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

ATTENTION: T. R. QUAY

SUBJECT: WESTINGHOUSE RESPONSES TO NRC REQUESTS FOR INFORMATION ON THE AP600

Dear Mr. Quay:

Enclosed are three copies of the Westinghouse responses to NRC's request for additional information concerning the SSAR. Responses to RAIs 410.297, 410.298 and 410.300 provide additional information on Section 9. The response to RAI 460.27 provides additional information on Section 11.4.

The NRC technical staff should review these responses as a part of their review of the AP600 design. These responses close, from a Westinghouse perspective, the addressed questions. The NRC should inform Westinghouse of the status to be designated in the "NRC Status" column of the OITS. We suggest "Action N."

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

Susan V Fanto for

Brian A. McIntyre, Manager
Advanced Plant Safety and Licensing

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Enclosure

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

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Question 410.297 (OITS 5358)

Re:

The staff has reviewed Table 9.1-4 in the SSAR which presents the time to saturation and height of water above the spent fuel given a station blackout and a seismic event. The staff believes that the shortest time to spent fuel pool boiling may occur during the following scenario that is not included in SSAR Table 9.1-4. The postulated scenario is: The AP600 unit undergoes a normal refueling outage where 1/3 of the core fuel assemblies are deposited into the spent fuel pool, the plant is operated at full power just long enough to allow the new core to become fully irradiated, then something happens to the AP600 plant that necessitates a full core offload. Should a station blackout or a seismic event then occur, the time to pool boiling could be shorter than the times presented in SSAR Table 9.1-4. Therefore, the staff is requesting Westinghouse to evaluate this bounding scenario and document in SSAR Table 9.1-4, the time to spent fuel pool saturation and the height of water above the fuel at 72 hours.

Response:

The response information was added to SSAR Table 9.1-4 in revision 11.

SSAR Revision: NONE

Question 410.298 (OITS 5359)

Re:

In SSAR Section 9.1.3.5, Westinghouse states, "the spent fuel pool is designed such that a water level is maintained above the spent fuel assemblies for at least 72 hours following a loss of the spent fuel pool cooling system and without makeup." Based on Table 9.1-4 in the SSAR, credit is taken for water in the in-containment refueling water storage tank (IRWST) and/or refueling cavity which is assumed to be available for gravity drain to the spent fuel pool following a full core off-load and loss of spent fuel pool cooling. This action is not described in the SSAR.

Based on a conference call with Westinghouse, the staff now understands that no operator action is needed for this gravity drain operation. Inventory from the refueling cavity/IRWST automatically gravity drains into the spent fuel pool via the fuel transfer tube and fuel transfer gate. This operation requires that the fuel transfer tube isolation valve and the fuel transfer gate remain open following a total core offload.

Given this information, the staff requests that:

a. Westinghouse clearly describe in the SSAR how the gravity drain process works following a loss of spent fuel pool cooling given a total core offload. This description needs to include when the fuel transfer tube isolation valve and the fuel transfer gate are opened and how the status of these components will be controlled following a total core offload (i.e. Technical Specifications).

b. Westinghouse clarify in the SSAR that the spent fuel pool level instrumentation is safety related.

Response:

Analysis subsequent to the referenced telephone conversation has shown that water from neither the refueling cavity nor IRWST is required to support 7 days of spent fuel cooling. This is consistent with the scenario of an emergency full core offload followed by draining the refueling cavity for inside containment repairs. Revision 11 of SSAR Section 9.1.3.5 and Table 9.1-4 reflects the results of this analysis.

Table 3.2-3 was revised in revision 11 to show that the spent fuel pool level instrumentation is safety related.

SSAR Revision: NONE

Question 410.300 (OITS 4195)

Re:

In Section 9.4.2.2.1.4, Westinghouse needs to clarify if high or low efficiency filters are used and provide justification for use.

