Radioactive Waste Volume Reduction System

Topical Report No. AECC-2-NP, Amendment 2
August 10, 1984

Prepared For:
Office of Nuclear Reactor Regulation
Division of Reactor Licensing
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Aerojet
Energy Conversion
Company

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Aerojet Energy Conversion Company
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Proprietary information has been deleted from this report and is presented in the companion proprietary report, Amendment 2 to Topical Report No. AECC-2-P. The information deleted from this report is:

(1) Figure 9. Material Balance Flow Diagram for the AECC VR System

(2) Figure 10. Piping and Instrumentation Diagram for the AECC VR System

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LIST OF FIGURES

*Figures 1 through 8 are contained in the Topical Report No. AECC-2-P(NP) and Amendment 1 to AECC-2-P(NP).

LIST OF TABLES

*Tables 1 through 39 are contained in the Topical Report No. AECC-2-P(NP) and Amendment 1 to AECC-2-P(NP)

NRC QUESTIONS AND AECC RESPONSES CONCERNING TOPICAL REPORT NO. AECC-2-P(NP) AND AMENDMENT 1 TO AECC-2-P(NP)

41. How can the operator of the VR System ensure that the quantity of halogenated plastics in the feed to the incinerator is limited to 1% by weight and the heat rate is limited to 700,000 Btu/hr?

RESPONSE:

It is the responsibility of the utility to limit the quantity of halogenated plastics to 1% by weight by imposing administrative limitations.

The combustible feedrate to the dry waste processor is adjusted to maintain the excess oxygen content in the dry waste processor exhaust at about 10-12%, as recorded on O_2R 107. This corresponds to 700,000 Btu/hour heat release rate since all of the air flowrates to the incinerator are controlled or regulated to maintain a uniform gas velocity in the vessel. High and low oxygen concentration alarms are provided to alert the operator to adjust the feedrate as necessary. The adjustment consists of adjusting the speed of the trash feed screws via controllers SC126 or SC127.

42. The AECC response to Question 34 provided the concentration of various off-gases following incineration of contaminated oil. What is the impact of scrubbing actions on the concentration of these off-gases and on the generation of acids in the off-gas stream? (Q34)

RESPONSE:

The contaminated oil that was incinerated consisted by weight of 88% 30-weight oil, 10% hydraulic fluid (ISO Grade 32), 1% water, and 1% particulate. The oil contained 0.23% weight sulfur.

After the off-gases leave the dry waste processor, they are combined with and diluted by the off-gas from the dryer. In the specific test in the full-scale prototype VR System cited in Question 34, those off-gases were also diluted with some additional air to cool the dry waste processor off-gases. Thus, each volume of off-gases resulting from the incineration of contaminated oil was effectively diluted with approximately 2.6 ± 0.3 volumes of air by the time the off-gases exited the gas/solids separator (S-1). The gas stream was not sampled at that point, but was calculated to have the composition shown in the second column of Table 40.

The off-gas was sampled and analyzed after the first stage of scrubbing, i.e., at the discharge of the S-2 scrubber/preconcentrator. The results are summarized in the third column of Table 40 and indicate that the scrubbing action did not change the off-gas composition to a statistically significant degree. It is suspected, however, that the scrubbing did remove some of the trace acid gases present (i.e. SO_2 and NO_2), but the analytical methods were not sufficiently accurate and sensitive to detect the anticipated changes in their concentrations.

The off-gas was also sampled and analyzed for only SO_x at the inlet to the F-1 filter/adsorber. That analysis indicated that SO_x was not detectable at the probable limit of detectability for the method employed (approximately 0.05 ppm).

From the calculations and chemical analyses cited in Table 40, it is concluded that the scrubbing action: (1) reduces the SO_x concentration in the off-gas to an extremely low value, <0.05 ppm, (2) has only a minor or insignificant effect on NO_x concentration since the NO_x is present primarily as the low-solubility species, NO, and (3) has no significant effect on the other gas components. The presence or absence of

42. Response (cont.)

acids per se in the off-gas stream was not evaluated experimentally. Acids are, however, deduced to be absent for all practical purposes at the inlet to the filter/adsorber in view of the extremely low concentration of acid precursors in the off-gas and the caustic nature of the scrub liquor (pH > 10.5) and condensate (pH > 8) circulating in the first and second stage scrubbers, respectively.

