flood level. Therefore, the control room supply AHUs, control room emergency makeup ACUs, and EDG room normal supply AHUs are not flooded.

3.4.1.5.3 Emergency Diesel Generator Building

The emergency diesel generator building is separated by distance from other buildings and divisionally separated by flood barriers. Emergency diesel generators (EDGs) are separated by distance and flood barriers so that an internal flooding event does not affect both EDGs simultaneously.

3.4.2 Analysis Procedures

Flood loads due to the design basis flood level and maximum groundwater level are estimated using the applicable codes and standards, as described in Section 3.8. Seismic Category I structures are designed to withstand flood loads and to remain watertight during the design basis flood event. The loads and load combinations provided in Section 3.8 take into consideration the static and dynamic loadings on seismic Category I structures including hydrostatic loading due to the design basis flood and/or the groundwater conditions specified in Table 2.0-1.

The COL applicant is to identify any site-specific physical models that could be used to predict prototype performance of hydraulic structures and systems (COL 3.4(4)).

The COL applicant is to describe the basis for the Probable Maximum Flood (PMF) to determine the maximum site-specific ground water elevation above the grade that may occur from tsunami or hurricane sources (COL 3.4(8)).

such levees, seawalls, flood walls, revetments or breakwaters or site bulkheads pursuant to RG 1.102

3.4.3 Combined License Information

COL 3.4(1) The COL applicant is to provide site-specific information on protection measures for the design basis flood, as required in Subsection 2.4.10.

COL 3.4(2) The COL applicant is to provide flooding analysis with flood protection and mitigation features from internal flooding for the CCW Heat Exchanger Building and ESW Building.

COL 3.4(3) The COL applicant is to confirm that the potential site-specific external flooding events are bounded by design basis flood values or otherwise demonstrate that the design is acceptable.

COL 3.4(4) The COL applicant is to identify any site-specific physical models that could be used to predict prototype performance of hydraulic structures and systems.

3.4.4 References

1. Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, August 1977.

2. ANSI/ANS 2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites," American Nuclear Society, 1992.

3. Regulatory Guide 1.102, "Flood Protection for Nuclear Power Plants," Rev. 1, Nuclear Regulatory Commission," September 1976.

COL 3.4(5) The COL applicant is to provide the site-specific design of plant grading and drainage.

COL 3.4(6) The COL applicant is to provide the site-specific flooding hazards from engineered features, such as water tank collapsing, water piping breaking, etc.

COL 3.4(7) The COL applicant is to provide the site-specific dewatering system if the plant is built below the design basis flood level.

COL 3.4(8) The COL applicant is to describe the basis for the Probable Maximum Flood (PMF) to determine the maximum site-specific ground water elevation above the grade that may occur from tsunami or hurricane sources.

SEB Issue List Regarding APR 1400, FSAR 3.4.2 “Analysis Procedures”

Issue #2 (AI 3-79.2)

[This was previously sent as an RAI but can be discussed further in a public meeting.] 10 CFR 52.47 requires, in part, that the applicant’s final safety analysis report (FSAR) must include sufficient information to allow NRC to make a final safety finding. In addition, GDC 2 requires that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions as it relates to natural phenomena. The design bases for these SSCs shall reflect appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena.

During the review of Section 3.4.2 “Analysis Procedures,” the staff found that the applicant did not provide a clear description on how the water heads transform into hydrostatic and hydrodynamic loadings on seismic Category I structures as per “areas of review” specified in SRP 3.4.2, Section I.2. In the first paragraph of the section, the applicant only makes a brief description at a high level of detail, and refers more details to Section 3.8. In accordance with 10 CFR 52.47 and GDC2, the applicant is requested to address following issues in Section 3.4.2 of the DCD:

a. Provide design input from all sources of water heads including but not limited to: (i) design basis flood level, Table 2.0-1; (ii) maximum ground water level, Table 2.0-1; (iii) PMWP, Table 2.0-1; (iv)maximum precipitation rate, Table 2.0-1; (v) probable maximum water level, PMF and PMP described in Sec. 2.4.

