# 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.:** | **227-8274** |
| **SRP Section:** | **03.08.04 – Other Seismic Category I Structures** |
| **Application Section:** | **03.08.04** |
| **Date of RAI Issue:** | **09/25/2015** |

## Question No. 03.08.04-3

10 CFR 50.55a and 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 1, 2, 4 and 5 provide the regulatory requirements for design of seismic Category I structures. Standard Review Plan (SRP) 3.8.4, Section II.2 provides the applicable codes standards and specifications that are either applicable in their entirety or in portions for seismic Category I structures.

In APR1400 DCD, Tier 2, Section 3.8.4.2, “Applicable Codes, Standards, and Specifications,” and Table 3.8-1, “Codes, Standards, Specifications, and Regulations,” the applicant provides the applicable codes, standards, specifications, and regulations without any editions. This occurs throughout the DCD and the staff also identified discrepancies related to referring to the applicable codes, standards, specifications, and regulations.

Example of inconstancies within the DCD:

a) DCD Tier 2, Section 3.8.4.2.2 identifies some regulatory guides (RGs) that are applicable to the design, construction, testing, and inspection of seismic Category I structures. A comparison of the RGs with those listed in SRP 3.8.4 shows that some RGs are not included (e.g., 1.127, 1.136, 1.160, and 1.221). All Sections of the DCD including DCD 3.8.4 should be revised to include the applicable RGs consistent with those in SRP 3.8.4, or alternative methods should be described and justified.

b) In subsection 3.8.4.6.1.1, “Concrete,” the applicant referenced ASTM D1888-78, “Method of Test for Particulates and Dissolved Matter in Water,” which was withdrawn in 1989 without a replacement.

c) ASCE 4, ASCE 7, & ASCE 37 were referenced in various sections of the DCD, but are not included in Table 3.8-1 of the DCD. Furthermore, ASCE 4 was not reference in Section 3.8.7, “References.”

d) In subsection 3.8.4.6.1.2, “Reinforcing Steel,” the applicant stated that “The fabrication of reinforcing bars, including fabrication tolerances, is in accordance with CRSI, MSP-1.” However, the Manual of Standard Practice-1 (MSP-1) of Concrete Reinforcing Steel Institute (CRSI) was not referenced in Section 3.8.7 and no edition was provided. There were also other references included in Section 3.8.7 without identification of the year or edition. [JIB1]

e) In subsection 3.8.4.6.1.4, “Stainless Steel,” and Table 3.8-1 “Codes, Standards, Specifications, and Regulations,” the applicant did not provide the welding code for the stainless steel material, and DCD Sections 3.8.3 and 3.8.4 did not identify other potentially applicable American Welding Society codes (e.g., AWS D1.4, 1.6, and 1.8). Furthermore, applicant referred to subsections 3.8.3.6.3, “Stainless Steel Pool Liners,” and 3.8.3.6.4, “Stainless Steel Other Than Pool Liners” for additional requirements. In subsection 3.8.3.6.3, the applicant described that welding procedure are performed in accordance with ASME Sec. III, Div. 2, Article CC-4540, “Rules Governing Making Examining, and Repairing Welds.” However, article CC-4540 does not provide any weld procedures for stainless steel materials. [JIB2]

f) In subsection 3.8.3.6.3, “Stainless Steel Pool Liners,” second paragraph “Welding procedures are in accordance with ASME Section, Division 2, Subarticle CC-4540 and ASME Section IX.” Should read “Welding procedures are in accordance with ASME Section III, Division 2, Subarticle CC-4540 and ASME Section IX.”

Therefore, the applicant is requested to ensure the completeness and accuracy of the codes, standards, and specifications, in the various sections of DCD 3.8, including Table 3.8-1, and Section 3.8.7. This should also include correcting discrepancies such as those described above and specifying the year or edition of each of these documents.

