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DCP/NRC1151
NSD-NRC-97-5441
Docket No.: 52-003

November 21, 1997

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

ATTENTION: T. R. Quay

SUBJECT: RESPONSES TO QUESTIONS OF CONTAINMENT SCREENS AND PAINT

Dear Mr. Quay:

Attached are responses to questions related to plugging of screens and safety classification of paint. These questions were included in letters from the NRC dated July 30 1997, August 21, 1997 and October 7, 1997. Included with the response are draft SSAR changes. These changes will be included in SSAR Revision 18.

These item will be statused as Action N or Confirm W pending inclusion in a SSAR revision as noted below.

OITS #	DSER/RAI #	Status
969	6.1.2-1	Confirm W
5739	480.1078	Action N
5740	480.1079	Confirm W
5741	480.1080	Action N
5750	----------	Action N
5972	650.10F	Confirm W

Please contact Donald A. Lindgren at (412) 374-4856 with any questions.

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

E004/1

jml

Attachment

cc: J. M. Sebrosky, NRC (w/Attachment)
N. J. Liparulo (w/o Attachment)

DSER Open Item 6.1.2-1 (OITS #969)

In a letter dated July 30, 1997 the NRC staff identified the following response to previous Westinghouse positions on this open item.

The staff is concerned that any improperly applied coatings within containment may peel off and thus prevent other safety related systems or components from performing their functions. Containment coatings at operating plants have been observed to peel off over large areas. On the basis of experiences with operating reactors, concerns have been raised over the potential for unqualified coatings, or incorrectly applied coatings, in conjunction with other loss-of-coolant accident generated debris, to cause blockage of the sump screens. For the purpose of the certified design, Westinghouse is relying on the COL applicant to demonstrate that the interior containment coatings will not interfere with the passive core cooling system through a coating transport evaluation. The staff disagrees with Westinghouse conclusion. The staff's position is that assurance of the integrity of the containment coating needs to be established prior to the design certification.

Response:

An evaluation has been performed to assess the potential for AP600 containment recirculation screen blockage. This has resulted in adoption of a protective plate above each screen, use of safety-related coatings in the immediate vicinity of each screen, and more restricted use of fibrous insulation. This response and the response to RAI 480.1079 (OITS #5740) provide the results of the evaluation and the associated SSAR and ITAAC changes to incorporate the results. This evaluation confirm that interior coatings will not interfere with the passive core cooling system and avoids reliance on a COL applicant evaluation.

The AP600 provides several features that precludes debris from the potential failure of nonsafety coatings used inside containment from interfering with core cooling. These features include a passive safety injection system that provides a long delay time (more than 5 hours) between a LOCA and the time recirculation starts. This time delay provides time for settling of debris. These passive systems also flood the containment to a high level which allows the use of containment recirculation screens that are located well above the floor and are relatively tall. Significant volume is provided for the accumulation of coating debris without affecting screen plugging. These screens are protected by plates located above the screens that extend out in front and to the side of the screens. The protective plates together with low recirculation flow approach velocity and the screen postulated coating debris from above the plates from reaching the screens. Coatings used under these plates in the vicinity of the screens are classified as safety-related.

SSAR/ITAAC Changes:

Revise the third paragraph of subsection 6.1.2.1.1 as follows:

The AP600 design considers the function of the coatings, their potential failure modes, and their requirements for maintenance. Local failure of the coatings on the exterior of the containment vessel and outside the containment does not prevent functioning of the engineered safety features required for safe shutdown of the plant during or after a design basis accident (DBA). Coatings inside the containment are evaluated to demonstrate that failure does not prevent functioning of the engineered safety features. ~~Since~~ Coatings used in the vicinity of the containment recirculation screens are classified as safety-related, refer to 6.3.2.2.7.3 for the extent of safety-related coatings. Other coatings inside containment are classified as nonsafety-related because their failure ~~of the coatings~~ does not prevent functioning of the engineered safety features~~, the coatings are classified as nonsafety-related~~. Protective coatings are maintained to provide corrosion protection for the containment pressure boundary and for other safety-related system components inside containment. The coatings on the outside of the containment vessel are maintained to provide corrosion protection for the containment pressure boundary and to support passive cooling through their wetting ability and heat transfer properties. These functions are in addition to other functions (such as enhancing decontamination inside the containment and assisting in general housekeeping). The corrosion protection and decontamination functions of the coatings are nonsafety-related functions.

Revise Subsection 6.1.2.1.5 as follows:

6.1.2.1.5 Safety Evaluation

This subsection describes the basis for the extent of safety-related coatings ~~evaluation methodology and conclusions that are~~ and the basis for classifying coatings on other areas inside containment ~~interior coatings~~ as nonsafety-related.

The AP600 has a number of design features that facilitate the use of nonsafety-related coatings. These features include a passive safety injection system that provides a long delay time (more than 5 hours) between a LOCA and the time recirculation starts. This time delay provides time for settling of debris. These passive systems also flood the containment to a high level which allows the use of containment recirculation screens that are located well above the floor and are relatively tall. Significant volume is provided for the accumulation of coating debris without affecting screen plugging. These screens are protected by plates located above the screens that extend out in front and to the side of the screens. Coatings used under these plates in the vicinity of the screens are classified as safety-related. The protective plates together with low recirculation flow approach velocity and the screen postulated coating debris from above the plates from reaching the screens.

Refer to subsection 6.3.2.2.7.3 for additional discussion of these screens, their protective plates and the areas utilizing safety-related coatings.