TABLE 40

OFF-GAS COMPOSITION WHEN BURNING CONTAMINATED OIL

	Off-Gas Composition at Various Process Locations (dry basis)		
Component	S-1 Discharge (Calculated) [a]	S-2 Discharge (Measured) [a]	F-1 Inlet (Measured)
CO, ppm	5.5 ± 5.5	20 ± 20	NM [b]
CO_2, % volume	1.54 ± .13	1.47 ± 0.1	NM [b]
O_2, % volume	18.8 ± 0.2	18.8 ± 0.2	NM [b]
NO, ppm	7.9 ± 0.9	8.6 ± 2	NM [b]
NO_x, ppm	8.2 ± 0.9	6.2 ± 2	NM [b]
SO_x, ppm	0.3 ± 0.3	1.1 ± 1	< 0.05 [c]
Hydrocarbons, ppm	0.7 ± 0.6	2.7 ± 2	NM [b]

a. Values following the ± represent the probable uncertainties in the calculated or measured values.

b. NM indicates a value was not measured, but is presumed to be essentially the same as given in the preceding column.

c. SO_x could not be detected at the probable limit of detectability (approximately 0.05 ppm).

43. AECC states, in the response to Question 35, that the processing rate for a 20% sodium sulfate solution is 30 gph and indicates that the data in Table 35 of the response to Question 35 is the basis for this information. This conclusion does not seem to follow from the data presented in Table 35. Please explain your basis for the 30 gph. (Q35)

RESPONSE:

The stated system processing rate of 30 gph for a 20% wt sodium sulfate feed solution is based on the results of a VR prototype system test, specifically on Run 310b which is cited in Table 35. Run 310b was a nominal 21-hour test to determine dryer capacity. The test results were as follows:

(1) The dryer processed scrubber-preconcentrated-feed containing an average of 28.2% wt solids (sodium sulfate) at an average rate of 24.9 gph which corresponded to an average gross solids feed rate to the dryer of 73.1 lb solids/hr.

(2) The average per-pass recovery of solid product from the dryer and gas-solids separator was 86.9% which corresponded to a net average dryer production rate or capacity of 63.5 lb/hr.

Because of the automatic feed preconcentration feature of the VR System, feed concentrations and feed rates to the system can vary over a wide range while the dryer capacity (in terms of pounds of dry solids produced per hour) remains constant. Thus, the net dryer capacity of 63.5 lb of solids/hr cited above is translatable into a wide range of system feed rates and feed concentrations that correspond to a net sodium sulfate input rate of 63.5 lb/hr. Some of the combinations of system feed rate and feed concentration that correspond to the demonstrated dryer capacity of 63.5 lb sodium sulfate/hr are given in Table 41.

Note that the claimed processing rates for sodium sulfate wastes given in the response to Question 35, i.e. 69 gph for solutions containing 10% wt Na_2SO_4 and 30 gph for solutions containing 20% wt Na_2SO_4, are similar to, but slightly less than, the demonstrated equivalent capacities listed in Table 41. Specifically, 30 gph at 20% wt Na_2SO_4 represents a production of 60 lbs per hour dry Na_2SO_4, somewhat below the value of 63.5 lbs per hour for 20% wt Na_2SO_4 shown in Table 41.

43. Response (cont.)

TABLE 41

EQUIVALENT SYSTEM CAPACITIES ON SODIUM SULFATE FEEDS BASED ON DEMONSTRATED DRYER CAPACITY IN RUN 310b

System Capacity on Various Na_2SO_4 Solutions		Feed Density at 140°F (60°C),	Na_2SO_4 Input Rate,
GPH	% wt Na_2SO_4	lb/gal	lb/hr
70.9	10	8.953	63.5
45.3	15	9.349	63.5
32.5	20	9.761	63.5
24.9	25	10.20	63.5

44. In the response to Question 40, AECC indicated that they limit the concentration of sulfur and chlorides in incoming dry active waste. How is this done? How are the concentrations in contaminated oil limited? (Q40)

RESPONSE:

This question is similar to Question 41. It is the responsibility of the utility to limit the concentration of sulfur and chlorides in dry active waste and contaminated oil by imposing administrative limitations.

