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DCP/NRC1226
NSD-NRC-98-5537
Docket No.: 52-003

January 22, 1998

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: T. R. QUAY

SUBJECT: AP600 RESPONSE TO FSER OPEN ITEMS

Dear Mr. Quay:

Enclosure 1 of this letter provides the Westinghouse responses to FSER open items on the AP600. A summary of the enclosed responses is provided in Table 1. Included in the table is the FSER open item number, the associated OITS number, and the status to be designated in the Westinghouse status column of OITS.

The NRC should review the enclosures and inform Westinghouse of the status to be designated in the "NRC Status" column of OITS.

Please contact me on (412) 374-4334 if you have any questions concerning this transmittal.

Eugene J. Piplica for

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

jml

Enclosure

cc: W. C. Huffman, NRC (Enclosure)
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N. J. Liparulo, Westinghouse (w/o Enclosure)

Table 1
List of FSER Open Items Included in Letter DCP/NRC1226

FSER Open Item	OITS Number	Westinghouse status in OITS
220.129F (R1)	6434	Confirm W
230.145F	6504	Confirm W
250.35F	6521	Action N
250.37F	6523	Action N
410.326F	6101	Confirm W

Enclosure to Westinghouse
Letter DCP/NRC1226

January 22, 1998

Open Item 220.129F (OITS #6434) Response Revision 1

Westinghouse should demonstrate the adequacy of using a 6-foot thick foundation mat, especially the foundation mat underneath the containment vessel. In its position letter dated November 4, 1994, the staff offered two options for Westinghouse to consider in resolving this issue: (1) demonstrating that the final foundation mat design can accommodate the effects of soil stiffness variations of hard and soft spots underneath the foundation mat, and (2) using different foundation mat thicknesses for a foundation mat with uniform soil foundation stiffness (such as rock sites) and for a foundation mat with non-uniform soil foundation stiffness (such as soil sites with hard and soft spots) and submitting the completed design of each foundation mat thickness for the staff review and approval.

During the meeting conducted on August 4 through 15, 1997, the staff reviewed the final design of the 6-foot thick foundation mat. As a result, based on the commitment made by Westinghouse in SAR Section 3.8.4 (Revision 15) that (1) the design and analysis procedures for SC-I structures are in accordance with ACI-349 Code for reinforced concrete structures, and (2) the ductility criteria of ACI 318 Code, Chapters 12 and 21, are considered in detailing, placing, anchoring and splicing of the reinforcing steel, three design concerns were identified by the staff:

1. According to Chapter 21 (Section 21.3.3.4) of ACI 318-95 Code, stirrups used as shear reinforcement have to be provided with a 135 degree hook at both the top and bottom faces of the foundation mat. However, only stirrups, with 90 degree hook at the bottom face and 135 degree hook at the top face of the mat, were provided by Westinghouse for resisting shear force. The flexural steel is spaced at 6 inch on centers top and bottom. Therefore, the provision of 135 degree hooks is not practical. The 6 ft thick foundation mat does not appear to be constructible with such heavy reinforcements.

2. According to the ratio of span to depth, the NI foundation mat should be classified as deep flexural members and be designed for the requirements for deep flexural members (Section 11.8.1 of ACI 349-90). However, based on some test results, the ACI 318 Code Committee determined that errors were identified in the 1983 code (same errors were in the ACI 349 code, because the 349 code is based on the 318 code) and these errors could result in an unconservative design for deep flexural members. As a result, ACI 318-95 was revised to correct these errors. For the case of AP600 foundation mat with exterior and interior stiffening walls, the foundation mat should be classified as a continuous deep flexural members (Sections 11.8.1 and 11.8.3 of ACI 318-95). ACI-318-95 Code (Section 11.8.5) requires that the critical section for shear is to be located at 0.15 times the span length from the support edge with reinforcing steel over the full span and the design should be based on Section 11.8.3. However, Westinghouse did not treat the foundation mat as a deep flexural member. The shear reinforcement used in the design was based on a much reduced shear force at a section which is further away from the edge at a distance of the effective depth of the mat. The correct amount of shear reinforcement would require the use of larger reinforcing bars which would be spaced at a distance not more than "d/2" throughout the length of the member.

3. The foundation mat calculation was performed using soil stiffness variation in alternate spans. While this design approach will maximize bending moments in the mid span, it will not indicate increases in shear force due to soil variation. If the soil variation is such that the soil stiffness is constant over two adjacent spans, and spans on either side are with lower or higher stiffness, the

maximum shear force will occur at the wall between the two spans with the greatest stiffness. This geometry was not considered in the Westinghouse design.

On the basis of the discussion above, the staff concluded that Westinghouse failed to demonstrate that the proposed foundation mat design is adequate with respect to the previously issued staff position. The final design of the foundation mat did not meet certain code requirements committed to in the SAR.

For the concern of seismic hooks used for the shear reinforcement (Item 1 above), Westinghouse proposed the use of headed anchors (instead of 135 degree bends) at both ends of the shear reinforcement (stirrups) during the meeting on August 4 through 8, 1997. Westinghouse also provided, in the meeting, test results published by the manufacturer for the staff review. As a result, the staff found that the shear reinforcement with headed anchors is equivalent to the use of 135 degree bends at both ends of the shear reinforcement and concluded that this issue is technically resolved. However, Westinghouse should document this commitment in a future revision of the SAR.