~~These features include the use of coatings that do not fail in a manner that would adversely affect the safe shutdown of the plant. Also, systems, and components are designed to minimize the effects of coating failures.~~

The recirculation inlets are screened enclosures located near the northwest and southwest corners of the east steam generator compartment (refer to the figures in Section 6.3.2.2.7.3). The enclosure bottoms are located above the surrounding floor which prevent ingress of heavy debris (specific gravity greater than 1.05). Additionally, the screens are oriented vertically and are protected by large plates located above the screens, further enhancing the capability of the screens to function with debris in the water. The screen mesh size and the surface area of the containment recirculation screens in the AP600, in conjunction with the large floor area for debris to settle on, can accommodate failure of coatings inside containment during a design basis accident even though the residue of such a failure is unlikely to be transported to the vicinity of the enclosures.

A large portion of the containment is painted with inorganic zinc applied without a top coat. Over 40 years of successful case histories in many industrial tank applications confirm that properly applied inorganic zinc does not fail by sudden delamination. Deterioration of the inorganic zinc (inside and outside containment) is very gradual over a period of years. ~~The inorganic zinc continues to provide good surface wetting and protection to the carbon steel during this gradual deterioration period. Deterioration will be detected in the early stages of the process through periodic coating performance inspections. When deterioration is detected, maintenance painting can be deferred until scheduled outages without reducing confidence that the inorganic zinc coating will continue to provide corrosion protection and good wetting.~~ Failure of the inorganic zinc coating produces a heavy zinc powder that will not plug the passive core cooling system flow paths or the upper annulus drains. Inorganic zinc applied without a top coat is ~~not~~ used on the area coated with safety-related coatings. ~~categorized as nonsafety related in all locations.~~

The inorganic zinc on the outside of containment continues to provide good surface wetting and protection to the carbon steel during deterioration. Deterioration will be detected in the early stages of the process through periodic coating performance inspections. When deterioration is detected, maintenance painting can be deferred until scheduled outages without reducing confidence that the inorganic zinc coating will continue to provide corrosion protection and good wetting.

Coatings that lack sufficient tensile strength to hold together in large enough pieces to create large blisters or sheet delamination do not block the containment recirculation screens or prevent the accomplishment of safety-related functions. These coatings are classified as nonsafety-related. This includes the thin film epoxy sealer for concrete where it is not top coated.

The AP600 does not have a ~~safety-related~~ containment spray system. ~~The containment spray system provided in the AP600 is not used in design basis events.~~ This reduces the chance that coatings will peel off surfaces inside containment because the thermal shock of cold spray water on hot surfaces combined with the rapid depressurization following spray initiation are recognized as contributors to coating failure. Parts of the containment below elevation 107'-2" are flooded and water is recirculated through the passive core cooling system. However, the volume of water moved in this manner is relatively small and the flow velocity is very low.

~~The recirculation inlets are screened enclosures located near the northwest and southwest corners of the east steam generator compartment (refer to the figures in Section 1.2). The enclosure bottoms are located above the surrounding floor with curbs to prevent ingress of heavy debris (specific gravity greater than 1.05). Additionally, the screens are oriented vertically, further enhancing the capability of the screens to function with debris in the water. The screen mesh size and the surface area of the containment recirculation screens in the AP600, in conjunction with the large floor area for debris to settle on, can accommodate failure of coatings inside containment during a design basis accident even though the residue of such a failure is unlikely to be transported to the vicinity of the enclosures.~~

The coating systems used inside containment also include epoxy coatings. These are applied to concrete substrates, as top coats over the inorganic zinc primer, and directly to steel, as noted in subsection 6.1.2.1.2. The failure modes of these systems could include delamination or peeling if the epoxy coatings are not properly applied. There are small items coated with various manufacturer's standard coating systems which may peel or delaminate under design basis accident conditions. The very high-build epoxy floor coatings and high-build epoxy carbon steel coatings are sufficiently heavy so that transport with the low water velocity in the AP600 containment is negligible.

~~Coatings used inside containment with a delamination failure mode must be evaluated for their potential effect on safety-related functions. Predicted adverse effects on safety-related functions may be addressed by the use of alternate types of coatings or design approaches other than the use of paint. The methodology for the evaluation of coatings is discussed in the following.~~

Coating Transport Methodology

The potential for transport of coating material into the reactor or onto the recirculation screens can be avoided by limiting transport of the debris from the coating after failure. This approach has been used in operating nuclear power plants to eliminate or minimize the amount of coatings required to be safety related.

An outline of the coating transport evaluation methodology is provided below.

- Identification of water sources at different elevations of the containment

  The water sources are primarily the postulated pipe break and crack locations. Consideration is also given to flood-up of the containment and release of the water in the in-containment refueling water storage tank into the containment.

- Evaluation of local fluid velocities in containment at various elevations to determine likely flow paths and potential for debris transport to the sump

  This evaluation includes consideration of local geometry effects on the flow about and around the containment. Design elements that may affect flow include gutters, drains, curbs, grates, walls, doorways, walkways, stairways, equipment, equipment supports, and recirculation screens.

- Description of generation of protective coating debris including composition, quantities, and locations

  The information on the composition of the coating debris addresses the hydraulic, physical, and chemical characteristics. This includes size and shape of the chips or particles; the brittleness, strength, and tackiness of the particles at accident temperatures; zinc content; and abrasiveness.

- Analysis of debris transport

  This analysis considers the hydraulic characteristics of the particles and the flow fields.