## Response – (Rev. 2)

a) NRC Regulatory Guides 1.7, 1.69, 1.91, 1.127, 1.136, 1.160, 1.216 and 1.221 will be added to the applicable DCD Section(s) 3.8.1.2.2, 3.8.2.2.2, 3.8.3.2.2, 3.8.4.2.2 and 3.8.7 to be consistent with the RGs described in SRP 3.8.1, 3.8.2, 3.8.3 and 3.8.4, as shown in Attachment 1 to this response.

b) All of the concrete for the APR1400 is to be produced in accordance with ASME Section III, Division 2, Subsection CC, 2001Edition with the 2003 Addenda and ACI 349-97. According to ASME CC-2223.1, the ASTM D1888-78 test is still referenced; thus, ASTM D1888-78 remains in effect.

c) ASCE 4, ASCE 7, and ASCE 37 will be added to Table 3.8-1 and ASCE 4 will be added to Section 3.8.7 to be consistent with the applicable codes described in the DCD, as shown in Attachment 2 to this response. ASTM standards will also be added to Table 3.8-1 to identify the standards described in Section 3.8.

d) DCD Tier 2, Subsection 3.8.4.6.1.2 will be revised to replace the reference to CRSI, MSP-1 with ACI 315 in ACI Detailing Manual (SP-66). Section 3.8.7 will be revised to include the new reference and add the appropriate year or edition to existing references, as indicated in Attachment 3 to this response.

e) Stainless steel liner plates referenced in subsections within 3.8.6 of the DCD are designed in accordance with ASME Section III, Div. 2, subsection CC. Although ASME Section III, Div. 2, subsection CC. is specifically intended for the design of concrete containments and the associated liner plate, the philosophy of a metallic liner anchored in concrete and functioning as a leak tight boundary is identical with the design approach for other stainless steel liner plates. The entire stainless steel liner plate is not designed as a structural member; however, the liner plates are designed to resist loads that occurred during construction, such as wet concrete pressure during the hardening process of concrete, which is identical to the design of containment liner plates. The stainless steel liners and its anchorage system is designed and constructed to act initially as form during concrete placement of walls and subsequently as a leak tight membrane. All liner plate seam welds and other complete penetration welds shall be vacuum box tested to prove leak tightness of the weld. This leak testing is required by ASME Section III, Div. 2, CC-4544. Therefore, welding procedures for the stainless steel liner plate will be in accordance with ASME Section III, Div. 2, CC-4540. The stainless steel liner plates referenced in subsections with 3.8.6 of the DCD do not perform a pressure boundary function. Therefore, a specific welding code, including the AWS, for those stainless steel liner plates is not described in the DCD.

The welding provisions under the AWS D1.4 “structural welding code-reinforcing steel” are not used in the APR1400 since mechanical splices and lap splices are used for reinforcing steel connections instead of welded connections. In addition, the AWS D1.8 “Structural welding code-Seismic supplement” is not used since a seismic resistance system is not used in the APR1400.

f) DCD Subsection 3.8.3.6.3 will be revised as shown in Attachment 4 to this response to specify ASME Section III. ASME Section III, Division 1, Subsection NF, ASME Section XI, Subsections IWE and IWL, and ASME Section IX will also be added in DCD Table 3.8-1 as shown in Attachment 2 to this response.

The DCD will be revised to add ASME Section III Division 1 Subsection NF, ASME Section IX in DCD Tier 2, Subsection 3.8.7 as shown in Attachment 1 to this response.

ASME Section XI has been included in the DCD Tier 2, subsection 3.8.7 through the response to RAI 199-8223 Question 03.08.01-9 (Rev. 2).

---

**Impact on DCD**

DCD Tier 2, Subsections 3.8.1.2.2, 3.8.2.2.2, 3.8.3.2.2, 3.8.3.6.3, 3.8.4.2.2, 3.8.4.6.1.2, 3.8.7 and Table 3.8-1 will be revised as indicated in the attachments associated with this response.

**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, or Environmental Report.

3.8.1.2.1 Design Codes, Standards, Specifications, and Regulations

The design codes, standards, specifications, and regulations are listed in Table 3.8-1. The primary design code for concrete containment is ASME Section III, Division 2, Subsection CC (Reference 3).

3.8.1.2.2 NRC Regulatory Guides

Conformance to each NRC Regulatory Guide (RG) is described in Section 1.9. The NRC RGs applicable to the design of the concrete containment are NRC RG 1.35 (Reference 4), NRC RG 1.35.1 (Reference 5), NRC RG 1.136 (Reference 6), and NRC RG 1.7 (Reference 7).

3.8.1.2.3 Industry Standards

NRC RG 1.91 (Reference 30), NRC RG 1.216 (Reference 46), NRC RG 1.221 (Reference 45)

Internationally recognized industry standards published by ASTM are used whenever possible to define material properties, testing procedures, and fabrication and construction methods.

