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NSD-NRC-97-5488
Docket No.: 52-003

December 12, 1997

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

ATTENTION: T. R. QUAY

SUBJECT: RESPONSES TO STAFF REQUESTS REGARDING THE AP600 INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE CRITERIA (ITAAC) - IRWST & RECIRC SCREENS

Dear Mr. Quay:

Enclosed are three copies of Westinghouse's revised response to RAI 480.1079 related to comments received from the staff related to the IRWST and recirculation screens during the AP600 ITAAC Task Group meeting on December 4, 1997.

This submittal closes, from Westinghouse's perspective, open item 5740. As a result, the Westinghouse status column will be changed to "Closed" in the Open Item Tracking System (OITS). The NRC should review this response and inform Westinghouse of the status of the open items to be designated in the "NRC Status" column of the OITS.

Please contact Mr. Eugene J. Piplica at (412) 374-5310 if you have any questions concerning this transmittal.

Eugene J. Piplica for

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

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jml

Enclosure

cc: J. M. Sebrosky, NRC (w/Enclosure)
J. N. Wilson, NRC (w/Enclosure)
N. J. Liparulo, Westinghouse (w/o Enclosure)

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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	Water Velocity 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 **by the LOCA**.

(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 **makes transport of the material to the screens unlikely and provides** 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) 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. 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 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 **protect against generation of** fibrous debris by **jet impengment during** a loss of coolant accident **that may** 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 sweep 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 **reaching** the screens.

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.

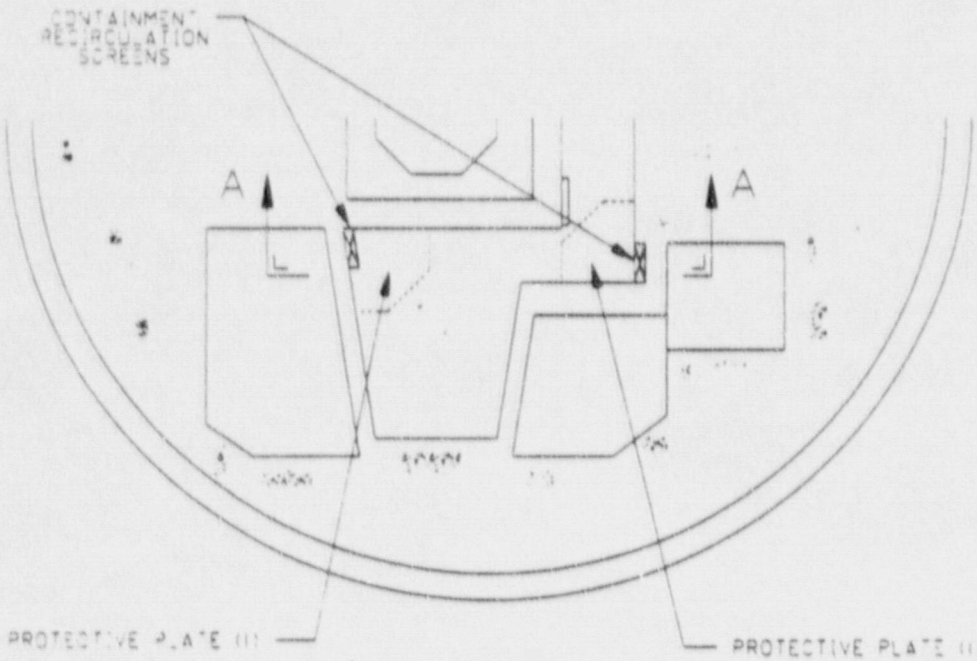
The design of the containment recirculation screens reduces the chance of debris reaching the screens. The screens are orientated vertically such that debris settling out of the water will not fall on the screens. The protective plates described above provide additional protection to the screens from debris. The bottom of the screens are **located** 2 feet 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:

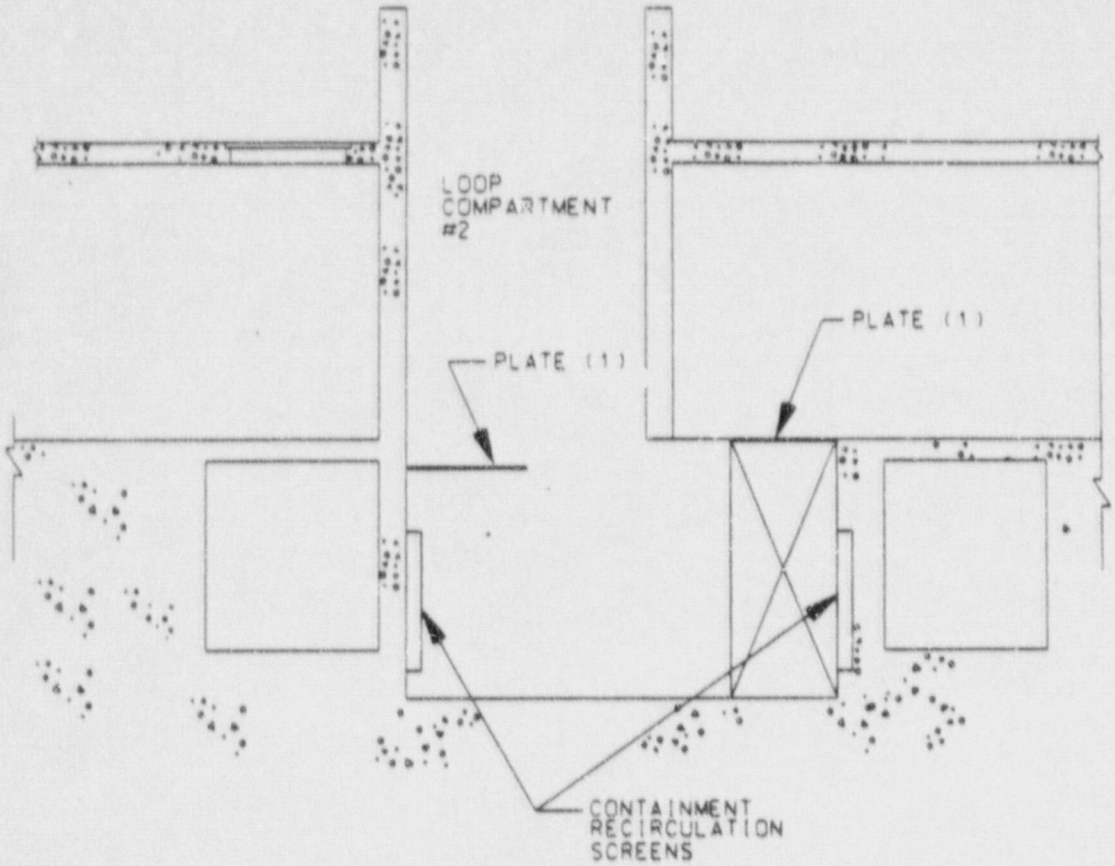
Add ITAAC for plates above screens**, screen size and type of insulation used inside containment** to Table 2.2.3-4. (Attached)



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

Figure 6.3-8

Containment Recirculation Screen Plan Location



SECTION A-A

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 Plan 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.	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.
	vi) Inspections of the IRWST and containment recirculation screens will be conducted.	*vi) The screen surface area (width x height) of each screen is ≥ 70 ft^2. The bottom of the containment recirculation screens is ≥ 2 ft above the compartment floor.*
	v) Inspections will be conducted of the insulation used inside the containment on ASME class 1 lines and on the reactor vessel, reactor coolant pumps, pressurizer and steam generators.	*v) The type of insulation used on these lines and equipment is not a fiberous type.*