- Evaluation of potential recirculation screen blockage

  This evaluation considers the flow field around the recirculation screen, the physical characteristics of the particles, and the particle critical transport velocities.

Completion of the coating transport evaluation is the responsibility of the Combined License applicant.

Production of hydrogen as a result of zinc corrosion in design basis accident conditions, including the zinc in paints applied inside containment, is addressed in subsection 6.2.4.3.1.

Revise subsection 6.1.3.2 as follows:

6.1.3.2 Coating Program

The Combined License applicants referencing the AP600 will address preparation of a program to control testing, application, and monitoring of nonsafety-related coatings. A coating transport evaluation similar to that described in subsection 6.1.2.1.5 will be performed.

Revise The fourth criteria of subsection 6.3.2.2.7.1 as follows:

Criteria 4) Use of coatings designed for post accident conditions. The coatings used on surfaces located close to the containment recirculation screens are safety-related. The surfaces considered close to the screens are defined in subsection 6.3.2.2.7.3. Refer to subsection 6.1.2.1.6.

See the response to RAI 480.1079 (OITS #5740) for additional SSAR revisions.

RAI 480.1078 (OITS #5739)

NRC Letter August 21, 1997
Provide a description and drawings(s) of the flow path of the condensate on the containment wall (following a PRHR actuation or LOCA) as it returns to the IRWST. Include the valves which must close and the screen

Response:

The flow path from the containment inside surface to the IRWST gutter is shown in the attached Figure 480.1078-1. A rough screen is provided on top of the gutter to prevent clogging of the gutter or the collection point overflow into the IRWST. The gutters gather condensate from the circumference of the containment and from the operating deck . The gutter drains this condensate to two collection points which are illustrated on SSAR figure 6.3-2. Drains from these collection points, normally allow the condensate that may form during normal plant operation to flow to the waste sump. A PRHR heat exchanger actuation signal closes redundant safety-related valves in the drain line to the waste sump, shown on SSAR figure 6.3-2. Closing of one of these valves forces the condensate to overflow from the collection points into the IRWST. The IRWST screens are shown in SSAR figures 6.3-6 and -7.

SSAR/ITAAC Changes: NONE

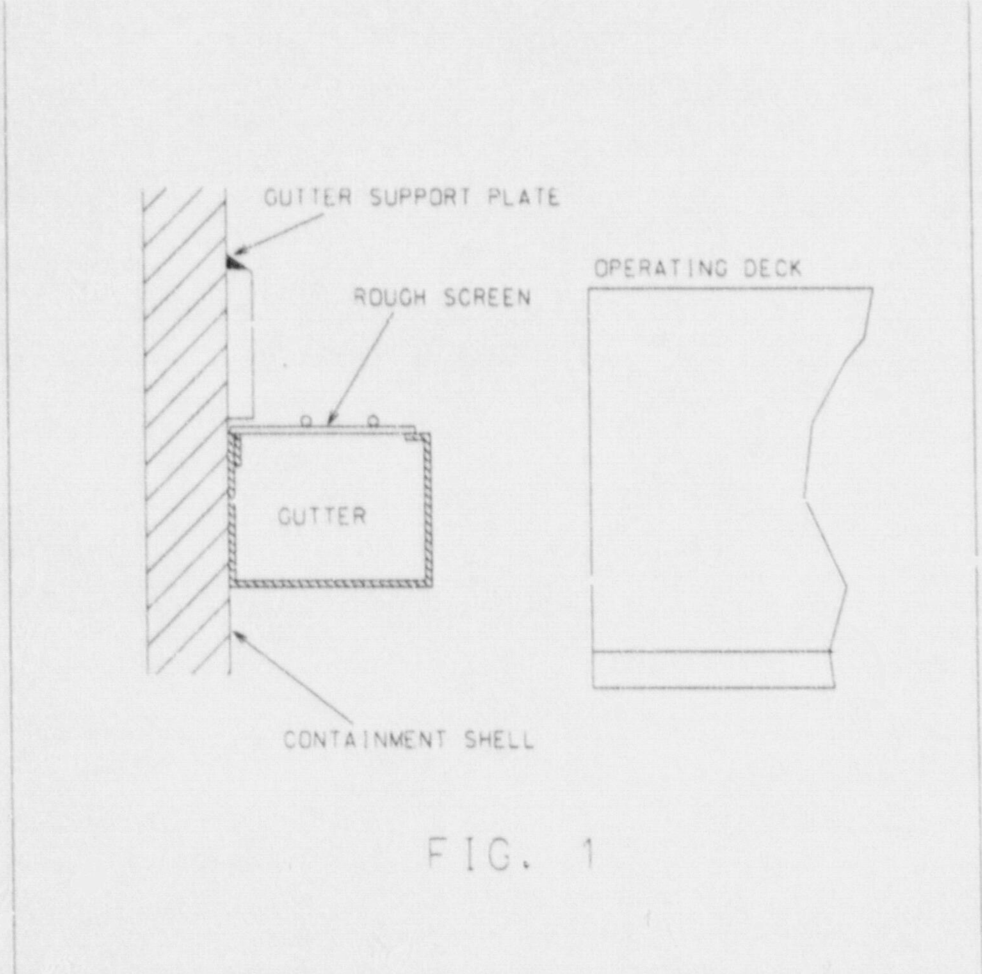


Figure 480.1078-1

RAI 480.1079 (OITS #5740)

Describe the basis for sizing the IRWST screens and recirculation screens.

(a) Include a discussion of flowrates through the screens and approach velocities with and without the nonsafety RHR pumps available.