3.8.1.3 Loads and Load Combinations

The containment is designed to resist the loads given in Article CC-3000 of the ASME Code and NRC RG 1.136 with the exceptions listed below.

a. The post-LOCA flooding combined with the safe shutdown earthquake (SSE) is more severe than the post-LOCA flooding combined with the operating basis earthquake (OBE) set at one third or less of the SSE for the plant. Therefore, only the post-LOCA flooding SSE combination is considered in the design.

b. Subarticle CC-3720 of the ASME Code is satisfied when the containment structure is exposed to the load combination listed below. As a minimum design condition, the pressure ($P_{g1} + P_{g2}$) is not less than 310 kPa (45 psig).

$$D + F + T + P_{g1} + P_{g2}$$

functionally grouped into medium-voltage power, low-voltage power, low-voltage control, and instrument cable penetration assemblies. Figure 3.8-9 shows a typical electric penetration assembly in place within the containment wall. An assembly is sized to be inserted into sleeves in the containment wall.

3.8.2.1.3.2 Component Classification

The penetration sleeve is designed as a class MC component in accordance with ASME Section III, Division 1, Subsection NE.

All penetration head fittings (penetration Type 1 of Figure 3.8-8) are classified as piping components and, as such, they have the same classification as the process pipe and are designed in accordance with ASME Section III, Division 1, Subsection NB, NC, or ND as applicable. The other head fittings are designed as ASME Class MC components.

3.8.2.1.4 Fuel Transfer Tube Sleeve and Bellows

The fuel transfer tube sleeve and bellows is designed as a class MC component in accordance with ASME Section III, Division 1, Subsection NE.

3.8.2.2 Applicable Codes, Standards, and Specifications

The following regulations, codes, standards, and specifications are used in the design of the class MC components.

3.8.2.2.1 Design Codes, Standards, Specifications, and Regulations

The design codes, standards, specifications, and regulations are listed in Table 3.8-1.

3.8.2.2.2 NRC Regulatory Guides

NRC RG 1.7 (Reference 7) and

Conformance to each NRC Regulatory Guide is described in Section 1.9. NRC RG 1.57 (Reference 21) ~~is~~ are applicable to the design of the ASME Class MC components.

3.8.3.1.11 Interior Concrete Fill Slab

The interior concrete fill slab is located on the surface of liner plate of the reactor containment building basemat for protection of pressure boundary structures.

3.8.3.1.12 Polar Crane Supports

A large capacity of polar crane is supported by brackets installed in the containment shell, and the bracket is a steel structure consisting of cantilever beam.

3.8.3.2 Applicable Codes, Standards, and Specifications

The following codes, standards, and specifications are applied to the design of internal concrete and steel structures.

3.8.3.2.1 Design Codes and Standards

The design codes, standards, and regulations are listed in Table 3.8-1.

3.8.3.2.2 NRC Regulatory Guides

Conformance to each NRC RG is described in Section 1.9. The NRC RGs applicable to the design of the concrete and steel structures are 1.60, 1.61, 1.92, 1.122, 1.142, ~~and~~ 1.199 (References 22 through 27), 1.69 (Reference 29), and 1.160 (Reference 44)

3.8.3.2.3 Industry Standards

Nationally recognized industry standards, such as those published by ASTM, will be used whenever possible to describe material properties, testing procedures, and fabrications and construction methods.

3.8.3.3 Loads and Load Combinations

The typical loads and load combinations used for the internal structures are detailed in Subsection 3.8.4.3.

d. Maintain the store fuel in a coolable geometry

3.8.4.2 Applicable Codes, Standards, and Specifications

The following design codes, standards, specifications, regulations, Regulatory Guides, and other industry standards are used in the design, fabrication, construction, testing, and inspection of all seismic Category I structures other than the reactor containment building.

3.8.4.2.1 Design Codes and Standards

The design codes, standards, and regulations are listed in Table 3.8-1.

3.8.4.2.2 Regulatory Guides

The conformance of other seismic Category I structures to the applicable NRC RGs is addressed in Section 1.9. The NRC RGs that are applicable to the design of all seismic Category I structures other than the reactor containment building are NRC RGs 1.29 (Reference 28), 1.60, 1.61, 1.69 (Reference 29), 1.91 (Reference 30), 1.92, 1.115 (Reference 31), 1.122, ~~1.142, 1.143 (Reference 32), and 1.199.~~

1.127 (Reference 42), 1.136 (Reference 43), 1.142, 1.143 (Reference 32), 1.199, 1.160 (Reference 44), and 1.221 (Reference 45).