With regard to the concerns of the use of design code and soil stiffness variation (Items 2 and 3 above), Westinghouse's response and the staff's evaluation are summarized below:

1. In the submittal dated November 24, 1997, Westinghouse provided a draft of SAR Section 3.8.5.5 to commit that the foundation mat below the auxiliary building is designed for shear in accordance with the requirements for continuous deep flexural members in ACI 318-95 (Section 11.8.3). Specifically, Westinghouse committed:

   (1) The design for shear is based on Sections 11.1 through 11.5 of ACI 349-90 except that the critical section measured from the face of the support is taken at a distance of $0.15l_n$.

   (2) Shear strength, V_n, is not taken greater than $8(f_c')^{1/2}b_w d$ when l_n/d is less than 2. When l_n/d is between 2 and 5,

   $$V_n=2/3(10+l_n/d)(f_c')^{1/2}b_w d$$

   (3) Area of vertical shear reinforcement, A_v, is not less than $0.0015b_w s$ and the spacing of shear reinforcement, s, does not exceed d/2 nor 24 inches.

   (4) Shear reinforcement required at the critical section is used throughout the span.

   Westinghouse's commitments in the draft SAR meet the requirement of ACI 318-95 and, therefore, are acceptable.

3. In Revision 17 of SAR Section 3.8.5.4.4, Westinghouse stated that the design moments and shears are increased by 20 percent above the required for uniform sites to accommodate the nonuniform sites defined in SAR Section 2.5.4.5. According to the common engineering practice and the staff's review experience, to increase the design moments and shears by 20 percent will accommodate the effects due to nonuniform sites. This issue is considered

resolved.

On the bases discussed above, the staff concluded that the concern regarding the design of shear reinforcement for the foundation mat is technically resolved. However, Open Item 3.8.5-9 will not be closed until Westinghouse formally revises the SAR to document its commitments concerning the use of headed anchors for shear reinforcement and the commitments contained in the submittal dated November 24, 1997.

Response: Revision 1

The use of shear reinforcement with headed anchors is documented in the SSAR revision shown below. The change in design criteria for the design of the basemat as a deep slab was included in SSAR subsection 3.8.5.5 in Revision 18.

SSAR Revision:

Revise second paragraph of subsection 3.8.4.6.1.2 as follows:

In areas where reinforcing steel splices are necessary and lap splices are not practical, mechanical connections (e.g. threaded splices, swaged sleeves or cadwelds) are used.

Headed reinforcement meeting the requirements of ASTM A970 (Reference 49) is used where mechanical anchorage is required, such as for shear reinforcement in the nuclear island basemat and in the exterior walls below grade.

Revise 3.8.5.4.4 as shown below. This also includes revisions discussed during the meetings on January 20 and 21, 1998.

3.8.5.4.4 Design Summary Report

A design summary report is prepared for the basemat documenting that the structures meet the acceptance criteria specified in subsection 3.8.5.5.

Deviations from the design due to as-procured or as-built conditions are acceptable based on an evaluation consistent with the methods and procedures of Section 3.7 and 3.8 provided the following acceptance criteria are met.

- the structural design meets the acceptance criteria specified in Section 3.8
- the seismic floor response spectra meet the acceptance criteria specified in subsection 3.7.5.4

Depending on the extent of the deviations, the evaluation may range from documentation of an engineering judgement to performance of a revised analysis and design. The results of the evaluation will be documented in an as-built summary report by the Combined License applicant.

3.8.5.4.45 Design Summary of Critical Sections

The basemat design meets the acceptance criteria specified in subsection 3.8.4.5. Two critical portions of the basemat are identified below together with a summary of their design. The boundaries are defined by the walls and column lines which are shown in Figure 3.7.2-12 (sheet 1 of 12). Table 3.8.5-3 shows the reinforcement required and the reinforcement provided for the critical sections.

Basemat between the shield building and exterior wall (line 11) and column lines K and L.

This portion of the basemat is designed as a one way slab spanning a distance of 23′ 6″ between the walls on column lines K and L. The slab is continuous with the adjacent slabs to the east and west. The critical loading is the bearing pressure on the underside of the slab due to dead and seismic loads. This establishes the demand for the top flexural reinforcement at mid span and for the bottom flexural and shear reinforcement at the walls. The basemat is designed for the bearing pressures and membrane forces from the analyses on uniform soil springs described in subsection 3.8.5.4.1. The design moments and shears are increased by 20 percent to accommodate the nonuniform sites defined in subsection 2.5.4.5. Negative moments are redistributed as permitted by ACI 349.

The top and bottom reinforcement in the east west direction of span are equal. The reinforcement provided is shown in sheets 1, 2 and 5 of Figure 3.8.5-3. Typical reinforcement details showing use of headed reinforcement for shear reinforcement are shown in Figure 3H.5-3.

Basemat between column lines 1 and 2 and column lines K-2 and N

This portion of the basemat is designed as a one way slab spanning a distance of 22′ 0″ between the walls on column lines 1 and 2. The slab is continuous with the adjacent slabs to the north and with the exterior wall to the south. The critical loading is the bearing pressure on the underside of the slab due to dead and seismic loads. This establishes the demand for the top flexural reinforcement at mid span and for the bottom flexural and shear reinforcement at wall 2. The basemat is designed for the bearing pressures and membrane forces from the analyses on uniform soil springs described in subsection 3.8.5.4.1. The design moments and shears are increased by 20 percent to accommodate the nonuniform sites defined in subsection 2.5.4.5. The reinforcement provided is shown in sheets 1, 2 and 5 of Figure 3.8.5-3. Typical reinforcement details showing use of headed reinforcement for shear reinforcement are shown in Figure 3H.5-3.