(b) What type of debris are assumed to be present for the purposes of determining an acceptable loss across the recirculation screens. In particular, what quantity of unqualified coatings, i.e., those which are not intended to remain attached to their substrate following a LOCA are present in containment? Such coating may be applied to commercially purchased electrical equipment, motors, etc. Verify that no fibrous insulation or particulate insulation is used in any area of the containment that contains high energy lines or may be impacted by the discharge of high energy lines. If this not possible, verify that the amount of fibrous or particulate insulation used in containment cannot adversely impact IRWST or recirculation flow during an accident. Information gathered while resolving the boiling water reactor (BWR) strainer blockage issue shows that a combination of fibrous material with particulates (e.g, paint chips, rust, etc) can produce a much higher pressure drop than that due to the fibrous material alone. If fibrous material can reach the IRWST or recirculation screens discuss how this effect is taken into account.

(c) Even a well-conceived and through foreign material exclusion program may leave behind some material capable of blocking portions of the IRWST or recirculation screens. Has any allowance been included in the screen sizing for such material..

Response:

(a) The following shows the containment recirculation screen flow rates and approach velocities both with and without operation of the RNS pumps. Note that the case with RNS pump operation assumes both pumps are operating at their maximum unthrottled flow with both recirculation screens in operation. Note that the ERG's require throttling of the RNS to lower flows.

	Max Flow	Water Velocity	
		At Screen Face	10' from Screen
With RNS pumps operating	1300 gpm/screen	.04 ft/sec	.006 ft/sec
Without RNS pumps	200 gpm (1 screen)	.006 ft/sec	.001 ft/sec

(b) Fibrous insulation will not be generated by a LOCA. Fibrous insulation will not be used on lines that can be LOCA's or can be jet impacted by LOCA's. Insulation located within 10 ID's of the LOCA pipe break are assumed to be affected.

(c) The AP600 SSAR requires that the COL develop and utilize a program to prevent foreign materials from being left in the containment following a maintenance shutdown. Even if some foreign materials are left in the containment, the design of the AP600 containment recirculation screens can tolerate additional material. The AP600 precludes any significant screen plugging due to known screen plugging mechanisms including fibrous insulation debris and paint debris. As a result, the screen area has significant margin available to accommodate such foreign material.

SSAR Changes:

Revise Subsection 6.3.2.2.7.1 as follows:

Criteria 1 item 9

- Screens have solid top cover Containment recirculation screens have protective plates that are located no more than 10 feet above the top of the screens and extend at least 10 feet in front and to the side of the screens.

Criteria 3) Use of stainless steel reflective insulation limits debris generated by high energy line breaks. Metal reflective insulation is used on lines subject to loss of coolant accidents and on lines located within 10 IDs of lines that are subject to loss of coolant accidents that are not otherwise shielded from the blowdown jet. As a result, fibrous debris is not generated by loss of coolant accidents.

Revise the fourth paragraph of subsection 6.3.2.2.7.2 as follows:

The design of the IRWST screens reduces the chance of debris reaching the screens. The screens are orientated vertically such that debris that settles out of the water does not fall on the screens. A debris curb located at the base of the IRWST screens prevents high density debris from being swept along the floor by water flow to the IRWST screens. The IRWST screens are made up of a trash rack and a fine screen. The trash rack prevents larger debris from reaching the finer screen. The fine screen prevents debris larger than 0.125" from being injected into the reactor coolant system and blocking fuel cooling passages.

Revise subsection 6.3.2.2.7.3 as follows:

6.3.2.2.7.3 Containment Recirculation Screens

The containment recirculation screens are oriented vertically along walls above the loop compartment floor (elevation 83 feet). Figure 6.3-8 shows a plan view and Figure 6.3-9 shows a section view of these screens. Two separate screens are provided as shown in Figure 6.3-3. The loop compartment floor elevation is significantly above (11.5 feet) the lowest level in the containment, the reactor vessel cavity, which is 11.5 feet below. The bottom of the recirculation screen is two foot above the floor, providing a curb function.

During a LOCA, the reactor coolant system blowdown will tend to carry debris created by the accident (pipe whip/jets) into the cavity under the reactor vessel which is located remote away from and below the containment recirculation screens. As the accumulators, core makeup tanks and IRWST inject, the containment water level will slowly rise up to the 108 foot elevation over at least 5 hours. The containment recirculation line opens when the water level in the IRWST drops to a low level setpoint a few feet above the final containment floodup level. When the recirculation lines initially open, the water level in the IRWST is higher than the containment water level and water flows from the IRWST backwards through the containment recirculation screen. This back flow tends to flush debris located close to the recirculation screens away from the screens.

The water level in the containment when recirculation begins is well above (~ 10 feet) the top of the recirculation screens. During the long containment floodup time (>5 hours), floating debris does not move toward the screens and heavy materials settle to the floors of the loop compartments or the reactor vessel cavity. During recirculation operation the containment water level will not change significantly nor will it drop below the top of the screens.

The amount of debris that may exist following an accident is limited. Reflective insulation is used on lines subject to loss of coolant accident and on lines located within 10 IDs of lines that are subject to loss of coolant accidents to preclude fibrous limit the control the source of fibrous debris that can be generated by a loss of coolant accident high energy line break and be postulated to reach the screens during recirculation. The nonsafety-related coatings used in the containment are designed to withstand the post accident environment. The containment recirculation screens are protected by plates located above them. These plates prevent debris from the failure of nonsafety-related coatings from getting into the water close to the screens such that the recirculation flow can cause the debris to be swept to the screens before it settles to the floor. Safety related coatings are used on the underside of these plates and on surfaces located below the plates, above the bottom of the screens, 10 foot in front and 10 foot to the side of the screens to prevent coating debris from plugging the screens. A COL evaluation (subsection 6.1.3.2) shows that these screens provide flow area margin considering the post accident generation and transport of debris from coatings inside containment.