3.8.4.2.3 Industry Standards

Nationally recognized industry standards, such as those published by ASTM, are used where practicable to define material properties, testing procedures, and fabrication and construction methods.

3.8.4.3 Loads and Load Combinations

This section presents the structural design load information for the APR1400 seismic Category I structures other than the reactor containment building. This load information consists of a summary list of major loads and load combinations. These load combinations are categorized on the basis of their nature, the probability of occurrence of each of the individual loads, and the probability of simultaneous occurrence of these loads to form a loading combination.

30. Regulatory Guide 1.91, "Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, April 2013.

31. Regulatory Guide 1.115, "Protection Against Low-Trajectory Turbine Missiles," Rev. 2, U.S. Nuclear Regulatory Commission, January 2012.

32. Regulatory Guide 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, November 2001.

33. ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures," American Society of Civil Engineering/Structural Engineering Institute, 2006.

34. GTSTRUDL User Guide, GTSTRUDL Version 31, Georgia Institute of Technology, August 2010.

35. Research Council on Structural Connections, "Specification for Structural Joints Using ASTM A325 or A490 Bolts," 2004.

36. AWS D1.1, "Structural Welding Code," American Welding Society, 2010.

37. ASTM C191, "Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle," American Society for Testing and Materials.

38. ASTM C109, "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars," American Society for Testing and Materials.

39. ASTM A36, "Standard Specification for Carbon Structural Steel," American Society for Testing and Materials.

40. APR1400-E-S-NR-14006-P, "Stability Check for NI Common Basemat" Rev. 0, KHNP, November 2014.

Add next page

42. Regulatory Guide 1.127, "Inspection of Water-Control Structures associated with Nuclear Power Plants," Rev.1, U.S Nuclear Regulatory Commission, March 1978.

43. Regulatory Guide 1.136, "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments," Rev.3, U.S Nuclear Regulatory Commission, March 2007.

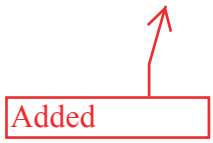
44. Regulatory Guide 1.160, "Monitoring The Effectiveness of Maintenance at Nuclear Power Plants," Rev.3, U.S Nuclear Regulatory Commission, May 2012.

45. Regulatory Guide 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," Rev.0, U.S Nuclear Regulatory Commission, October 2011.

46. Regulatory Guide 1.216, "Containment Structural Integrity Evaluation for Internal Pressure Loadings Above Design-Basis Pressure," U.S. Nuclear Regulatory Commission, August 2010.

47. ASME Section III, Division 1, Subsection NF, "Supports", The American Society of Mechanical Engineers, the 2007 Edition with the 2008 Addenda.

48. ASME Section IX, "Welding and Brazing Qualifications", The American Society of Mechanical Engineers, the 2007 Edition with the 2008 Addenda.



30. Regulatory Guide 1.91, “Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants,” Rev. 2, U.S. Nuclear Regulatory Commission, April 2013.

31. Regulatory Guide 1.115, “Protection Against Low-Trajectory Turbine Missiles,” Rev. 2, U.S. Nuclear Regulatory Commission, January 2012.

32. Regulatory Guide 1.143, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants,” Rev. 2, U.S. Nuclear Regulatory Commission, November 2001.

33. ASCE 7-05, “Minimum Design Loads for Buildings and Other Structures,” American Society of Civil Engineering/Structural Engineering Institute, 2006.

34. GTSTRUDL User Guide, GTSTRUDL Version 31, Georgia Institute of Technology, August 2010.

35. Research Council on Structural Connections, “Specification for Structural Joints Using ASTM A325 or A490 Bolts,” 2004.