Response:

Revision 12 of subsection 9.4.2.2.1.4 indicates that only low efficiency filters are used in the MSIV Compartment HVAC Subsystem. This subsystem has no defense-in-depth function. Each distribution system within this subsystem is wholly contained within its MSIV compartment and is operated in the recirculation mode. As such, the filters for the MSIV compartment AHUs are selected solely for the purpose of keeping the cooling and heating coils clean. The specific selection of filters for this purpose is consistent with industry practice and ASHRAE recommendations of the 1992 HVAC Systems and Equipment Handbook, Chapter 52, Table 2.

SSAR Revision: NONE

Question 460.27

Re:

In a telecon of April 8, 1997, Westinghouse stated that: in the revised design, two spent resin tanks an nine spent filter tubes in the auxiliary building, and a packaged waste storage room in the radwaste building are designed for onsite storage. The remaining solid waste is expected to be shipped offsite. If this is correct, the staff finds the information in Section 11.4 of the SSAR to be incomplete. For example, the number of spent filter tubes and their storage capacity, and the expectation for the COL applicant to provide sufficient shipment capability by a mobile systems are not specified in the SSAR.

a. Revise the SSAR to address the above staff concern.

b. Using the data in SSAR Table 11.4-1, Westinghouse is requested to demonstrate that the AP600 has sufficient storage capacity to allow time for short-lived radionuclides to decay prior to shipping in accordance with the regulatory guidance in the standard review plan (SRP) Section 11.4, Paragraphs II.6 and III.4, and BTP ETSB 11-3 Position B.III.

c.1. In SSAR Table 11.4-1, the amount of "expected" generation and "expected" shipped solid waste are significantly lower than that of "maximum" generation and "maximum" shipped solid waste. Clarify whether the designed process and storage capacity are based on the "expected" amount or on the "maximum" amount.

If the design storage capacity is based on the expected amount:

2. explain how the AP600 will handle the waste that is beyond what is expected, and

3. compare the values given in the SSAR for the volumes and radionuclide content of solid waste to be shipped offsite with data from operating plants of similar size.

Response:

Westinghouse has revised the SSAR as shown on the attached markup to resolve NRC concerns.

SSAR Revision: See attached markup.

11.4 Solid Waste Management

The solid waste management system (WSS) is designed to collect and accumulate spent ion exchange resins and deep bed filtration media, spent filter cartridges, dry active wastes, and mixed wastes generated as a result of normal plant operation, including anticipated operational occurrences. The system is located in the auxiliary and radwaste buildings. Processing and packaging of wastes are by mobile systems in the auxiliary building rail car bay and in the mobile systems facility part of the radwaste building. The packaged waste is stored in the auxiliary and radwaste buildings until it is shipped offsite to a licensed disposal facility.

The use of mobile systems for the processing functions permits the use of the latest technology and avoids the equipment obsolescence problems experienced with installed radwaste processing equipment. The most appropriate and efficient systems may be used as they become available.

This system does not handle large, radioactive waste materials such as core components or radioactive process wastes from the plant's secondary cycle. However, the volumes and activities of the secondary cycle wastes are provided in this section.

11.4.1 Design Basis

11.4.1.1 Safety Design Basis

The solid waste management system performs no function related to the safe shutdown of the plant. The system's failure does not adversely affect any safety-related system or component; therefore, the system has no nuclear safety design basis.

There are no safety related systems located near heavy lifts associated with the solid waste management system. Therefore, a heavy loads analysis is not required.

11.4.1.2 Power Generation Design Basis

The solid waste management system provides temporary onsite storage for wastes prior to processing and for the packaged wastes. The system has a 60-year design objective and is designed for maximum reliability, minimum maintenance, and minimum radiation exposure to operating and maintenance personnel. The system has sufficient temporary waste accumulation capacity based on normal waste generation rates so that maintenance, repair, or replacement of the solid waste management system equipment does not impact power generation.

maximum

The radioactivity of the dry active waste is expected to normally range from 0.1 curies per year to 8 curies per year with a maximum of about 16 curies per year. This waste includes spent HVAC filters, compressible trash, non-compressible components, mixed wastes and solidified chemical wastes. These activities are produced by relatively long lived radionuclides (such as Cr-51, Fe-55, Co-58, Co-60, Nb-95, Cs-134 and Cs-137), and therefore, radioactivity decay during processing and storage is minimal. These activities thus apply to the waste as generated and to the waste as shipped.