45. In the response to Question 21, AECC indicated that decontamination of the trash hopper (H-3A and H-3B) is accomplished by vacuuming and that if the feed screw fails, the shredded trash can be manually shoveled from the hopper. This manual shoveling of this waste is not consistent with the guidelines of Regulatory Guide 8.8. The response, which addressed the bed storage and transfer hopper (H-4) stated that the hopper is decontaminated by pneumatically conveying the bed material to the dry waste hopper or the fluid bed dryer. Why would the Al_2O_3 bed material be sent to the fluid bed dryer? The mechanical transfer of the storage hopper contents cannot be considered a decontamination process. Other means of decontaminating the hopper should be provided. (Q21)

RESPONSE:

Decontamination of the trash hoppers (H-3A and H-3B) is accomplished in the following manner:

a. Screw conveyor operable - Screw convey the shredded trash out of the hopper into a temporary container. Vacuum any residual material from the hopper.

b. Screw conveyor inoperable - Vacuum the entire contents from the hopper. This is possible due to the nominal 1/2" x 1/2" dimensions of the shredded trash.

Removal of the shredded trash by vacuuming represents a very effective decontamination procedure and also minimizes the chance for dust in the trash to become airborne. This vacuuming procedure was successfully demonstrated on several occasions at the AECC VR System full-scale prototype facility. The actual procedure utilized is the responsibility of the utility.

The original response to Question 21 which addressed the H-4 bed storage and transfer hopper stated that the hopper is decontaminated by pneumatically conveying the bed material to R-3 (the dry waste processor vessel) or R-1 (the fluid bed dryer), not the dry waste hopper or fluid bed dryer, as restated in Question 45. The alumina (Al_2O_3) bed material is transferred to the dry waste processor vessel (R-3) if the bed is to be reused. It is transferred to the fluid bed dryer (R-1) only for final disposal via the packaging system. The fluid bed dryer provides the most direct transfer route to the packaging system. Such a transfer will remove almost all of the activity from the H-4 hopper and will effect substantial decontamination even though such an action may not, strictly speaking, be termed a "decontamination process". If further "decontamination" should be required, the hopper can be vacuumed via its flanged fill port.

46. Why was the recirculation rate to the venturi scrubber increased by a factor of two from previous mass balances? How has this increase affected the erosion rate of the piping and the venturi scrubber? Has the amount of liquid in the sump of the scrubber preconcentrator been increased? (Q6)

RESPONSE:

The liquid recirculation rate to the scrubber/preconcentrator must be increased from the nominal rate when the system is operated in the dryer only mode. The overall gas flowrate and temperature to the scrubber is lower even if the dry waste processor gas flowrate remains the same because the lack of combustion products, water cooling flows, and reduced temperature, will reduce the gas velocity. In order to maintain the same differential pressure across the venturi which will maintain the system DF, the recirculation liquid rate must be increased to offset the reduced gas flowrate.

Since the pressure drop across the venturi remains the same, the velocity through the venturi will be about the same. Consequently, there is no reason for an increase in erosion. In general, erosion in pipelines occurs at liquid velocities approaching 9 to 10 feet per second. The maximum velocity at 30 gpm liquid recirculation rate is 6.8 feet per second which is well below the erosion velocities. Refer to Figure 9, which is the current Material Balance Flow Diagram for the AECC VR System (AECC Drawing No. 1190500, Rev. F, 2 sheets). In Figure 9, the nominal flowrate, represented by line "CC" is 23.3 gpm which corresponds to a velocity of 5.3 feet per second. This is the flowrate at which the system will be operating for more than 75% of the duty cycle.

The amount of liquid in the sump of the scrubber preconcentrator has not changed.