36. AWS D1.1, “Structural Welding Code,” American Welding Society, 2010.

37. ASTM C191, “Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle,” American Society for Testing and Materials.

38. ASTM C109, “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars,” American Society for Testing and Materials.

39. ASTM A36, “Standard Specification for Carbon Structural Steel,” American Society for Testing and Materials.

40. APR1400-E-S-NR-14006-P, “Stability Check for NI Common Basemat” Rev. 0, KHNP, November 2014.

41. ASCE 4-98, "Seismic Analysis of Safety-Related Nuclear Structures and Commentary,"American Society of Civil Engineers, 2000

RAI 129-8085-Question 03.08.01-4

RAI 227-8274-Question 03.08.04-3

Table 3.8-1 (Sh. 1 of 3) Revised

Codes, Standards, Specifications, and Regulations

| Document Reference No. | Document Designation | Edition | Document Title |
|---|---|---|---|
| Codes & Standards (Added) | | | |
| 1 | ASME CC | 2001 with 2003 Addenda | Code for Concrete Containment |
| 2 | ACI 349 | 1997 | Code requirements for nuclear safety related concrete structure |
| 3 | AISC N690 | 1994 including Supp. 2(2004) | Specification for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities |
| 4 | ASME NE | 2007 with 2008 Addenda | Class MC components |
| 5 | ASME NQA-1 | 2008 with 2009 Addenda | Quality assurance Requirements for Nuclear Facility Applications |
| 6 | ASME NF | 2007 with 2008 Addenda | Supports |
| 7 | ACI 318 | 2008 | Building code requirements for reinforced concrete |
| 8 | ASCE 4 | 1998 | Seismic Analysis of Safety-Related Nuclear Structures and Commentary |
| 9 | ASCE 7 | 2005 | Minimum Design Loads for Buildings and Other Structures |
| 10 | SEI/ASCE 37 | 2002 | Design Loads on Structures during Construction Standard |
| 11 | ASTM C150 | 2012 | Standard Specification for Portland Cement |
| 12 | ASTM C33 | 2013 | Standard Specification for Concrete Aggregates |
| 13 | ASTM C260 | 2010 | Standard Specification for Air-Entraining Admixtures for Concrete |
| 14 | ASTM C494 | 2013 | Standard Specification for Chemical Admixtures for Concrete |
| 15 | ASTM C618 | 2012 | Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete |
| 16 | ASTM A615 | 2006 | Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| 17 | ASTM A513 | 2000 | Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing |
| 18 | ASTM A519 | 2003 | Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing |
| 19 | ASTM A576 | 1990 | Standard Specification for Steel Bars, Carbon, Hot-Wrought, SpecialQuality |

Added

RAI 129-8085-Question 03.08.01-4

Table 3.8-1 (Sh. 2 of 3)

Revised

| | | | |
|---|---|---|---|
| 20 | ASTM A416 | 2002 | Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete |
| 21 | ASTM C191 | 2013 | Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle |
| 22 | ASTM C109 | 2013 | Standard Test Method for Compressive Strength of Hydraulic Cement Mortars |
| 23 | ASTM A36 | 2012 | Standard Specification for Carbon Structural Steel |

RAI 227-8274-Question 03.08.04-3

Added

Insert "A"

Specifications:

| | | | | |
|---|---|---|---|---|
| 27 | ~~24~~ | AISC 360 | 2005 | Specification for Structural Steel Buildings |
| 28 | ~~25~~ | ACI 301 | 2010 | Specifications for structural concrete for building |
| 29 | ~~26~~ | AWS D1.1 | 2010 | Structural welding code – steel structure |
| 30 | ~~27~~ | AWS D1.3 | 2008 | Structural welding code - sheet steel structure |
| 31 | ~~28~~ | AISI S100 | 2012 | Specification for the design of cold-formed steel structural members |
| 32 | ~~29~~ | ACI 211.1 | 1991(R2007) | Standard practice for selecting proportions for normal, heavy weight, and mass Concrete |
| 33 | ~~30~~ | ACI 214 | 1991(R1997) | Recommended practice for evaluation of strength test results of concrete |
| 34 | ~~31~~ | ACI 304 R | 2000(R2009) | Guide for measuring, mixing, transporting, and placing concrete |
| 35 | ~~32~~ | ACI 305 R | 1999 | Hot weather concreting |
| 36 | ~~33~~ | ACI 306 R | 1998(R2002) | Cold weather concreting |
| 37 | ~~34~~ | ACI 308 | 1992(R1997) | Standard practice for curing concrete |
| 38 | ~~35~~ | ACI 309 R | 2005 | Guide for consolidation of concrete |
| 39 | ~~36~~ | ACI 311.1 R | 1999 | ACI manual of concrete inspection |
| 40 | ~~37~~ | ACI 315 | 1999 | Details and detailing of concrete reinforcement |
| 41 | ~~38~~ | ACI 347 | 2004 | Guide to formwork for concrete |
| 42 | ~~39~~ | ANSI/ANS 8.1 | 1988 | Nuclear criticality safety in operations with fissionable materials outside reactors |
| 43 | ~~40~~ | ANSI/ANS 8.17 | 1984 | Criticality safety criteria for handling, storage, and transportation of LWR fuel outside reactors |
| 44 | ~~41~~ | ANSI/ANS 57.2 | 1983 | Design requirements for light water reactor spent fuel storage facilities at nuclear power plants |