The estimated expected and maximum annual quantities of waste influents by source and form are listed in Table 11.4-1 with disposal volumes. The influent volumes are conservatively based on an 18-month refueling cycle. Annual quantities based on a 24-month refueling cycle are less than those for an 18-month cycle. The estimated expected isotopic curie content of the primary spent resin and filter cartridge wastes to be shipped offsite are presented in Table 11.4-4 based on 90 days of decay before shipment. The same information is presented in Table 11.4-5 for the estimated maximum activities based on 30 days of decay before shipment.

Section 11.1 provides the bases for determination of liquid source terms used to calculate several of the solid waste management system influent source terms. The influent data presented in Tables 11.4-2 and 11.4-3 are conservatively based on Section 11.1 design basis (Technical Specification) values.

Shipped volumes of radwaste for disposal are estimated in Table 11.4-1 from the estimated expected or maximum influent volumes by making adjustments for volume reduction processing by mobile systems and the expected container filling efficiencies. For drum compaction, the overall volume reduction factor, including packaging efficiency, is 3.6. For box compaction, the overall volume reduction factor is 5.4. These adjustments result in a packaged internal waste volume for each waste source, and the number of containers required to hold this volume is based on the container's internal volume. The disposal volume is based on the number of containers and the external (disposal) volume of the containers.

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The disposal volumes of wet and dry wastes are approximately 377 and 1254 cubic feet per year, respectively. The wet wastes include 315 cubic feet per year of spent ion exchange resins and deep bed filter carbon, which fills two 158 cubic feet high-integrity containers. The spent resin waste container fill station at the west end of the rail car bay of the auxiliary building provides about 5 months of storage. Solidified chemical wastes fill about three 55-gallon drums per year (about 20 cubic feet per year) and are stored in the packaged waste storage room of the radwaste building for up to 3 years as evaluated below. The mixed liquid wastes fill less than three drums per year (about 17 cubic feet per year) and are stored on containment pallets in the waste accumulation room of the radwaste building until shipped offsite for processing. One four-drum containment pallet provides nearly 2 years of storage capacity for the liquid mixed wastes as well as for the 7.5 cubic feet per year (one drum per year) of solid mixed wastes.

High-activity filter cartridges fill three drums per year (22.5 cubic feet per year) and are stored in portable processing or storage casks in the rail car bay of the auxiliary building. One three-

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The expected disposal volumes of wet and dry wastes are approximately 352 and 1278 cubic feet per year, respectively as shown in Table 11.4-1. The wet wastes shipping volumes include 315 cubic feet per year of spent ion exchange resins and deep bed filter activated carbon, 20 cubic feet of liquid chemical wastes and 17 cubic feet of mixed liquid wastes. The spent resins and activated carbon are initially stored in the spent resin storage tanks located in the rail car bay of the auxiliary building. When a sufficient quantity has accumulated, the resin is sluiced into two 158 cubic feet high-integrity containers in anticipation of transport for off site disposal. Liquid chemical wastes are reduced in volume and packaged into three 55-gallon drums per year (about 20 cubic feet) and are stored in the packaged waste storage room of the radwaste building. The mixed liquid wastes fill less than three drums per year (about 17 cubic feet per year) and are stored on containment pallets in the waste accumulation room of the radwaste building until shipped off site for processing.

The two spent resin storage tanks (275 cubic feet usable, each) and one high integrity container in the spent resin waste container fill station at the west end of the rail car bay of the auxiliary building provide more than 2 years of spent resin storage at the expected rate and more than 6 months of storage at the maximum generation rate.