46. Response (cont.)

Figure 9. Material Balance Flow Diagram for the AECC VR System
(AECC Drawing No. 1190500, Revision F, Sheet 1 of 2)

46. Response (cont.)

Figure 9. Material Balance Flow Diagram for the AECC VR System
(AECC Drawing No. 1190500, Revision F, Sheet 2 of 2)

47. From the mass balance provided in response to Question 20, it appears that approximately 80% of the mass of liquid in the stream to the condenser, indicated as I, is condensed rather than 90% as stated in the response to Question 18. Discuss this change and its impact upon system performance. (Q18 and 20)

RESPONSE:

As the cooling water inlet temperature increases, the differential temperature between the condensing vapor and the cooling water decreases, which causes a decrease in the amount of water condensed. The mass balance provided in response to Question 20 used a worst-case cooling water temperature of 110°F. For this case, only 80% of the water vapor was condensed. If the cooling water temperature is 80°F, which is the nominal value, 90% of the water vapor will be condensed. There is no impact on overall system performance. At either condensation rate there is sufficient condensate produced for (1) dilution of the liquor in the scrubber/preconcentrator, and (2) cooling of the dry waste processor.

48. Can the dry waste processor incinerate dry activated waste and oil at the same time? How is the heat content of the feed limited to 700,000 Btu/hr if both are incinerated together?

RESPONSE:

The processor can incinerate DAW and oil simultaneously at combined feed rates corresponding to a heat release of about 700,000 Btu/hr. The DAW and oil feeds are individually controllable by adjusting the speeds of the trash feed screws via controllers SC126 or SC127, and the speed of the contaminated oil pump via the variable speed transmission on its drive assembly. The total feed is maintained at about 700,000 Btu/hr by adjusting either or both of the feeds so that the oxygen concentration in the freeboard of the processor as recorded on O_2R 107 is in the range of 10-12% volume.

49. Table 30 of Amendment 1 to Topical Report No. AECC-2-NP (P) provides the expected volumes of waste to be processed by the AECC VR System. We believe that the values presented in this Table are low by at least 20%. No response is required.

RESPONSE:

No response is required.

50. Your response to Question 3 in Amendment 1 only addresses the anticipated levels of contamination of the refractory liner of the incinerator vessel based upon incineration of dry active wastes. What are the levels when contaminated oil is incinerated? (Q3)

RESPONSE:

AECC has not conducted long-term contaminated oil incineration tests to determine contamination levels of the refractory liner. However, AECC anticipates the level of contamination of the refractory liner due to the incineration of oil to be substantially less than due to the incineration of dry active wastes for the following reasons:

a. The expected annual volume of oil is only 460 cubic feet for a BWR and 80 cubic feet for a PWR (Reference 8). By comparison, the expected annual volume of DAW is much larger, 7,800 cubic feet for a BWR and 7,600 cubic feet for a PWR (see Table 30).

b. The expected activity of the contaminated oil is only 10^{-3} μCi/cc, or about 0.01 Ci per year (Reference 8). By comparison, the expected annual activity of the DAW is about 5 Curies per year (see Table 30).

c. The combustion rate for contaminated oil is about 30 lbs per hour, whereas for DAW it is about 100 lbs per hour.

51. Has AECC written a service manual or some similar document describing the maintenance to be performed on the VR System and the schedule for performing such maintenance? Will this manual be provided to the purchaser as part of the normal contract?

RESPONSE:

Yes. AECC has written an Operation and Maintenance Manual which is provided to the purchaser as part of the normal contract. A maintenance section is included in the manual. A copy of the Table of Contents Section 3, Preventive Maintenance, is included below. In addition, all vendor data concerning their components, including repairs and recommended spare parts are included in a separate book.

51. Response (cont.)

TABLE OF CONTENTS (cont.)

52. What is the frequency of service on the centrifugal pumps P-1, P-3, P-5 and P-8 listed in Table 32?

RESPONSE:

The frequency of service is once per year.

53. Are 160 man-hours required to inspect and service the trash shredder and, if it is, does this necessitate an outage of greater than 2 weeks?