b. How are those various water heads transformed into hydrostatic or hydrodynamic loadings (including buoyant forces)? [such as hydrostatic load, (L_h), Flooding load,(Y_f), Design flood/precipitation, (H), PMF/PMP, (H_s). Hydrodynamic load in seismic loads (E_s)—See Sec. 3.8.4.3.and Table 3.8-9A, Footnote (2)]

c. How are those effective loadings being classified into various categories of loadings such as normal load, abnormal load, severe environmental load or extreme environmental load? Note that assignment to a proper class of loading will assure correct load combinations for the design input in compliance with the code specifications.

d. How are those loadings applied in the design of seismic Category I structures?

Response

KHNP supplied a response to the above questions via RAI 75-8023 (refer to letter MKD/NW-15-0083L dated August 13, 2015; ML15225A567). Through discussions on August 20 and September 17, it was understood that additional explanation was required on the how the hydrostatic or hydrodynamic loads were derived. The relationship between part ‘a’ and part ‘c’ are reflected in the response to part ‘c’. The response to part ‘b’ is being revised to explain more clearly the hydrostatic and hydrodynamic loading which is applied considering the various water heads. Therefore, the formal response to part ‘b’ and part ‘c’ will reflect the additional explanation as described in the proposed revised response to RAI 75-8023, attached.

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 Specification.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

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.: **75-8023**

SRP Section: **3.4.2 - Analysis Procedures**

Application Section: **3.4.2**

Date of RAI Issue: **07/15/2015**

Question No. 03.04.02-1

10 CFR 52.47 requires, in part, that the applicant's final safety analysis report (FSAR) must include sufficient information to allow NRC to make a final safety finding. In addition, GDC 2 requires that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornados, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions as it relates to natural phenomena. The design bases for these SSCs shall reflect appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena.

During the review of Section 3.4.2 "Analysis Procedures," the staff found that the applicant did not provide a clear description on how the water heads transform into hydrostatic and hydrodynamic loadings on seismic Category I structures as per "areas of review" specified in SRP 3.4.2, Section I.2. In the first paragraph of the section, the applicant only makes a brief description at a high level of detail, and refers more details to Section 3.8. In accordance with 10 CFR 52.47 and GDC2, the applicant is requested to address following issues in Section 3.4.2 of the DCD:

a. Provide design input from all sources of water heads including but not limited to: (i) design basis flood level, Table 2.0-1; (ii) maximum ground water level, Table 2.0-1; (iii) PMWP, Table 2.0-1; (iv) maximum precipitation rate, Table 2.0-1; (v) probable maximum water level, PMF and PMP described in Sec. 2.4.

b. How are those various water heads transformed into hydrostatic or hydrodynamic loadings (including buoyant forces)? [such as hydrostatic load, (L_h), Flooding load,(Y_f), Design flood/precipitation, (H), PMF/PMP, (H_s). Hydrodynamic load in seismic loads (E_s)—See Sec. 3.8.4.3.and Table 3.8-9A, Footnote (2)]

c. How are those effective loadings being classified into various categories of loadings such as normal load, abnormal load, severe environmental load or extreme environmental load? Note that assignment to a proper class of loading will assure correct load combinations for the design input in compliance with the code specifications.

d. How are those loadings applied in the design of seismic Category I structures?

Proposed Response – Revision 1

a. The requested design input sources are provided as follows:

(i) Design Basis Flood Level in Table 2.0-1

According to Table 1.2-6 of EPRI Advanced Light Water Reactor (ALWR) Utility Requirements Document (URD) (Reference 1), maximum flood elevation is determined to be 0.30 m (1 ft) below plant grade in the vicinity of the SSCs important to safety.