The dry solid radwaste includes 1246 cubic feet per year of compactible and non-compactible waste packed into about 13 boxes (90 cubic feet each) and ten drums per year. Drums are used for higher activity compactible and noncompactible wastes. Compactible waste includes HVAC exhaust filters, ground sheets, boot covers, hair nets, etc. Non-compactible waste includes about 60 cubic feet per year of dry activated carbon and other solids such as broken tools and wood. Solid mixed wastes will occupy 7.5 cubic feet per year (one drum). The low activity spent filter cartridges may be compacted to fill about 0.26 drums per year (2 ft^3/year) and are stored in the packaged waste storage room. Compaction is performed by mobile equipment or is performed off site. High activity filter cartridges fill three drums per year (22.5 cubic feet per year) and are stored in portable processing or storage casks in the rail car bay of the auxiliary building.

The total volume of solid radwaste to be stored in the radwaste building packaged waste storage room is 1256 cubic feet per year at the expected rate and 1922 cubic feet per year at the maximum rate. This includes the dry wastes packaged in drums or steel boxes, the mixed solid chemical wastes and the lower activity filter cartridges. The quantities of liquid radwaste stored in the packaged waste storage room of the radwaste building consists of 20 cubic feet of chemical waste and 17 cubic feet of mixed liquid waste. The useful storage volume in the packaged waste storage room is approximately 3900 cubic feet (10 feet deep, 30 feet long, and 13 feet high). The packaged waste storage room provides storage for about 3 years at the expected rate of generation and more than 2 years at the maximum rate of generation. One four-drum containment pallet provides more than 8 months of storage capacity for the liquid mixed wastes and the volume reduced liquid chemical wastes at the expected rate of generation and more than 4 months at the maximum rate

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drum cask provides storage for 1 year. The other spent filter cartridges may be compacted to fill about 0.26 drums per year (2 ft^3/year) and are stored in the packaged waste storage room. Compaction is performed by mobile equipment or is performed off site.

The other dry wastes are packaged in drums or steel boxes and are stored in the packaged waste storage room of the radwaste building. About 60 cubic feet per year of activated carbon and higher-activity compactible and noncompactible wastes fill about eight drums per year, and 1186 cubic feet per year of lower-activity compactible and noncompactible waste and HVAC exhaust filters fill about 12 boxes (90 cubic feet) per year. Together with the solidified chemical wastes and the lower activity filter cartridges, the total volume to be stored in the packaged waste storage room is 1268 cubic feet per year. The useful storage volume in the packaged waste storage room is approximately 3900 cubic feet (10 feet deep, 30 feet long, and 13 feet high), providing a storage duration of up to 3 years.

Based on continuous operation of the steam generator blowdown purification system, with leakage from the primary to secondary cycles, the volume of radioactively contaminated material is estimated to be 540 cubic feet per year. Provisions for processing and disposal of radioactive steam generator blowdown resins and membranes are described in subsection 10.4.8.

The condensate polishing system includes mixed bed ion exchanger vessels for purification of the condensate as described in subsection 10.4.6. Should the resins become radioactive, the resins are transferred from the condensate polishing vessel directly to a temporary processing unit or to the temporary processing unit via the spent resin tank. The processing unit, located outside of the turbine building, dewaters and processes the resins as required for offsite disposal. Radioactive condensate polishing resin will have very low activity. It will be disposed in containers as permitted by DOT regulations. After packaging, the resins may be stored in the radwaste building. Based on a typical condensate polishing system operation of 30 days per refueling cycle with leakage from the primary system to the secondary system, the volume of radioactively contaminated resin is estimated to be 206 cubic feet per year (one 309 cubic foot bed per refueling cycle). Normal disposal of nonradioactive condensate polishing system resins is described in subsection 10.4.6.

The parameters used to calculate the activities of the steam generator blowdown solid waste and condensate polishing resins are given in Table 11.4-1. Based on the above volumes, the disposal volume is estimated to be 939 cubic feet per year. The expected and maximum activities of the resins as generated are given in Tables 11.4-6 and 11.4-7, respectively. The expected and maximum activities of resins as shipped, based on 90 days decay prior to shipment, are given in Tables 11.4-8 and 11.4-9, respectively.