Deviations from the design due to as-procured or as-built conditions are acceptable based on an evaluation consistent with the methods and procedures of Section 3.7 and 3.8 provided the following acceptance criteria are met.

- The structural design meets the acceptance criteria specified in Section 3.8
- The amplitude of the seismic floor response spectra do not exceed the design basis floor response spectra by more than 10 percent

Depending on the extent of the deviations, the evaluation may range from documentation of an engineering judgement to performance of a revised analysis and design.

Add reference 49

49. ASTM A 970, "Specification for Welded Headed Bars for Concrete Reinforcement."

Revise Figure 3.8.5-3 (sheets 4 and 5 of 5) to show additional shear reinforcement.

Add Figure 3H.5-3 - also included in response to FSER Open Item 220.128F.

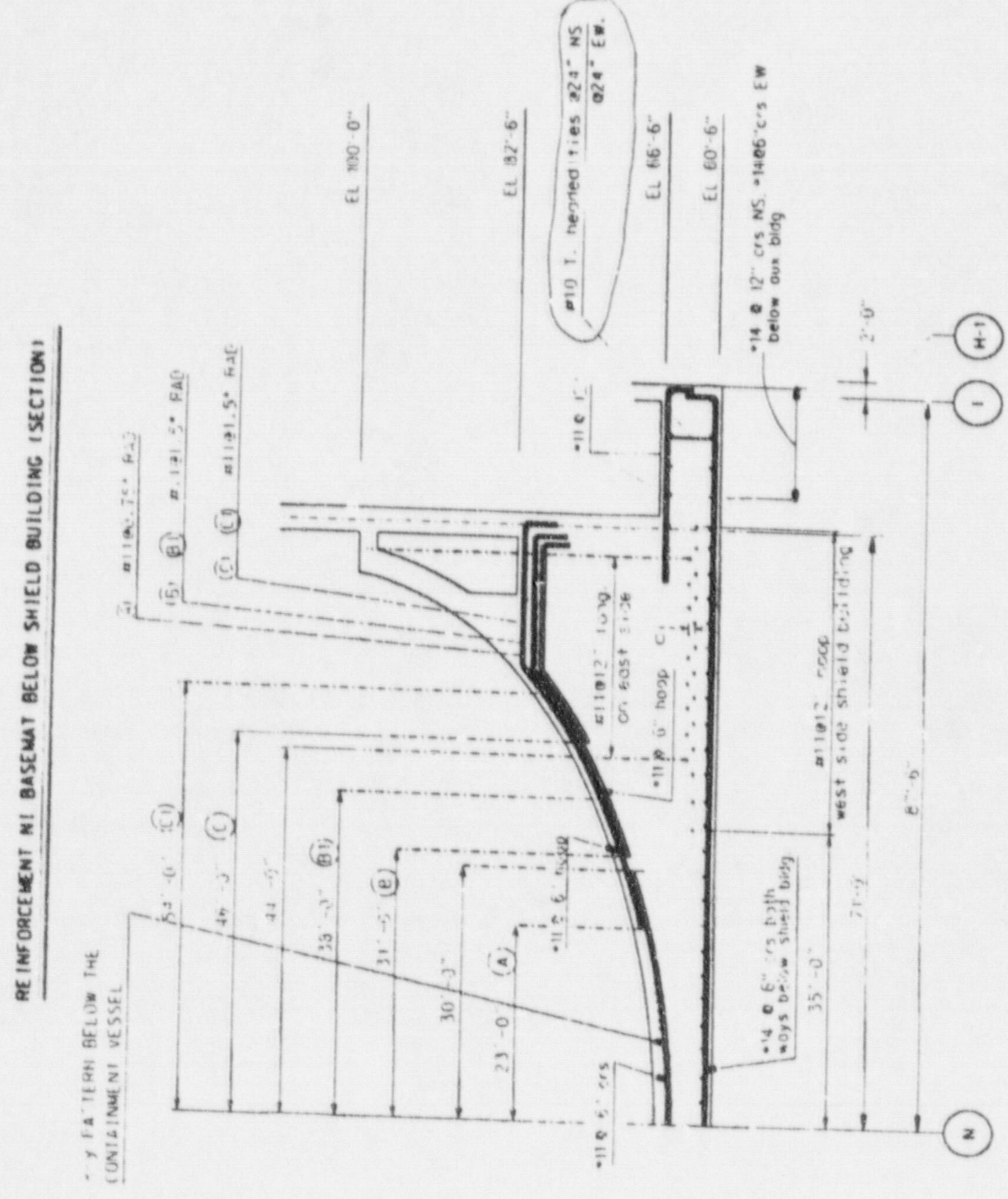

Figure 3.8.5-3 (Sheet 4 of 5)