A COL cleanliness program (refer to subsection 6.3.8.1) controls foreign debris introduced into the containment during maintenance and inspection operations. The Technical Specifications require visual inspections of the screens during every refueling outage.

The design of the containment recirculation screens reduces the chance of debris reaching the screens. The screens are orientated vertically such that debris settling out of the water will not fall on the screens. ~~The protective plates described above provide additional protection to the screens from debris.~~ The bottom of the screens are raised 2 feet ~~about 1 foot~~ above the floor, instead of using a debris curb, to prevent high density debris from being swept along the floor by water flow to the containment recirculation screens. The containment recirculation screens are made up of a trash rack and a fine screen. The trash rack prevents larger debris from reaching the finer screen. The fine screen prevents debris larger than 0.125" from being injected into the reactor coolant system and blocking fuel cooling passages.

The screen flow area is conservatively designed considering the operation of the normal residual heat removal system pumps which produce a higher flow than the gravity driven IRWST injection / recirculation flows. As a result, when the normal residual heat removal system pumps are not operating there is even more margin in screen clogging.

Revise figures 6.3-8 and 6.3-9 (attached) to show plates over screens.

ITAAC CHANGES:

Add ITAAC for plates above screens and coatings in vicinity of screens to Table 2.2.3-4. (Attached)