11.4.2.2 Component Description

The seismic design classification and safety classification for the solid waste management system components are listed in Section 3.2. The components listed are located in the Seismic Category I Nuclear Island. Table 11.4-10 lists the solid waste management system equipment design parameters. The following subsections provide a functional description of the major system components.

11.4.2.2.1 Spent Resin Tanks

The spent resin tanks provide holdup capacity for spent resin and filter bed media decay before processing. One spent resin tank can hold high activity chemical and volume control system resins for 59 and 29 months at expected and maximum generation rates, respectively. 2
The other tank can hold other spent resin and bed media for 14 and 2 months at expected and maximum generation rates, respectively. When high- and low-activity resins must be mixed may
to limit the radioactivity concentration in the waste containers to 10 Ci/ft^3 in accordance with the USNRC Technical Position on Waste Form (Reference 6), the maximum spent resin holdup times prior to processing are estimated to be approximately 11.8 months and 1.7 months for expected and maximum generation rates, respectively. 2

Resin mixing capability is provided by mixing eductors in each tank, and resin dewatering, air sparging and complete draining capabilities are also provided. The ultrasonic level sensors and dewatering screens are arranged for remote removal. The vent and overflow connections have screens to prevent the inadvertent discharge of spent resin.

11.4.2.2.2 Resin Mixing Pump

The resin mixing pump provides the motive force to fluidize and mix the resins in the spent resin tanks, to transfer water between spent resin tanks, to discharge excess water from the spent resin tanks to the liquid waste processing system, and to flush the resin transfer lines.

11.4.2.2.3 Resin Fines Filter

The resin fines filter minimizes the spread of high-activity resin fines and dislodged crud particles by filtering the water used for line flushing or discharged from the spent resin tanks to the liquid waste processing system.

11.4.2.2.4 Resin Transfer Pump

The resin transfer pump provides the motive force for recirculation of spent resins via either one of the spent resin tanks for mixing and sampling, for transferring spent resin between tanks, and for blending high- and low-activity resins to meet the specific activity limit for disposal. The resin transfer pump is also used to transfer spent resins to a waste container in the fill station or in its shipping cask located in the auxiliary building rail car bay.

11.4.2.2.5 Resin Sampling Device

The resin sampling device collects a representative sample of the spent resin either during spent resin recirculation or during spent resin waste container filling operations. A portable shielded cask is provided for sample jar transfer.

accumulates in the container. The resin dewatering pump discharges the water to the recirculation line. The water flows back to the spent resin tank, thereby preserving the water inventory in the system and retaining any resin fines or dislodged crud within the system.

The resin mixing pump can be stopped at any time during the filling operation. When the solids level nears the top of the container, as detected by level sensors and observed by a television camera, the fill valve is closed and cycled to top off the container. Excessive water or solids level automatically closes the fill valve.

When the filling operation is complete, the line flushing sequence controller is manually initiated to automatically operate the pumps and valves to flush the resin transfer lines back to the spent resin tank. The container fill valve is opened for a short time period to flush the remaining resin to the waste container. The resin mixing pump supplies filtered flush water from the spent resin tank. The portable dewatering system's dewatering pump is operated periodically until no further dewatering flow is detected by the pump discharge pressure indicator and/or audible indications from the pump.

11.4.2.3.2 Spent Filter Processing Operations

A filter transfer cask is used to change the higher-activity filters of the chemical and volume control system and spent fuel cooling system. The filter vessel is drained, and the filter cover is opened remotely. The shield plug of the port over the filter is removed and the transfer cask, without its bottom shield cover, is lifted and positioned on the port directly over the cartridge in the filter vessel.

A grapple inside the transfer cask is remotely lowered and connected to the filter cartridge. The cartridge is lifted into the transfer cask, and the cask is transferred over plastic sheeting to the bottom shield cover. The dose rate of the cartridge is measured with a long probe, and the cask is lowered onto and connected to the bottom shield cover. The transfer cask is then moved to the auxiliary building rail car bay.