Basemat Reinforcement - Cross Section

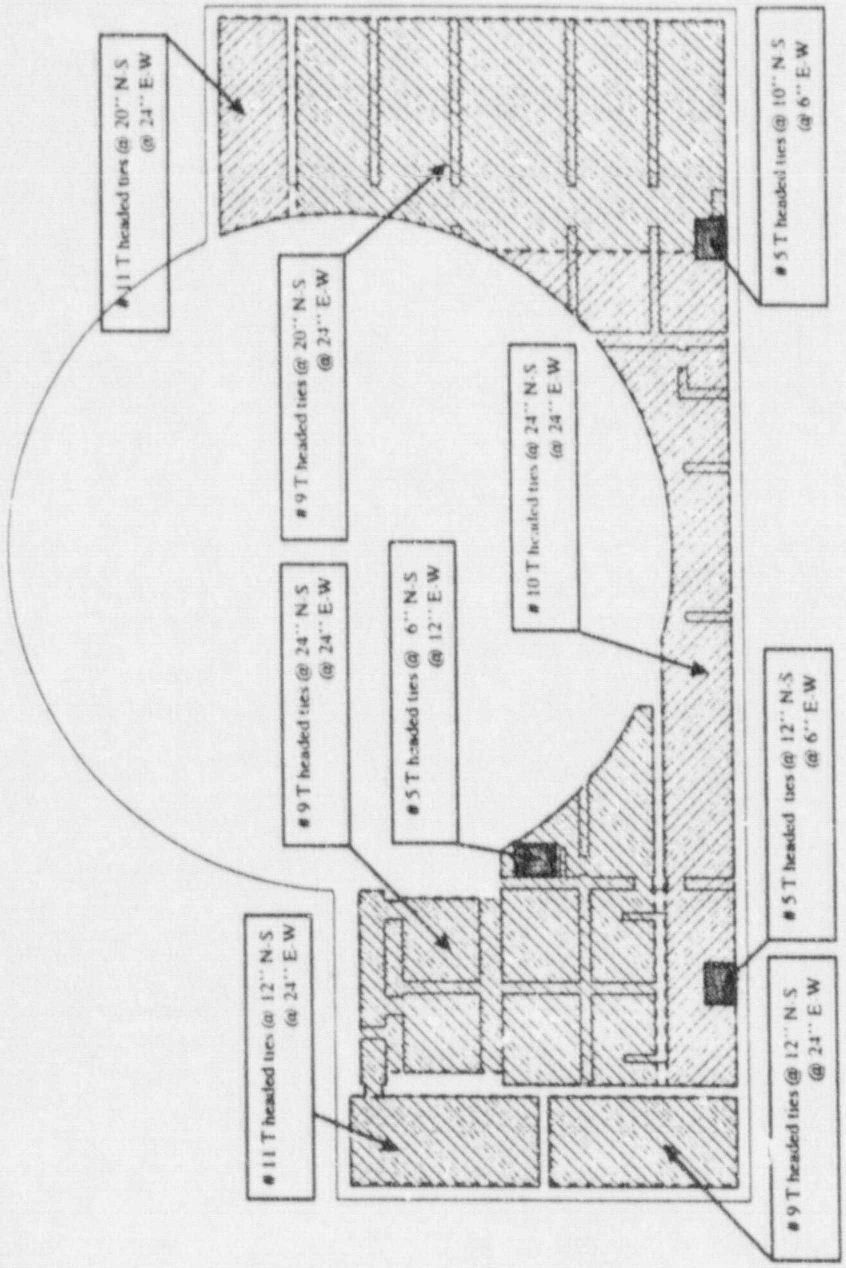

Figure 3.8.5-3 (Sheet 5 of 5)