Revised

A

| | | | |
|---|---|---|---|
| 24 | ASME IWE | 2007 with 2008 Addenda. | Requirements for class MC and metallic liners of class CC components of lightwater cooled plants |
| 25 | ASME IWL | 2007 with 2008 Addenda. | Requirements for class CC concrete components of light-water cooled plants |
| 26 | ASME IX | 2007 with 2008 Addenda. | Welding and Brazing Qualifications |

RAI 129-8085-Question 03.08.01-4

RAI 227-8274-Question 03.08.04-3

Table 3.8-1 (Sh. 3 of 3)

Revised

| Document Reference No. | Document Designation | Edition | Document Tit1e |
|---|---|---|---|
| U.S. Regulations | | | |
| ~~42~~ | 10 CFR Part 50 | - | Domestic licensing of production and utilization facitilities |
| ~~43~~ | 10 CFR Part 52 | - | Domestic licensing of production and utilization facilities |
| ~~44~~ | 10 CFR Part 100 | - | Reactor site criteria |

45

46

47

Revised

Abbreviation

ACI American Concrete Institute
AISC American Institute of Steel Construction
AISI American Iron and Steel Institute
ANS American Nuclear Society
ASME American Society of Mechanical Engineers
ASTM American Society of Testing and Materials
AWS American Welding Society

f. Plasticizing admixtures, ASTM C1017, "Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete"

The ingredient materials are stored in accordance with the recommendations in ACI 304R.

Concrete mixes are designed in accordance with ACI 301. The batching, mixing, and transporting of concrete conform with ACI 301. The placement of concrete, consisting of preparation before placing, conveying, depositing, protection, and bonding is in accordance with ACI 301.

3.8.4.6.1.2 Reinforcing Steel

Reinforcing steel consists of deformed reinforcing bars conforming to ASTM A615, Grade 60, or ASTM A706, Grade 60. The fabrication of reinforcing bars, including fabrication tolerances, is in accordance with ~~CRSI, MSP-1.~~ The placing of reinforcing bars, including spacing of bars, concrete protection of reinforcement, splicing of bars and field tolerances is in accordance with ACI 349. Epoxy-coated reinforcing steel may be used for areas where a corrosive environment is encountered.

ACI 315 in ACI Detailing Manual (SP-66).

3.8.4.6.1.3 Structural Steel

Structural steels are used as follows:

Other structural steels listed in AISC N690 may also be used.

a. ASTM A36 (Reference 39), "Standard Specification for Carbon Structural Steel"

b. ASTM A572, "Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural"

c. ASTM A588, "Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4 in. [100 mm] Thick"

d. ASTM A53, "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"

6. Regulatory Guide 1.136, "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments," Rev. 3, U.S. Nuclear Regulatory Commission, March 2007.

7. Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment," Rev. 3, U.S. Nuclear Regulatory Commission, March 2007.

8. SEI/ASCE 37-02, "Design Loads on Structures during Construction Standard," American Society of Civil Engineers, 2002.

9. ANSYS, Advanced Analysis Techniques Guide, Release 14.0, ANSYS Inc., November 2011.

10. ASTM C150, "Standard Specification for Portland Cement," American Society for Testing and Materials, 2012.

11. ASTM C33, "Standard Specification for Concrete Aggregates," American Society for Testing and Materials, 2013.

12. ASTM C260, "Standard Specification for Air-Entraining Admixtures for Concrete," American Society for Testing and Materials, 2010.

13. ASTM C494, "Standard Specification for Chemical Admixtures for Concrete," American Society for Testing and Materials, 2013.

14. ASTM C618, "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete," American Society for Testing and Materials, 2012.

15. ASTM A615, "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement," American Society for Testing and Materials, 2006.