(ii) Maximum Groundwater Level in Table 2.0-1

According to Table 1.2-6 of EPRI Advanced Light Water Reactor (ALWR) Utility Requirements Document (URD) (Reference 1), maximum groundwater level is determined to be 0.61 m (2 ft) below plant grade in the vicinity of the SSCs important to safety.

(iii) PMWP in Table 2.0-1

Probable Maximum Winter Precipitation (PMWP) in the U.S. can be obtained from Hydro Meteorological Reports (HMRs) of U.S. Department of Commerce, National Oceanic and Atmosphere Administration (NOAA).

Based on Figures 26, 27, 35, 36, 37 and 45 of HMR-53 (Reference 5), the maximum 48-hour probable maximum winter precipitation of the U.S. is calculated by averaging and comparing the 24-hour and 72-hour probable maximum precipitations during the winter season (December through March).

The 48-hour probable maximum winter precipitation for the APR1400 is determined to be 914.4 mm (36 in.) which bounds the U.S.

(iv) Maximum Precipitation Rate in Table 2.0-1

Based on the HMRs, the Probable Maximum Precipitation (PMP) for 1-hour over 1 mi^2 in each HMR is identified as shown in Table 1 below.

Table 1. Probable Maximum Precipitation from HMRs

HMR No.	PMP (in) [for 1-hour over 1 mi^2]
58 (Reference 9), 59 (Reference 10)	12.0
57 (Reference 8)	10.2
56 (Reference 7)	18.2
55a (Reference 6)	13.0
51 (Reference 3), 52 (Reference 4), 53 (Reference 5)	19.4
49 (Reference 2)	12.5

Therefore, the Maximum Precipitation Rate of 1-hour over 1 mi^2 is determined to be 19.4 in. (492.7 mm) which is the highest value in the U.S.

Based on Figure 24 and 36 of HMR-52 (Reference 4), the Maximum Precipitation Rate of 5-min. over 1 mi^2 is determined to be 6.2 in. (157 mm).

(v) Probable Maximum Water Level, PMF and PMP in Section 2.4

As mentioned in item (i) above, the Probable Maximum Water Level is 0.30 m (1 ft) below plant grade in the vicinity of the SSCs important to safety as referenced in the EPRI URD (Reference 1).

As mentioned in item (iv) above, the PMP values over 1 mi^2 in Table 2.0-1 are determined to be 492.7 mm (19.4 in.) over 1 hour and 157 mm (6.2 in.) in 5 minutes referring to the applicable HMRs.

Probable Maximum Flood (PMF) is site-specific hydrologic information which is to be provided by the COL applicant.

b. The water heads are transformed into hydrostatic or hydrodynamic loadings, including buoyant forces, as shown below:

- Soil and Surcharge loading
  Soil and Surcharge loading is calculated as a linearly distributed pressure on the external walls depending on the design water level (EL. 96'-8") according to the basic equation of hydrostatics as shown in Figure 1.

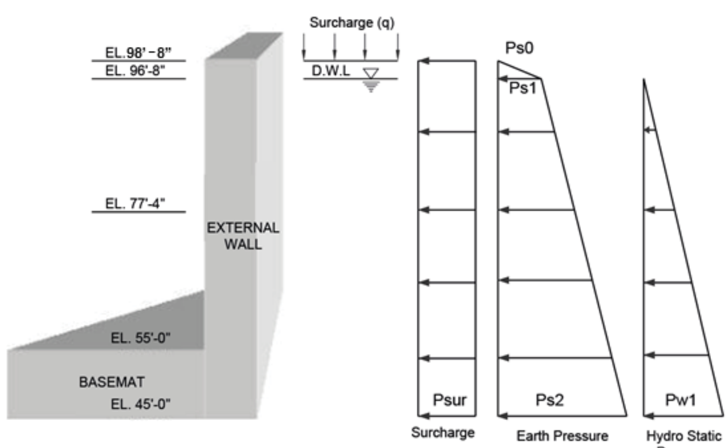

Figure 1

- Dynamic groundwater pressure (Hydrodynamic water pressure)
  Dynamic groundwater pressure is calculated based on the hydrodynamic formula suggested by Matsuo and O'Hara in "Principles of Soil Dynamics" written by Braja M. DAS. Based on the hydrodynamic formula, the hydrodynamic water pressure due to seismic load is expressed as a parabolic distributed pressure as shown in Figure 2. The design water level (EL. 96'-8") is considered in the calculation of the hydrodynamic water pressure.