Basemat Shear Reinforcement

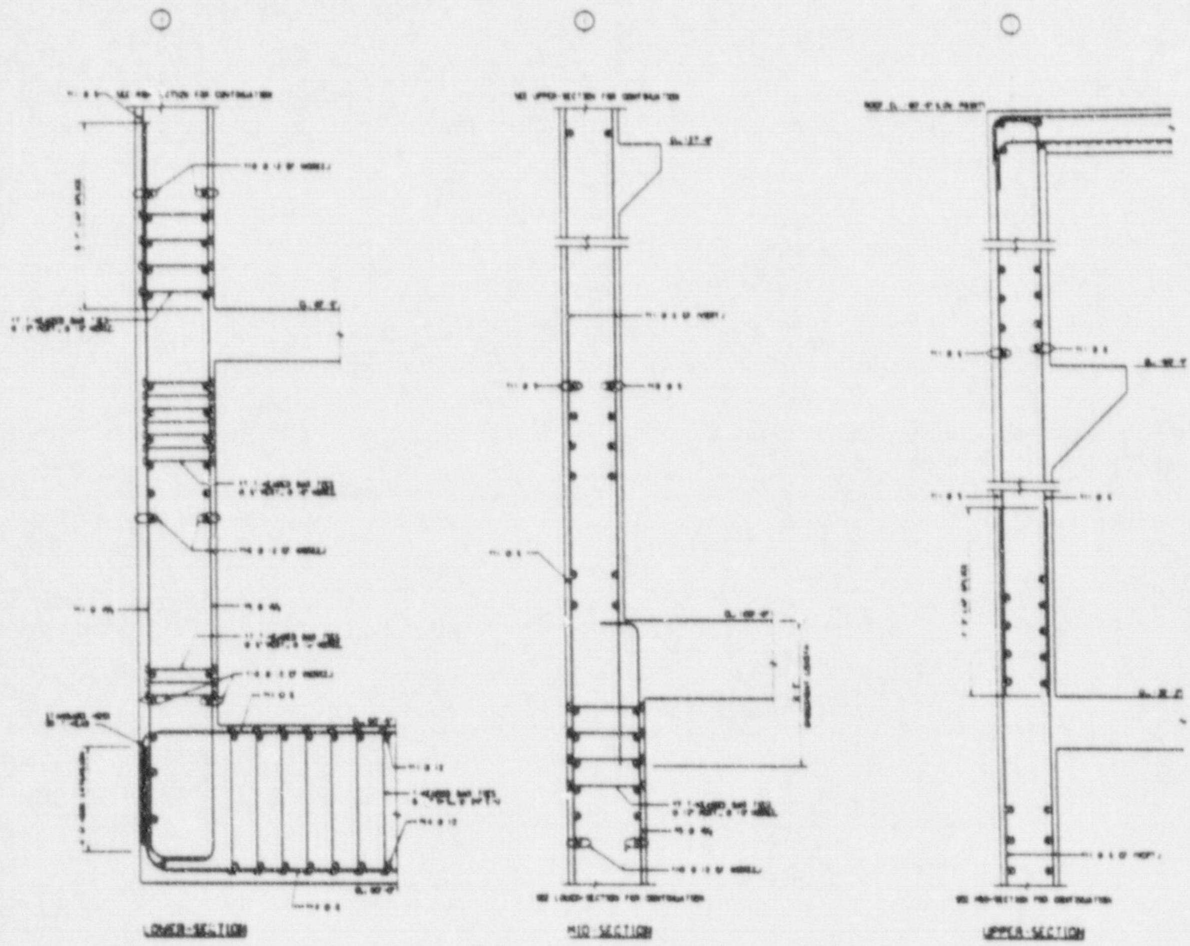

Figure 3H.5-3

Typical Reinforcement and Column Line 1

230.145F (OITS #6504)

The design changes made to the CVS as provided in Westinghouse letter NSD-NRC-97-5452 dated November 21, 1997, are acceptable to the staff. However, the request for exemption to the definition of reactor coolant pressure boundary is too broad and, therefore, not acceptable. The CVS piping within containment is part of the reactor coolant pressure boundary and will not be considered otherwise. An exemption to 10 CFR 50.55a(c) may not be necessary if Westinghouse justifies its proposed alternative classification of the CVS reactor coolant pressure boundary piping under 10 CFR 50.55a(a)(3). Westinghouse should discuss how its classification of the CVS would provide an acceptable level of quality and safety considering the quality, inspection, and integrity criteria for reactor coolant pressure boundary cited in GDCs 14, 30, and 32 . Westinghouse should also discuss the conformance and exceptions of its classification with regulatory guide 1.26. In addition, Westinghouse should address how the AP600 will be shut down and cooled down in an orderly manner assuming makeup is provided by the reactor coolant makeup system only, as discussed in 10 CFR 50.55a(c)(2)(ii). The staff notes that the AP600 would not be able to rely on makeup from the CVS for shut down in an orderly manner since the CVS piping is non-safety related and non-seismic and may not be available due to isolation or breakage. Westinghouse should include this discussion in the SSAR.

Response:

Westinghouse is withdrawing the request for an exemption to the definition of reactor coolant pressure boundary. The use of nonsafety-related piping and components for a portion of the chemical and volume control system inside containment that is defined as reactor coolant pressure boundary will be justified using the alternate classification requirements of 10CFR50.55a(a)(3). The portion of the chemical volume and control system that is nonsafety-related is located between the inside containment isolation valves and the valves that provide isolation from the reactor coolant system.

10 CFR 50.55a(3) states the following:

> Proposed alternatives to the requirements of paragraphs (c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director of the Office of Nuclear Reactor Regulation. The applicant shall demonstrate that:
>
> (i) The proposed alternatives would provide an acceptable level of quality and safety, or
>
> (ii) Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The AP600 chemical and volume control system (CVS) is a reliable system, using high quality industry standards. ANSI B31.1 and ASME Code, Section VIII are used for the construction of the piping, valves, and components. The nonsafety-related portion of the CVS inside containment will be analyzed seismically. The methods and criteria used for the seismic analysis are defined in the response to FSER Open Item 230.146. The chemical and volume control system components are located inside the containment which is a seismic Category I structure.

The chemical and volume control system can be isolated from the reactor coolant system in the event of a break or other adverse condition. The isolation valves between the reactor coolant system and chemical and volume control system are designed and qualified for design conditions that include closing against blowdown flow with full system differential pressure. These valves are qualified for adverse seismic and environmental conditions. The valves are subject to inservice testing including operability testing. The operability testing is a diagnostic test against operating flow and differential pressure.

The chemical and volume control system inside containment is has a design pressure of 3100 psig and would not be expected to fail at reactor system operating pressure. This pressure exceeds the reactor coolant system design pressure. Therefore, the chemical and volume control system purification loop is not subject to an intersystem LOCA due to overpressure.

Chemical and volume control system leakage inside containment is detectable by the reactor coolant leak detection function as potential reactor coolant pressure boundary leakage. This leakage must be identified before the reactor coolant leak limit is reached. The nonsafety-related classification of the system does not impact the need to identify the source of a leak inside containment.

10CFR50.55a(c) requires the following:

> Reactor coolant pressure boundary. (1) Components which are part of the reactor coolant pressure boundary must meet the requirements for Class 1 components in Section III of the ASME Boiler and Pressure Vessel Code, except as provided in paragraphs (c)(2), (c)(3), and (c)(4) of this section.
>
> (2) Components which are connected to the reactor coolant system and are part of the reactor coolant pressure boundary as defined in Sec. 50.2 need not meet the requirements of paragraph (c)(1) of this section, Provided:
> (i) In the event of postulated failure of the component during normal reactor operation, the reactor can be shut down and cooled down in an orderly manner, assuming makeup is provided by the reactor coolant makeup system; or
> (ii) The component is or can be isolated from the reactor coolant system by two valves in series (both closed, both open, or one closed and the other open). Each open valve must be capable of automatic actuation and, assuming the other valve is open, its closure time must be such that, in the event of postulated failure of the component during normal reactor operation, each valve remains operable and the reactor can be shut down and cooled down in an orderly manner, assuming makeup is provided by the reactor coolant makeup system only.