RESPONSE:

The necessary inspection and servicing of the trash shredder will require three to four maintenance personnel, working 4 to 5 days. Consequently, the maintenance can be accomplished during the 2 week outage.

54. Should the production rate for a feed stream consisting of 80% sodium metaborate and 20% sodium sulfate have a bed production rate of approximately 34 lbs/hr and a fines production rate of approximately 26 lbs/hr?

RESPONSE:

No. The production rate of fines is greater than the production rate of bed material when drying a mixed feed stream consisting of 80% sodium metaborate and 20% sodium sulfate as indicated in the response to Question 10. Note that the production rate of fines from the drying of a mixed sodium metaborate/sodium sulfate (80/20, wt) feeo is higher than it is when drying either of the pure component feeds. Generally, mixed dryer feeds yield higher proportions of the total dry product as fines than do the pure components. Also, contamination of a feed with organics such as oils and detergents is conducive to increased fines production.

55. The response to Question 9 of Amendment 1 to Topical Report No. AECC-2-P (NP) states that the AECC VR System complies with Regulatory Guide 1.143, October 1979. Regulatory Position 1.2 of this guide discusses the requirements to prevent uncontrolled releases of liquids. Items discussed include level indicators, alarms, and routing of spills to the liquid radwaste system. Based upon a visit to Byron, neither the design nor the as-built system seem to comply with these requirements, e.g., contaminated oil storage tank. The system design and the as-built system at Byron should be modified to comply with this regulatory position. (Q9)

RESPONSE:

The design of the contaminated oil storage tank has been modified to comply with Regulatory Position 1.2 of Regulatory Guide 1.143. The modifications are as follows:

1. Low-level switch, indicator, and alarm have been added to the tank.
2. High-level switch, indicator, and alarm have been added to the tank.
3. The curbing surrounding the contaminated oil tank has been increased in height so that the contained volume due to a potential tank overflow is equal to the contaminated oil tank volume, i.e., 150 gallons.

The design of the contaminated oil tank system does deviate from Regulatory Position 1.2 in one respect, i.e., no provision has been made to route oil spills to the liquid radwaste treatment system. Introduction of contaminated oil to the liquid radwaste treatment system could cause a wide variety of problems with downstream equipment. In the event of a contaminated oil tank overflow, the plan is to pump the oil contained by the curb directly into a 55-gallon drum or directly back into the contaminated oil tank using a suitable portable pump.

56. Your response to Question 7 does not address the radioactivity associated with contaminated oil which will be incinerated nor does it address dry activated wastes. How effective will the hot water solution be in decontaminating the dry waste processor? (Q7)

RESPONSE:

The response to Question 7 stated that the majority of the radioactivity is associated with the liquid wastes rather than the dry active wastes or contaminated oil. Table 30 summarizes the expected annual activity from evaporator concentrates and dry active wastes and illustrates this point. The annual activity from dry active wastes is a small fraction of the annual activity from evaporator concentrates. Furthermore, the expected annual activity from contaminated oil is only 0.01 Ci (Reference 8).

There is no provision to decontaminate the dry waste processor with water. The flyash remaining after the combustion of dry active wastes and oil is carried out of the vessel as fines. This flyash is not sticky and does not cling to the walls of the vessel. Data for the TRECAN incinerator at Ontario Hydro revealed that very little activity remains on the refractory section of their vessel. Because of the low activity inside the vessel and the shielding provided by the two rows of refractory brick, the hardware around the vessel can be serviced, inspected and repaired without decontaminating the vessel.

In the event that access to the dry waste processor is required, the unit can be operated empty with high air flow through the vessel to convey the dust to the scrubber/preconcentrator. A top mounted port is provided to allow vacuuming of the internal walls and a full diameter access flange is located at the bottom of the vessel.

57. Your response to Question 28 indicated that the quality of the condensate from the condenser was only slightly affected by the addition of a second venturi scrubber. Doubling the solids concentrations from 150 ppm to 300 ppm can hardly be considered to be slightly affecting the quality. Clarify your response to Question 28 to demonstrate that the addition of the second venturi scrubber has not affected the quality of the condensate.