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If recent applicable sample analysis results are available, the filter cartridge can be loaded directly into a disposal container as described in the following paragraph. If analysis is required, a sample of the filter media is obtained through a port in the transfer cask. The filter cartridge is placed in a high-activity filter storage tube until sample analysis results are available. The transfer cask bottom cover is disconnected, the transfer cask is lifted by the crane and transferred to a position over one of the temporary storage tubes, and the spent filter cartridge is lowered into the tube. After moving the transfer cask away, the crane is used to install a shield plug onto the storage tube. Any water draining from the filter during storage collects in the storage tube which may be drained to a floor drain for subsequent transfer to the liquid radwaste system.

When sample analysis is complete and packaging requirements are established, the transfer cask is used to retrieve the spent cartridges from storage and deposit them into a waste container via a port in the top of a portable processing and storage cask. Plastic coverings are removed and the container is capped, smear-surveyed, and decontaminated as required,

Table 11.4-1

ESTIMATED INFLUENT ACTIVITY PARAMETERS

Source	Expected Generation (ft^3/yr)	Expected Shipped Solid (ft^3/yr)	Maximum Generation (ft^3/yr)	Maximum Shipped Solid (ft^3/yr)
Primary Resins	250(2)	314.8	1060(4)	1334
Primary Filters	3.6(3)	24.5	6.5(3)	48.1
Compactible Dry Waste	4101	872.7	6265	1336
Non-Compactible Solid Waste	233.7	373.2	910	567.3
Mixed Liquid and Chemical Waste	370	44.3	740	88.3
Condensate Polishing Resin(1)	0	0	206(5)	259.4
Steam Generator Blowdown(1) Material (Resin and Membrane)	0	0	540(5)	680

Notes:

1. Radioactive secondary resins and membranes result from primary to secondary systems leakage (e.g., SG tube leak)
2. Estimated activity basis is ANSI 18.1 source terms in reactor coolant
3. Estimated activity basis is breakdown and transfer of 10% of resin from upstream ion exchangers
4. Reactor coolant source terms corresponding to 0.25% fuel defects
5. Estimated activity basis from Table 11.1-5, 11.1-7 and 11.1-8 and a typical 30 day process run time, once per refueling cycle

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Table 11.4-1 ESTIMATED SOLID RADWASTE VOLUMES

Source	Expected Generation (ft^3/yr)	Expected Shipped Solid (ft^3/yr)	Maximum Generation (ft^3/yr)	Maximum Shipped Solid (ft^3/yr)
WET WASTES				
Primary Resins (includes spent resins and wet activated carbon)	250[2]	315	1060[4]	1334
Chemical	350	20	700	40
Mixed liquid	15	17	30	34
Condensate Polishing Resin[1]	0	0	206[5]	259
Steam Generator Blowdown[1] Material (Resin and Membrane)	0	0	540[5]	680
Wet Waste Sub-Totals	615	352	2536	2347
DRY WASTES				
Compactible Dry Waste	4101	873	6265	1336
Non-Compactible Solid Waste	234	373	910	567
Mixed Solid	5	7.5	10	15
Primary Filters (includes high activity and low activity cartridges)	3.6[3]	24.5	6.5[3]	48
Dry Waste Sub-Totals	4344	1278	7192	1966
TOTAL WET & DRY WASTES	4959	1630	9728	4313

Notes:

1. Radioactive secondary resins and membranes result from primary to secondary systems leakage (e.g., SG tube leak)
2. Estimated activity basis is ANSI 18.1 source terms in reactor coolant
3. Estimated activity basis is breakdown and transfer of 10% of resin from upstream ion exchangers
4. Reactor coolant source terms corresponding to 0.25% fuel defects
5. Estimated activity basis from Table 11.1-5, 11.1-7 and 11.1-8 and a typical 30 day process run time, once per refueling cycle