The purification loop of the CVS can be isolated by three safety-related valves in series in both the letdown and return lines. The valves with motor and air operators receive a signal to close in the event of low level in the pressurizer. Check valves are self actuated. These valves are included in the inservice testing requirements. The valves are designed and qualified design for conditions that include closing against full differential pressure.

The AP600 chemical and volume control system does not have a safety related function to provide reactor coolant makeup. Safety-related core makeup tanks are capable of providing sufficient reactor coolant makeup for shutdown and cooldown without makeup supplied by the CVS. The safety-related means for safe shutdown of the reactor uses safety-related systems and components including the passive core cooling system heat exchanger. See Section 7.4 for a discussion of safe shutdown of the reactor. If available, other nonsafety-related systems are also used for safe shutdown and cooldown of the reactor without requiring use of CVS makeup.

SSAR Revision:

In Appendix 1A add a discussion for criterion C.1 as follows:

Criteria Section	Referenced Criteria	AP600 Position	Clarification/Summary Description of Exceptions
Reg. Guide 1.26, Rev. 3, 2/76 - Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containment Components of Nuclear Power Plants			
C.1		Exception	A portion of the chemical and volume control system that is defined as reactor coolant pressure boundary uses an alternate classification in conformance with the requirements of 10 CFR 50.55a(a)(3). The alternate classification is discussed in Section 5.2.

In subsection 3.1.1. revise the fourth paragraph of the **AP600 Compliance** for Criterion 1 as follows:

> Design, procurement, fabrication, inspection, and testing are performed according to recognized codes, standards, and design criteria that comply with the requirements of 10 CFR 50.55a. As necessary, supplemental standards, design criteria, and requirements are developed by the AP600 designers. A portion of the chemical and volume control system that is defined as reactor coolant pressure boundary uses an alternate classification in conformance with the requirements of 10 CFR 50.55a(a)(3). The alternate classification is discussed in subsection 5.2.1.3.

In subsection 3.1.2 add the following to the **AP600 Compliance** for Criterion 14 as follows:

> A portion of the chemical and volume control system that is defined as reactor coolant pressure boundary is nonsafety related. This portion of the system is capable of being automatically isolated by safety-related valves that are designed and qualified for the design requirements.

In subsection 3.1.4 revise the first paragraph under **AP600 Compliance** for Criterion 30 as follows.

> Reactor coolant pressure boundary components are designed, fabricated, inspected, and tested in conformance with the ASME Code, Section III. A portion of the chemical and volume control system that is defined as reactor coolant pressure boundary uses an alternate classification in conformance with the requirements of 10 CFR 50.55a(a)(3). The alternate classification is discussed in Section 5.2.

In subsection 3.1.4 revise the first paragraph under **AP600 Compliance** for Criterion 31 as follows:

> Control is maintained over material selection and fabrication for the reactor coolant pressure boundary components so that the boundary behaves in a nonbrittle manner. The

portion of the chemical and volume control system that uses an alternate classification is not required to meet the requirements to prevent brittle failure. The reactor coolant pressure boundary materials exposed to the coolant are corrosion-resistant stainless steel or nickel-chromium-iron alloy. The nil-ductility transition reference temperature of the reactor vessel structural steel is established by Charpy V-notch and drop weight tests in accordance with 10 CFR 50, Appendix G (Reference 1). See Section 5.3 for additional information.

In subsection 3.1.4 revise the first paragraph under **AP600 Compliance** for Criterion 32 as follows:

The design of the reactor coolant pressure boundary provides accessibility to the internal surfaces of the reactor vessel and most external zones of the vessel, including the nozzle-to-reactor coolant piping welds, the top and bottom heads, and external surfaces of the reactor coolant piping, except for the area of pipe within the primary shield concrete. The inspection capability complements the leakage detection systems in assessing the integrity of the pressure boundary components. The reactor coolant pressure boundary will be periodically inspected under the provisions of the ASME Code, Section XI. Section 5.1 provides the reactor coolant system primary loop drawings. The portion of the chemical and volume control system that uses an alternate classification is constructed to requirements that do not require inservice inspection.

In subsection 3.2.2.6 add the following after the fourth paragraph.

A portion of chemical and volume control system is defined as the reactor coolant pressure boundary and is Class D. This portion of the chemical and volume control system is seismically analyzed. See subsection 5.2.1.1 for the seismic analysis requirements.

Revise the third paragraph of Section 5.2 as follows:

The term reactor coolant system, as used in this section, is defined in Section 5.1. The AP600 reactor coolant pressure boundary is consistent with that of 10 CFR 50.2. ~~except that the boundary ends at the third isolation valve between the reactor coolant system and the chemical and volume control system. Section 5.2.1.3 provides the justification for a limited exemption to the definition of the reactor coolant pressure boundary.~~

Revise the first paragraph of subsection 5.2.1.1 as follows:

Reactor coolant pressure boundary components are designed and fabricated in accordance with the ASME Boiler and Pressure Vessel Code, Section III. A portion of the chemical and volume control system inside containment that is defined as reactor coolant pressure boundary uses an alternate classification in conformance with the requirements of 10 CFR 50.55a(a)(3). Systems other than the reactor coolant system connecting to the chemical and volume control system have required isolation and are not classified as reactor coolant pressure boundary. The alternate classification is discussed in Section 5.2.1.3. The quality group classification for the reactor coolant pressure boundary components is identified in subsection 3.2.2. The quality group classification is used to determine the appropriate sections of the ASME Code or other standards to be applied to the components.