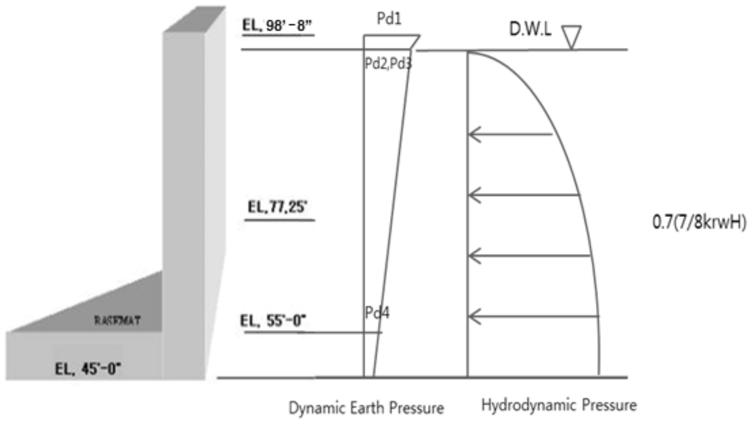

Figure 2

- Buoyant force

  Buoyant force is calculated as a uniform pressure corresponding to the design water level (EL. 96'-8" for normal operating condition and EL. 97'-8" for flooding). This force acts in the direction opposite to gravity and is the weight of the water displaced by that of the building.

c. The classification of effective loadings complies with code specification ACI 349 Ch.9 and are as follows:

- Hydrostatic load (L_h)

  Hydrostatic loads are due to the weight and pressure of fluids with well defined densities and controllable maximum heights or related internal moments and forces specified in DCD Tier 2 Section 3.8.4.3.1.b.2). This load is generally not related to natural phenomena.

- Soil and surcharge load (L_g): Normal load as described in DCD Tier 2 Section 3.8.4.3.1.b.1)

  This load is applied up to the maximum elevation of groundwater specified in DCD Tier 2 Table 2.0-1 (0.61 m (2 ft) below plant grade). The design water level in DCD Tier 2 Section 3.8.4.3.1 will be revised to be consistent with the site parameters described in Table 2.0-1.

- Flooding load (Y_f): abnormal load as described in DCD Section 3.8.4.3.2.g

  This load is applied due to internal flooding generated by a postulated pipe break in abnormal/extreme environmental loading conditions.

- Design flood/precipitation (H): severe environmental load as described in DCD Section 3.8.4.3.3.b

  This load is applied up to the maximum site flood elevation which is specified in DCD Tier 2 Table 2.0-1 (0.30 m (1 ft) below plant grade).

- PMF/PMP (H_s): extreme environmental load as described in DCD Section 3.8.4.3.4.c

This load is applied based on the maximum flood elevation which is specified in DCD Tier 2 Table 2.0-1 (0.30 m (1 ft) below plant grade).

- Hydrodynamic load in seismic loads (E_s): extreme environmental load as described in DCD Section 3.8.4.3.4.a.1)
  This load included in SSE loads (E_s) is applied based on maximum elevation of groundwater specified in DCD Tier 2 Table 2.0-1 (0.61 m (2 ft) below plant grade).

The soil load (L_g) and hydrodynamic load in the seismic loads (E_s) are applied to the design. Design flood/precipitation (H) and PMF/PMP (H_s) are not governing loads in the design of APR 1400 since the load combinations including those loadings are negligibly small compared to the other load combinations.

d. These loadings are used as design inputs for the load combinations in designing the seismic Category I structures. For the reactor containment building, the load combinations of Table 3.8-2 are used and for the other seismic Category 1 structures, the load combinations specified in Table 3.8-9A are used.