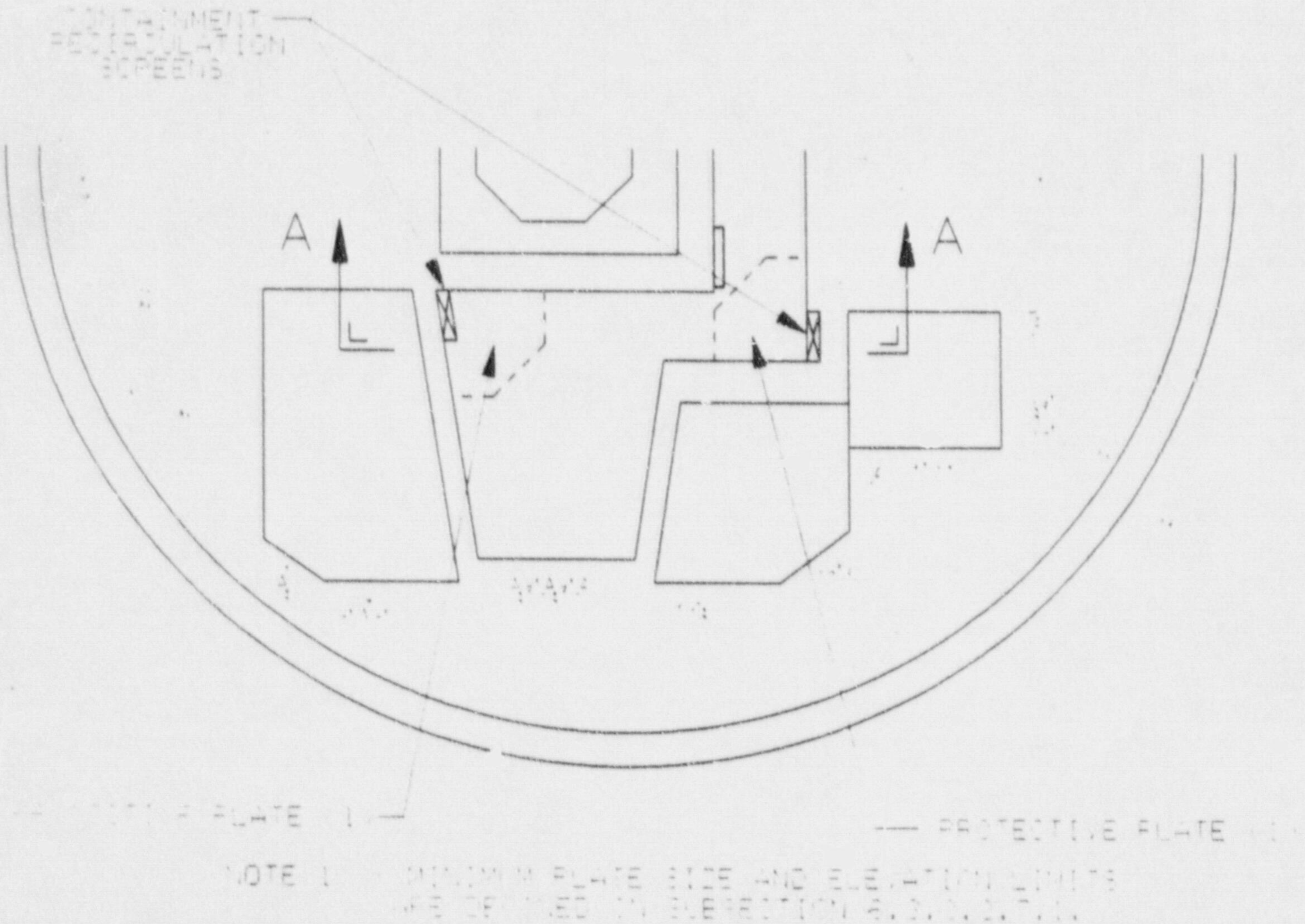
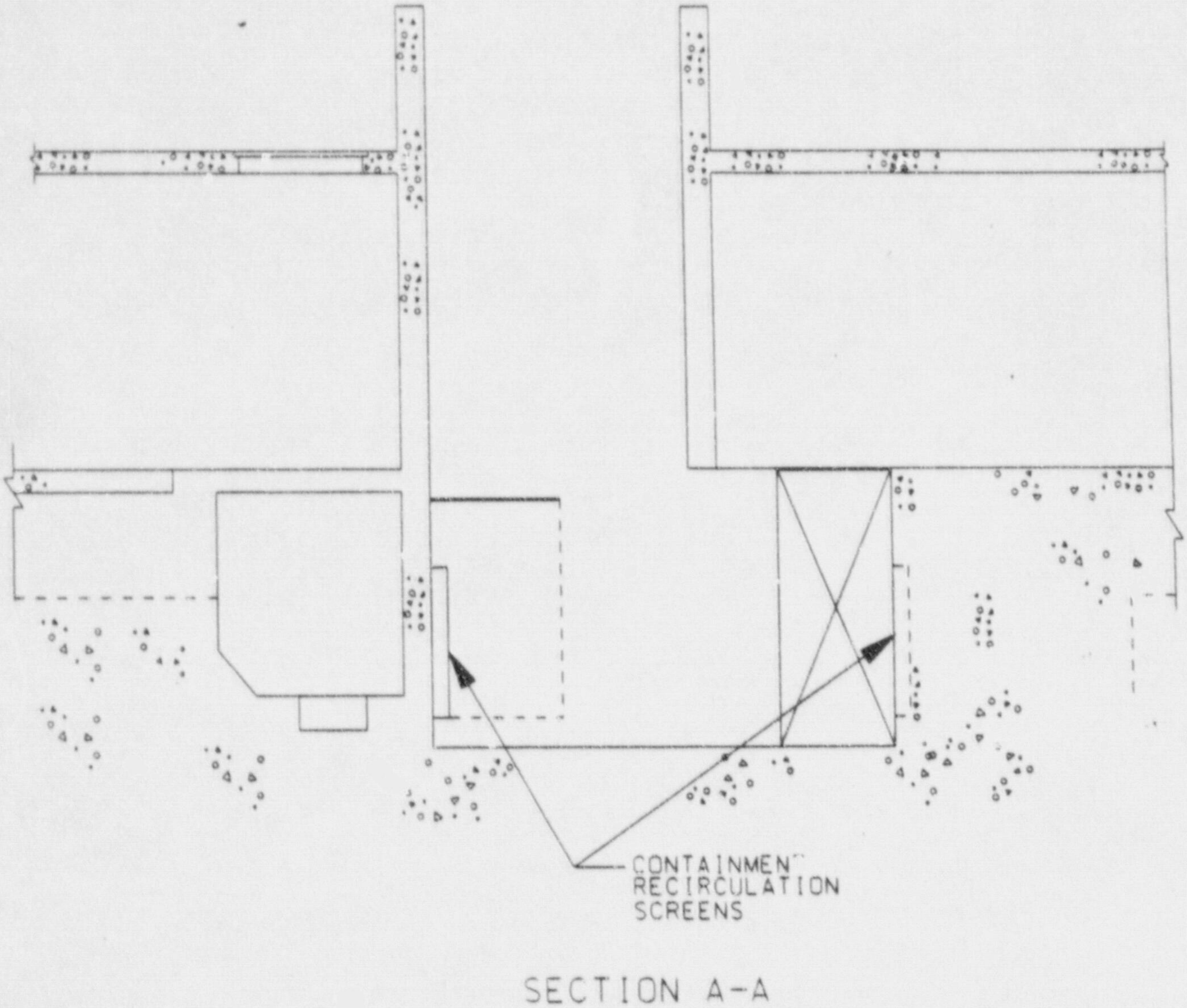


Figure 6.3-8

Containment Recirculation Screen Plan Location



NOTE 1 - MINIMUM PLATE SIZE AND ELEVATION LIMITS ARE DEFINED IN SUBSECTION 6.3.2.2.7.1.

Figure 6.3-9

Containment Recirculation Screen Section Location

Table 2.2.3-4 Inspections, Tests, Analyses, and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
8.c) The PXS provides RCS makeup, boration, and safety injection during design basis events.	i) A low-pressure injection test and analysis for each CMT, each accumulator, each IRWST injection line, and each containment recirculation line will be conducted. Each test is initiated by opening isolation valve(s) in the line being tested.	i) The injection line flow resistance from each source is as follows:
	CMTs: Each CMT will be initially filled with water. All valves in these lines will be open during the test.	CMTs: The calculated flow resistance between each CMT and the reactor vessel is $\geq 3.07 \times 10^{-5}$ ft/gpm^2 and $\leq 3.84 \times 10^{-5}$ ft/gpm^2.
	Accumulators: Each accumulator will be partially filled with water and pressurized with nitrogen. All valves in these lines will be open during the test. Sufficient flow will be provided to fully open the check valves.	Accumulators: The calculated flow resistance between each accumulator and the reactor vessel is $\geq 1.49 \times 10^{-5}$ ft/gpm^2 and $\leq 1.86 \times 10^{-5}$ ft/gpm^2.
	IRWST Injection: The IRWST will be partially filled with water. All valves in these lines will be open during the test. Sufficient flow will be provided to fully open the check valves.	IRWST Injection: The calculated flow resistance for each IRWST injection line between the IRWST and the reactor vessel is $\geq 1.33 \times 10^{-5}$ ft/gpm^2 and $\leq 2.66 \times 10^{-5}$ ft/gpm^2.
	Containment Recirculation: A temporary water supply will be connected to the recirculation lines. All valves in these lines will be open during the test. Sufficient flow will be provided to fully open the check valves.	Containment Recirculation: The calculated flow resistance for each containment recirculation line between the containment and the reactor vessel is $\leq 2.17 \times 10^{-5}$ ft/gpm^2.