5.2.1.3 Alternate Classification ~~Exemption to 10 CFR 50.2~~

The Code of Federal Regulations, Section 10 CFR 50.55a requires the reactor coolant pressure boundary be class A (ASME Boiler and Pressure Vessel Code Section III, Class 1). Components which are connected to the reactor coolant pressure boundary that can be isolated from the reactor coolant system by two valves in series (both closed, both open, or one closed and the other open) with automatic actuation to close can be classified as class C (ASME Section III, class 3) according to 50.55a.

A portion of the chemical and volume control system inside containment is not classified as safety related. The classification of the AP600 ~~definition of~~ reactor coolant pressure boundary deviates from the requirement that the reactor coolant pressure boundary be classified as safety related and be constructed using the ASME Code, Section III as ~~definition~~ provided in 10 CFR 50.55a. ~~2 for the reactor coolant pressure boundary~~ in that ~~the reactor coolant pressure boundary connections to the chemical and volume control system purification loop ends inside containment.~~ The safety-related classification of the AP600 reactor coolant pressure boundary ends at the third isolation valve between the reactor coolant system and the chemical and volume control system. The nonsafety-related portion of the chemical and volume control system inside containment provides purification of the reactor coolant and includes heat exchangers, dimineralizers, filters and connecting piping. For a description of the chemical and volume control system refer to subsection 9.3.6. The portion of the chemical and volume control system between the inside and outside containment isolation valves is classified as Class B and is constructed using the ASME Code, Section III. ~~The justification for this exemption is based on the difference between the AP600 and plants in use and under consideration at the time the definition for reactor coolant pressure boundary was written.~~

The nonsafety-related portion of the chemical and volume control system is designed using ANSI B31.1 and ASME Code, Section VIII for the construction of the piping, valves, and components. The nonsafety-related portion of the CVS inside containment is analyzed seismically. The methods and criteria used for the seismic analysis are similar to those used of seismic Category II pipe and are defined in the subsection 5.2.1.1. The chemical and volume control system components are located inside the containment which is a seismic Category I structure.

The alternate classification of the ~~limited exemption from the definition of reactor coolant pressure boundary and the design of the AP600 with a~~ nonsafety-related purification subsystem satisfies the purpose of ~~10 CFR 50.2 and~~ 10 CFR 50.55a ~~and the definition of reactor coolant pressure boundary~~ that structures, systems, and components of nuclear power plants which are important to safety be designed, fabricated, erected, and tested to quality standards that reflect the importance of the safety functions to be performed.

The AP600 chemical and volume control system is not required to perform safety-related functions such as emergency boration or reactor coolant makeup. Safety-related core makeup tanks are capable of providing sufficient reactor coolant makeup for shutdown and cooldown without makeup supplied by the chemical and volume control system. Safe shutdown of the reactor does not require use of the chemical and volume control system makeup. AP600 safe shutdown is discussed in Section 7.4. ~~The use of a nonsafety-related chemical and volume control system does not result in a reduction of safety and will result in reduction of occupational radiation exposure and less generation of radioactive waste.~~

The isolation valves between the reactor coolant system and the chemical and volume control system are active safety-related valves that are designed, qualified, inspected and tested for the isolation requirements. The isolation valves between the reactor coolant system and chemical and volume control system are designed and qualified for design conditions that include closing against blowdown flow with full system differential pressure. These valves are qualified for adverse seismic and environmental conditions. The valves are subject to inservice testing including operability testing.

The potential for release of activity from a break or leak in the chemical and volume control system is minimized by the location of the purification subsystem inside containment and the design and test of the isolation valves. Chemical and volume control system leakage inside containment is detectable by the reactor coolant leak detection function as potential reactor coolant pressure boundary leakage. This leakage must be identified before the reactor coolant leak limit is reached. The nonsafety-related classification of the system does not impact the need to identify the source of a leak inside containment.

Revise the first paragraph of subsection 5.2.3.1 as follows.

Table 5.2-1 lists material specifications used for the principal pressure-retaining applications in Class 1 primary components and reactor coolant system piping. Material specifications with grades, classes or types are included for the reactor vessel components, steam generator components, reactor coolant pump, pressurizer, core makeup tank, and the passive residual heat removal heat exchanger. Table 5.2-1 lists the application of nickel-chromium-iron alloys in the reactor coolant pressure boundary. The use of nickel-chromium-iron alloy in the reactor coolant pressure boundary is limited to Alloy 690. Alloy 600 may be used for cladding or buttering. Steam generator tubes use Alloy 690 in the thermally treated form. Nickel-chromium-iron alloys are used where corrosion resistance of the alloy is an important consideration and where the use of nickel-chromium-iron alloy is the choice because of the coefficient of thermal expansion. Subsection 5.4.3 defines reactor coolant piping. See subsection 4.5.2 for material specifications used for the core support structures and reactor internals. See appropriate sections for internals of other components. Engineered safeguards features materials are included in subsection 6.1.1. The nonsafety-related portion of the chemical and volume control system inside containment is constructed of corrosion resistant material that is compatible with the reactor coolant pressure boundary. The nonsafety-related portion of the chemical and volume control system is not required to conform the process to requirements outlined below.