RESPONSE:

The AECC response to Question 28 was in error. The addition of the second venturi scrubber increases the solids concentration of the condensate to a maximum level of approximately 200 ppm, not 300 ppm, as previously stated. Ten condensate samples from various tests in the full-scale prototype VR System during the period September 1980 - September 1982 were analyzed and found to have total solids contents in the range of 88-203 ppm (average = 154, standard deviation = 38). Thus, the test data have shown that condensate quality has not decreased significantly with the modification to the off-gas scrubbing system. Note also that the condensate produced by the VR System is either used directly within the VR System or sent to the power plant's liquid waste evaporators for reconcentration and returned to the VR System for reprocessing.

58. Why aren't the flow rates, Items B, K, V and X, in Figure 8A, zero?

RESPONSE:

Gas flows are maintained to the dry waste processor via streams K, V, and X even when operating in the Fluid-Bed-Dryer-Only mode of operation to provide a nearly constant gas flow through the off-gas cleanup system. Stream B provides the secondary gas flow to the gas/solids separator which is necessary to keep it operating efficiently. Similarly, the nearly constant total gas flows through the first-and second-stage venturi scrubbers (streams H and I, respectively) are necessary to maintain their normal operating pressure drops and efficiencies.

59. It is the staff's position that decontamination solutions containing organics should not be processed in evaporators unless the plant has a chemical oxygen demand monitor (COD). The reason being that, in the past, the decontamination solutions sent to various radwaste treatment systems have been recycled to reactor water storage tanks. When the organics made it into the reactor, the organics decomposed and played havoc with reactor instrumentation, e.g., incidents at the Brunswick and Hatch plants. AECC should address how they recommend the handling of their decontamination solutions.

RESPONSE:

There is no intent to use organic decontamination solutions with the VR System. Water is adequate for decontamination. The resulting decontamination solutions can be routed to the radwaste evaporators for processing. However, it is the responsibility of the utility to make the final selection of decontamination solutions, compatible with the VR System and the balance of plant.

60. The response to Question 33 is inadequate. The response did not clarify Table 20 as to what parameters are being monitored and it did not clarify which parameters control the process, including shutting it down. (Q33)

RESPONSE:

Table 20 has been revised to include these parameters and identifications as follows: (see next page)

TABLE 20
AECC VR SYSTEM PROCESS CONTROLS AND ALARMS

Parameters	Process Function	Alarms	Shutdown/Override
R-1 Dryer Fluidizing Air	Air Flow Control	Hi/Lo	--*
R-1 Dryer Wind Box	Monitoring System Pressure	Hi/Lo	Process Shutdown
R-1 Dryer Distributor Plate	Monitoring Pressure Drop	Hi	--*
R-1 Dryer Bed	Bed Level Control	Hi/Lo	--*
R-1 Dryer Bed	Bed Temperature Control	Hi/Lo	Hi E-3 Bed & E-1 Air Heaters (off) Lo P-2 Dryer Feed Pump (off)
S-2 Venturi Scrubber	Monitoring Pressure Drop	Hi/Lo	--*
S-2 Preconcentrator Sump	Density Control	Hi/Lo	Hi P-4 Waste Feed Pump (off) Lo P-2 Dryer Feed Pump (off)
S-2 Preconcentrator Sump	Level Control	Hi/Lo	Hi/Hi P-4 Waste Feed Pump (off)
S-1 Separator	Monitoring Pressure Drop	Hi/Lo	--*
P-2 Dryer Feed Pump Discharge	Monitoring Outlet Pressure	Hi/Lo	P-2 Dryer Feed Pump (off)
P-4 Waste Feed Pump Discharge	Monitoring Outlet Pressure	Hi/Lo	P-4 Waste Feed Pump (off)
F-3 Feed Filter Back Flush	Monitoring Pressure Drop**	Hi/Lo	
E-3 Bed Heaters	Monitoring Element Temperature**	Hi	Hi E-3 Heaters EC-16 (off)
E-1 Air Heaters	Temperature Control	Hi/Lo	Hi E-1 Heater EC-17 (off)
E-2 Gas Heaters	Temperature Control	Hi/Lo	Hi E-2 Heater EC-18 (off)
P-5 Condensate Pump Discharge	Monitoring Outlet Pressure	Hi/Lo	Process Shutdown
R-1 Feed Nozzle Atomizing Air	Monitoring Pressure/Flow	Hi/Lo	Process Shutdown
R-1 Feed Nozzle Face Air	Monitoring Pressure/Flow	Hi/Lo	Process Shutdown
T-1 Waste Feed Tank pH	Monitoring pH in Waste Feed	Hi/Lo	Hi P-6 Caustic Pump (off) Lo P-2 Waste Feed Pump (off)
T-4 Waste Feed Tank pH	Monitoring pH in Waste Feed	Hi/Lo	Hi P-6B Caustic Pump (off) Lo P-2 Waste Feed Pump (off)
S-2 Scrubber/Preconcentrator Sump pH	Monitoring pH in Scrubber/Preconcentrator	Hi/Lo	Hi/Lo P-2 Dryer Feed Pump (off)