Table 2.2.3-4 Inspections, Tests, Analyses, and Acceptance Criteria		
Design Commitment	**Inspections, Tests, Analyses**	**Acceptance Criteria**
	ii) A low-pressure test and analysis will be conducted for each CMT to determine piping flow resistance from the cold leg to the CMT. The test will be performed by filling the CMT via the cold leg balance line by operating the normal residual heat removal pumps.	ii) The flow resistance from the cold leg to the CMT is ≤ 7.69 x 10^{-6} ft/gpm^2.
	iii) Inspections of the elevation of the following tanks will be conducted: – CMTs – IRWST	iii) The elevation of the bottom inside tank surface is higher than the direct vessel injection nozzle centerline by the following: – CMTs ≥ 7.5 ft – IRWST ≥ 3.4 ft
	iv) Inspections of each of the following tanks will be conducted: – CMTs – Accumulators – IRWST	iv) The calculated volume of each of the following tanks is as follows: – CMTs ≥ 2000 ft^3 – Accumulators ≥ 2000 ft^3 – IRWST ≥ 557,000 gal between the tank outlet connection and the tank overflow
	v) Inspection of the as-built components will be conducted for plates located above the containment recirculation screens.	*v) Plates located above each containment recirculation screen are no more than 10 ft above the top of the screen and extend out at least 10 ft from the trash rack portion of the screen.*

New ITAAC

Table 2.2.3-4
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
	vi) Inspection will be conducted of the as-built coatings used close to the containment recirculation screens.	*vi) A report exists and concludes that the coatings used on the underside of the plates located above the containment recirculation screens, down to the bottom of the screens and within 10 ft of the trash rack portion of the screen, meet the requirements for safety-related coatings.*

RAI 480.1080, (OITS #5741)

The SSAR, Chapter 6, Section 6.3.2.2.8.5, states that the fourth stage of the automatic depressurization system discharges directly to the steam generator compartment. What target will this discharge impact? What and how much debris may be generated by this impact? Can this debris be transported to the recirculation screens? If so, what will be the effect?

Response:

ADS stage 4 discharge is directed at the loop compartment wall which is about 3 feet from the discharge. There are no intervening structures or components. The loop compartment wall is a concrete filled, steel module. With the low RCS pressures when ADS stage 4 opens (about 50 psig), no debris generation is expected. Even if there is some debris generation occurs, there will be about 5 hours for the debris to settle before containment recirculation starts. Also refer to response to RAI 480.1079.

SSAR/ITAAC Changes: NONE

NRC Letter dated July 30, 1997, Item 2) (OITS #5750)

The inorganic zinc coating on the containment shell exterior and interior regions above the operating deck provides the basis for the performance of the passive containment cooling system (PCS). The inorganic zinc coating selected for the AP600 was used in the Westinghouse flat plate test, the water distribution test, and the large scale test facilities. Surface wettability on the exterior of the containment dome and vertical shell, in the form of expected surface area coverage based on the applied flow rate, and the expected behavior of the water film are based on the attributes of the inorganic zinc coating as evaluated in these test facilities. These characterizations form the basis for the design basis licensing analyses. In addition, the characteristics of the inorganic zinc coating on the interior of the containment dome and shell support the PCS performance based on the large scale test data. It is the staff conclusion the inorganic zinc coating is an integral aspect of the PCS design. Westinghouse should address the staff's concerns by providing additional justification for the use of nonsafety-related coatings or reclassify the coatings as safety-related.

Response:

The exterior of the containment vessel is coated with the inorganic zinc coating to enhance surface wetting of the exterior surface of the containment vessel. The AP600 Technical Specifications commit to verifying the water coverage of the containment water distribution system periodically over the plant life. In the process of verifying the water coverage, the wetting performance of the inorganic zinc coating is also verified. This commitment provides ongoing direct assurance that the nonsafety-related coating on the containment is capable of supporting the containment cooling function.

The testing, application, and monitoring of nonsafety-related coatings are controlled by a program prepared by the Combined License applicant. The specified coatings used inside of containment and on the containment shell outside containment are tested for radiation tolerance per ASTM D4082 (Reference 1), for decontaminability per ASTM D4256 (Reference 2) and for performance under design basis accident conditions per ASTM D3911 (Reference 3).

Over 40 years of successful case histories in many industrial tank applications confirm that properly applied inorganic zinc does not fail by sudden delamination. Deterioration of the inorganic zinc is very gradual over a period of years and would be detected as a part of the Combined License applicants program of testing, application, and monitoring of nonsafety-related coatings. Deterioration of the coating due to either long term effects, abrasion or other damage would be readily observable as rusting and discoloration of the surface. The inorganic zinc continues to provide good surface wetting and protection to the carbon steel during this gradual deterioration period. Failure due to deterioration will be detected in the early stages of the process through periodic coating performance inspections. Failure of the inorganic zinc coating produces a heavy zinc powder that will not plug the PCS upper annulus drains.