In addition to the design load combinations, the acceptance criteria for the stability of seismic Category I structures are checked in accordance with Table 3.8-10 of the APR1400 DCD. The buoyant forces of normal and flood conditions are considered in the stability check of overturning, sliding, and flotation as shown in Table 3.8-10.

References

1) EPRI ALWR Utility Requirement, Volume II, Electric Power Research Institute (EPRI), 2008

2) Hydrometeorological Report No. 49, “Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages”, U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), Reprinted 1984.

3) Hydrometeorological Report No. 51, “Probable Maximum Precipitation Estimates, United States East of the 105th Meridian”, U.S. Department of Commerce, NOAA, June 1978.

4) Hydrometeorological Report No. 52, “Application of Probable Maximum Precipitation Estimates - United States East of the 105th Meridian”, U.S. Department of Commerce, NOAA, August 1982.

5) Hydrometeorological Report No. 53, “Seasonal Variation of 10-Square-Mile Probable Maximum Precipitation Estimates, United States East of the 105th Meridian”, U.S. Department of Commerce, NOAA, April 1980.

6) Hydrometeorological Report No. 55A, “Probable Maximum Precipitation Estimates - United States Between the Continental Divide and the 103rd Meridian”, U.S. Department of Commerce, NOAA, June 1988.

7) Hydrometeorological Report No. 56, “Probable Maximum and TVA Precipitation Estimates with Areal Distribution for Tennessee River Drainages Less Than 3,000 Mi2 in Area”, U.S. Department of Commerce, NOAA, October 1986.

8) Hydrometeorological Report No. 57, “Probable Maximum Precipitation - Pacific Northwest States Columbia River (including portions of Canada), Snake River and Pacific Coastal Drainages”, U.S. Department of Commerce, NOAA, October 1994.

9) Hydrometeorological Report No. 58, “Probable Maximum Precipitation for California – Calculation Procedures”, U.S. Department of Commerce, NOAA, October 1998.

10) Hydrometeorological Report No. 59, “Probable Maximum Precipitation for California”, U.S. Department of Commerce, NOAA, February 1999.

Impact on DCD

DCD Tier 2 Section 3.8.4.3.1 will be revised as indicated in the attached markup.

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

There is no impact on any Technical, Topical and Environmental Report.

Evaluation of the capability of a structure for a given load combination is based on providing a factor of safety appropriate to the probability of occurrence. The appropriate factor of safety is reflected in the load factors and allowable stresses for the various load combinations.

The COL applicant is to identify any applicable site-specific loads such as site proximity explosions and missiles, potential aircraft crashes, and the effects of seiches, surges, waves, and tsunamis (COL 3.8(2)).

3.8.4.3.1 Normal Loads

a. Dead loads – (D)

Dead load refers to loads that are constant in magnitude and point of application. The types and definitions of dead loads and their combination requirements are given in Table 3.8-8.

b. Live loads – (L)

Live load refers to any normal loads that may vary with intensity and location of occurrence. The types and definitions of live loads and their combination requirements are given in Table 3.8-8. The specified design values for live loads are summarized in Table 3.8-7.

1) Soil and surcharge load (L_g)

Maximum elevation of groundwater is specified to be 0.61 m (2 ft) below plant grade for safety-related structures.

Soil and surcharge load refers to load due to weight and pressure of soil, water in soil, or other material such as soil surcharge. ~~Maximum flood level is specified to be 0.30 m (1 ft) below plant grade for safety-related structures.~~ For the construction loading condition, the minimum surcharge load is 48.0 kN/m^2 (1,000 psf) over any unoccupied area plus the actual construction loading surcharge from any known structures or load sources. For the normal loading condition, the minimum surcharge load is 24.0 kN/m^2 (500 psf). For the design of underground utilities, the minimum surcharge load for the construction loading condition is 24.0 kN/m^2 (500 psf) and for the