TABLE 20 (Continued)
AECC VR SYSTEM PROCESS CONTROLS AND ALARMS

Parameters	Process Function	Alarms	Shutdown/Override
R-1 Dryer Bed Transfer Air	Monitoring Air Flow	Lo	Bed Transfer Valve (off)
F-1A Pre-Filter	Monitoring Pressure Drop**	Hi	
D-1A Adsorber and F-28 Filter	Monitoring Pressure Drop**	Hi	
F-1B Pre-Filter	Monitoring Pressure Drop**	Hi	
D-1B Adsorber and F-2B Filter	Monitoring Pressure Drop**	Hi	
S-2 Preconcentrator Demister	Monitoring Pressure Drop**	Hi	
H-2 Hopper	Monitoring Temperature**	--	Hi ROV-541 Rotary Air-Lock (off)
C-3 Air Blower Bearing Vibration	Monitoring Bearing Wear**	Hi	--
T-1 Liquid Waste Tank	Monitoring Level	Hi/Lo	Lo Stops Waste Feed to System
T-4 Liquid Waste Tank	Monitoring Level	Hi/Lo	Lo Stops Waste Feed to System
T-2 Caustic Tank	Monitoring Level	Hi/Lo	Lo Caustic Pump P-6A&B (off)
T-8 Decon Tank	Monitoring Level	Lo	Lo Decon Pump P-8/Heater E-52 (off)
T-1 Liquid Waste Tank	Controlling Temperature	Lo	--
T-4 Liquid Waste Tank	Monitoring Temperature	Lo	--
Tramp Metal	Monitoring Metal Size	Hi	--
R-3 Incinerator Fluidizing Air	Flow Control	Hi/Lo	Lo Heater E-4 (off)
R-3 Incinerator Pneumatic Feed of Dry Active Waste	Flow Control	Lo	Lo Trash Feed Train Shutdown
R-3 Incinerator Wind Box	Monitoring Pressure	Hi/Lo	Lo Waste Feed (off)
R-3 Incinerator Distribution Plate	Monitoring Pressure Drop	Hi	--
R-3 Incinerator Bed	Monitoring Bed Level	Hi/Lo	--
R-3 Incinerator Gas Outlet	Monitoring Oxygen Concentration	Hi/Lo	--
R-3 Incinerator Bed	Temperature Control	Hi/Lo	Lo/Lo Trash Feed Shutdown
H-3A and B Trash Hoppers	Monitoring Level	Hi/Lo	Lo/Lo Trash Feed Shutdown

TABLE 20 (Continued)
AECC VR SYSTEM PROCESS CONTROLS AND ALARMS

Parameters	Process Function	Alarms	Shutdown/Override
E-4 Startup Heater	Temperature Control	Hi	Hi G-4 Heater EC-111 (off)
H-4 Hopper	Monitoring Temperature**	Hi	Hi ROV-582 Rotary Air Lock (off)
C-2 Air Blower Vibration	Monitoring Bearing Wear**	Hi	--
R-3 Incinerator Gas Outlet	Temperature Control	Hi	Hi Trash Feed Shutdown
P-1 and P-7 Waste Recirculation Pump	Monitoring Outlet Pressure	--	--
P-3 Scrubber/Preconcentrator Recirculation Pump	Monitoring Outlet Pressure	--	--
T-5 Decon Tank	Monitoring Temperature	--	--
F-4 Gas Filter (Recycle)	Monitoring Pressure Drop	--	--
T-3 Contaminated Oil Tank	Monitoring Level	Hi/Lo	Hi Shut Inlet Valve Lo Stops P-9
P-9 Contaminated Oil Pump	Monitoring Pressure	--	--