The performance of the installed coatings is monitored by the Combined License applicant. The coatings performance monitoring program includes periodic inspections of the coatings inside containment and the exterior of the containment vessel during planned outages. The monitoring program includes the planning of maintenance painting schedules so that the installed coatings can be maintained to perform as intended. The maintenance painting inside containment and on the exterior of the containment vessel is conducted during scheduled outages using qualified maintenance coating systems applied and inspected by qualified personnel.

Potential failure of the zinc coating due to misapplication will be readily assessable shortly after application as either excessive thickness or as "mud cracking". Mud cracking may be due to either excessive application thickness or excessive thinning. Either problem will be detected shortly after application and corrected prior to plant operation as a part of the Combined License applicants coatings program. Should misapplication not be detected locally then the results may be disbondment with small amounts of small sized flaking which will not effect either the overall water distribution or drainage of the containment annulus. In this manner localized failure does not prevent accomplishing a safety-related function

The coating manufacturer is required to manufacture the coatings under a suitable quality assurance program and to provide a product identity certification record. Coating specifications also require that the surfaces to be coated are properly prepared, coated, inspected and documented.

The Combined License applicants referencing the AP600 will address preparation of a program to control testing, application, and monitoring of nonsafety-related coatings.

SSAR/ITAAC Changes: NONE

FSER Open Item 650.10F, Issue A-43 Containment Emergency Sump Performance, (OITS #5972)

The staff has not completed its review of Unresolved Safety Issue A-43 for the AP600 design. The amount of fibrous insulation in containment and its effect on the recirculation flow together with the RMI following a LOCA must be evaluated. Open Item 20.3-4 remains unresolved.
In addition, Westinghouse does not address BL-96-03 in WCAP-13559, Revision 1 "Operational Assessment for AP600." This is an Open Item. In WCAP-13559 Revision 1, Westinghouse also states that Bulletin 93-02 "Debris Plugging of Emergency Core Cooling Suction Strainers," and Bulletin 95-02 "Unexpected Clogging of a Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode" are not applicable to the AP600 design. Because of the unique features of the AP600 mentioned above, the staff disagrees with this assessment. Therefore, Westinghouse should revise WCAP-13559 to state that these Bulletins are applicable to the AP600 and should reference issue A-43 and the appropriate SSAR sections in the comment block for these Bulletins.

Response:

The response to RAI 480.1079 provides the basis for sizing the containment recirculation screens. The design of the screens minimizes the water velocity through and approaching the screens. Plates located above the screens precludes dropping debris into the water directly in from of the screens. Issue A-43 and WCAP-13559 will be revised to reflect this information.

Bulletin 93-02 addresses plugging of strainers due to temporary fibrous filters remaining in the containment. The AP600 design has no provision for such filters. The program to limit the amount of debris that might be left in the containment following refueling and maintenance outages is the responsibility of the Combined License applicant. See subsection 6.3.8.1. WCAP-13559 will be revised to reflect this.

Bulletin 95-02 addresses clogging of strainers due to debris in containment. The program to limit the amount of debris that might be left in the containment following refueling and maintenance outages is the responsibility of the Combined License applicant. See subsection 6.3.8.1. WCAP-13559 will be revised to reflect that this a procedural issue.

Bulletin 96-03 addresses means to minimize clogging of strainers in operating boiling-water reactors by design and procedure changes. As described in the response to RAI 480.1079 the containment recirculation screens in the AP600 have a large surface area and slow approach velocity of the water to promote settling of debris in the water prior to reaching the screens. This is consistent with Option 1 of the bulletin. Since the containment recirculation screens are located in a dry loop compartment and not a flooded suppression pool, a technical specification to assure that the screens are not blocked by debris during operation is not required. Bulletin 96-03 will be added to WCAP-13559.

SSAR/ITAAC Changes:

Revise the first paragraph of the response to Issue A-43 in subsection 1.9.4.2.2 as follows:

> Air ingestion, vortexing, and debris blockage are not significant concerns for the AP600. Containment recirculation includes sump screens that conform to the criteria specified in Regulatory Guide 1.82. The recirculation screens have a large cross-sectional area to reduce the fluid flow velocity through the screen and to provide a large screening area to accommodate accumulated debris. Horizontal plates located above the recirculation screens preclude debris being deposited in the water directly adjacent to the screens. Piping subject to loss of coolant pipe breaks and piping in the vicinity of these breaks use reflective metallic insulation to preclude the generation of fibrous insulation debris. See subsection 6.3.2.2.7 for additional information on the design of the screens and limits on use of fibrous insulation.

WCAP-13559 Changes:

Revise the entry for Bulletin 93-02 as follows:

Number	Title	Comment
93-02	Debris Plugging of Emergency Core Cooling Suction Strainers	Not Applicable ~~Procedural Issue~~ SSAR subsection 1.9.4.2.2 Issue A-43 and 6.3.2.2.7 ~~AP600 has no air filters inside containment with the exception of portable filters which should be stored outside containment~~

Revise the entry for Bulletin 95-02

Number	Title	Comment
95-02	Unexpected Clogging of a Residual Heat Removal (RHR) Pump Strainer While Operating in Suppression Pool Cooling Mode	Not Applicable ~~BWR only~~ ~~Procedural Issue~~ ~~SSAR subsection 6.3.8.1~~

Add entry for Bulletin 96-03

Number	Title	Comment
96-03	Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors	Procedural Issue SSAR subsection 1.9.4.2.2 Issue A-43, 6.3.2.2.7, and 6.3.8.1