Revise subsection 9.3.6.1.1 as follows:

9.3.6.1.1 Safety Design Basis

The safety functions provided by the chemical and volume control system are limited to containment isolation of chemical and volume control system lines penetrating containment, termination of inadvertent reactor coolant system boron dilution, isolation of makeup on a steam generator or pressurizer high level signal, and preservation of the reactor coolant system pressure boundary, including isolation of normal chemical and volume control system letdown from the reactor coolant system. As outlined in Section 5.2, a portion of the chemical and volume control system inside containment that is defined as reactor coolant pressure boundary is nonsafety-related and uses an alternate classification.

Revise subsection 9.3.6.3 as follows:

9.3.6.3 Component Descriptions

The general descriptions and summaries of the chemical and volume control system components are provided below. The key equipment parameters for the chemical and volume control system components are contained in Table 9.3.6-2. Information regarding component classifications is available in Section 3.2. The purification subsystem inside containment is defined as reactor coolant pressure boundary. This subsystem is nonsafety-related and is constructed using standards outlined in subsection 3.2.2.6 to the ASME Code, Section III. See Section 5.2 for additional information on analysis requirements.

250.35F (OITS #6521)

FSER open item 230.147F, related to the CVS classification issue, requested that Westinghouse perform ASME Section XI leak testing on the isolation valves between the RCS and the CVS piping. Although these valves do not strictly meet the definition of PIVs (two normally closed valves between high pressure and low pressure systems), the staff believes that the function of these valves is equivalent to PIVs for isolating the RCS from the non-ASME code class CVS piping. The potential for full RCS differential pressure across the valves from a failure of the downstream CVS piping dictates that leak tightness be assured so that failure of the CVS piping will not result in a LOCA for the AP600. Westinghouse should include valves CVS-PL- V001, V002, V003, V080, V081, V082, V084, and V085 as PIVs under proposed SSAR Table 3.9-18 and subject them to the RCS PIV Integrity technical specification, TS 3.4.16 Limiting Conditions of Operation. In addition, these valves should be included in IST Table 3.9-16 as Category A valves requiring a leak test.

Response:

The reasons for leak testing of these valves are different from the reasons for leak testing the pressure isolation valves (PIVs)included in the tech specs. The leak test requirement for the CVS valves should not be included with the tech spec requirements for PIVs. As discussed with the NRC staff, the requirement for leak testing of the valves at the interface between the CVS and RCS will be included in the inservice test plan included in SSAR subsection 3.9.6 and Table 3.9-16.

The discussion on the requirements for testing of the CVS valves and the associated SSAR changes are included in the response to FSER Open Item 230.147.

SSAR Revision: NONE

250.37F (OITS #6523)

The BASES background discussion of TS 3.4.16 should be revised to explain that the normally open RCS to CVS interface valves will be treated as PIVs for the AP600 design because of the potential of these valves to perform a PIV functions if the CVS piping were to experience a failure. Westinghouse should develop appropriate wording for a PIV inclusion criterion explaining that the NRC rationale for designating the RCS to CVS interface valves as PIVs is based on the capability of these valves to establish and maintain the leak tight integrity of ASME Section III reactor coolant pressure boundary piping under high pressure RCS operation. Westinghouse should review the entire TS 3.4.16 BASES discussion and make it consistent with inclusion of the RCS to CVS interface valves.

Response:

The leak test requirement for the CVS valves will not be included with the Technical Specifications or bases. The leak test is included in the inservice testing. See the response to FSER Open Items 250.35 and 230.147 for a discussion of the requirements for leak testing of these valves.

SSAR Revision: NONE

AP600

Question 410.326F (OITS 6101)

Re:

NUREG/CR-0660 recommends the use of a three-way thermostat temperature control valve for directing the engine water to the bypass or cooler. It should be of or equivalent to the "Amot" brand with an expanding wax-type, temperature-sensitive element. In its response to RAI Q410.183 dated August 3, 1994, Westinghouse states that the SDECS is designed to use three-way thermostat water temperature control valves. These valves split the water flow between the cooling radiator circuit and the engine return inlet circuit such that the engine cooling inlet circuit temperatures remain nearly constant under various engine loads and ambient temperature conditions. However, Westinghouse needs to verify that the three-way thermostat has an expanding wax type temperature sensitive element and add this information to the SSAR. (OITS No. 333).

Response: ***(Revision 1)***

The motor-operated temperature control valve is replaced with a self-contained temperature control valve. Based on a review of the Amot Controls Product Catalog, the phrase "expanding wax type" is not a proper description of the temperature control valve; therefore, this phrase will not be used. The SSAR revisions below reflect this change.

SSAR Revision:

The fifth paragraph of SSAR subsection 8.3.1.1.2.1 ***Revision 19*** will be revised as shown below:

> The diesel-generator engine cooling system is an independent closed loop cooling system, rejecting engine heat through two separate roof-mounted, fan-cooled radiators. The system consists of two separate cooling loops each maintained at a temperature required for optimum engine performance by separate engine-driven coolant water circulating pumps. One circuit cools the engine cylinder block, jacket, and head area, while the other circuit cools the oil cooler and turbocharger aftercooler. The cooling water in each loop passes through a three-way self-contained temperature control valve which modulates the flow of water through or around the radiator, as necessary, to maintain required water temperature. ***The temperature control valve has an expanding wax-type temperature-sensitive element or equivalent.*** The cooling circuit, which cools the engine cylinder blocks, jacket, and head areas, includes a keep-warm circuit consisting of a temperature controlled electric heater and an ac motor-driven water circulating pump.

SSAR Figure 8.3.1-4 will be revised as shown on the following pages. ***in Revision 19 to shows this change.***