16. ASTM A513, "Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing," American Society for Testing and Materials, 2000.

17. ASTM A519, "Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing," American Society for Testing and Materials, 2003.

18. ASTM A576, "Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality," American Society for Testing and Materials, 1990.

19. ASTM A416, "Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete," American Society for Testing and Materials, 2002.

20. ASME SA240, "Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications," The American Society of Mechanical Engineers, the 2007 Edition with 2008 Addenda.

21. Regulatory Guide 1.57, "Design Limits and Loading Combinations for Metal Primary Reactor Containment System Components," Rev. 2, U.S. Nuclear Regulatory Commission, May 2013.

22. Regulatory Guide 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, July 2014.

23. Regulatory Guide 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," Rev. 1, U.S. Nuclear Regulatory Commission, March 2007.

24. Regulatory Guide 1.92, "Combining Modal Responses and Spatial Components in Seismic Response Analysis," Rev. 3, U.S. Nuclear Regulatory Commission, October 2012.

25. Regulatory Guide 1.122, "Development of Floor Design Response Spectra for Seismic Design of Floor-Supported Equipment or Components," Rev. 1, U.S. Nuclear Regulatory Commission, February 1978.

26. Regulatory Guide 1.142, "Safety-Related Concrete Structures for Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, November 2001.

27. Regulatory Guide 1.199, "Anchoring Components and Structural Supports in Concrete," U.S. Nuclear Regulatory Commission, November 2003.

28. Regulatory Guide 1.29, "Seismic Design Classification," Rev. 4, U.S. Nuclear Regulatory Commission, March 2007.

29. Regulatory Guide 1.69, "Concrete Radiation Shields and Generic Shield Testing for Nuclear Power Plants," Rev. 1, U.S. Nuclear Regulatory Commission, May 2009.

30. Regulatory Guide 1.91, "Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, April 2013.

31. Regulatory Guide 1.115, "Protection Against Low-Trajectory Turbine Missiles," Rev. 2, U.S. Nuclear Regulatory Commission, January 2012.

32. Regulatory Guide 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," Rev. 2, U.S. Nuclear Regulatory Commission, November 2001.

33. ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures," American Society of Civil Engineering/Structural Engineering Institute, 2006.

34. GTSTRUDL User Guide, GTSTRUDL Version 31, Georgia Institute of Technology, August 2010.

35. Research Council on Structural Connections, "Specification for Structural Joints Using ASTM A325 or A490 Bolts," 2004.

36. AWS D1.1, "Structural Welding Code," American Welding Society, 2010.

37. ASTM C191, "Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle," American Society for Testing and Materials, 2013.

38. ASTM C109, "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars," American Society for Testing and Materials, 2013.

39. ASTM A36, "Standard Specification for Carbon Structural Steel," American Society for Testing and Materials, 2013.

40. APR1400-E-S-NR-14006-P, "Stability Check for NI Common Basemat" Rev. 0, KHNP, November 2014.

46. ACI SP-66, "ACI Detailing Manual", American Concrete Institute, 2004.

3.8.3.6 Materials, Quality Control, and Special Construction Techniques

3.8.3.6.1 Concrete Internal Structures

Materials, quality control, and special construction techniques for the concrete internal structures are outlined in Subsection 3.8.4.6. The compressive strength of concrete is 6,000 psi at 91 days.

3.8.3.6.2 Structural Steel

The following materials are used:

a. Structural steel – ASTM A36, A572, A588, and A53

b. Bolts – ASTM A325, A490, and A307

c. Anchor bolts – ASTM 193 Grade B-7 and A36

Furnishing and fabrication of structural steel conform with all applicable requirements of AISC N690. Certified mill test reports for structural steel are submitted for review.

3.8.3.6.3 Stainless Steel Pool Liners

Stainless steel pool liners are fabricated from ASTM A240 Type 304 material, hot rolled, annealed and pickled and further processed by cold rolling.

III

Welding procedures are in accordance with ASME Section, Division 2, Subarticle CC-4540 and ASME Section IX. All seam welds are full-penetration butt welds. The liner plate seam welds are examined and tested as follows:

a. Liquid penetrant examination is performed on austenitic materials. The weld surfaces and at least 12.7 mm (1/2 in) of the adjacent base material on each side of the weld are examined. The examination coverage is 100 percent of all shop and field seam welds.