* Can cause automatic shutdown by affecting fluid bed dryer windbox pressure.

** Switch - No indication.

61. In your response to Question 14 you stated that the concentration of dry active waste feed to the dry waste processor are limited to 1000 ppm sulfur and 5000 ppm chlorides. How is this done? How is the sulfur content in contaminated oil limited? What is the limit? (Q14)

RESPONSE:

This question is similar to Questions 41 and 44. It is the responsibility of the utility to limit the concentration of sulfur and chlorides in dry active wastes and the concentration of sulfur in contaminated oil by imposing administrative limitations.

The limit of sulfur content in the contaminated oil is 3000 ppm.

62. Your response to Question 22 addresses the decontamination of the fluid bed dryer and the activity associated with it. How about the remainder of the system? How much activity will be generated from decontamination? (Q22)

RESPONSE:

The response to Question 22 addressed the decontamination of the total system. A total system decontamination will yield approximately 1000 gallons of decontamination solution based on experience from the AECC full-scale prototype system. The total activity of the decontamination solution is only 0.005 Ci, which is based on a small amount of residual dry product, about 0.5 lbs in the complete system, being contacted by the decontamination solution. This dry product is a composite of bed material from the fluid bed dryer and a small amount of dry waste processor ash.

63. The failure of the off-gas system to include in its design the monitoring of certain parameters raises some questions as to whether the system is designed in accordance with ANSI/ASME N509-1980 as was stated in the response to Question 23. Missing is the following instrumentation:

Inlet or outlet	F(I, R, AH, AL)
HEPA (1st)	ΔP (I)
Charcoal	T(I, AH - 2nd stage)
HEPA (2nd)	ΔP (I)

ΔP = differential pressure
F = flow
T = temperature
I = indicator
R = record
AH = alarm high
AL = alarm low

RESPONSE:

The unit is designed to meet the intent of ANSI/ASME N509. However, this specification is very general and applies more to ventilation equipment than process air filters. Although AECC does not directly measure all of the above parameters, it does provide methods of indirect measurements with alarms/interlocks to allow efficient and safe use of the process filters. The method of indirect measurements and alarms for the parameters are as follows:

Inlet and Outlet Flow

While the flow to the filters is not measured, the flow to the total system is accurately measured, controlled, and alarmed. The major air flows, approximately 2/3 of the gas flow, are the fluidizing air to both the dryer and dry waste processor. These flows are indicated, recorded, and alarmed (high and low). Two other flows which constitute about 1/4 of the remaining gas flow are the pneumatic transfer air to convey trash to the incinerator and transfer air to convey dryer bed material to the cyclone. These flows are also indicated and controlled. The remaining gas flows are instrument air and nozzle atomization air and are indicated and adjusted on a twice

63. Response (cont.)

per shift basis. In this way the gas flow to the filters is indirectly monitored and controlled. In addition, the system acts much like a flow restriction, and as the gas flows are increased and decreased, the system pressure varies accordingly. This pressure is recorded and alarmed (high and low) to identify upset conditions.

HEPA (1st & 2nd) Differential Pressure

No indicator is provided. The filters are anticipated to last approximately 4 to 6 months, or longer, before approaching the maximum dust loading capability of the filter. The differential pressure across the first-stage HEPA filter and the differential pressure across the combined charcoal adsorber/second-stage HEPA filter are connected to high differential pressure alarms at the main control panel. The high pressure alarms are set at 75% of the maximum allowable differential pressure to provide ample time and reserve filter capacity to allow changeover. A parallel filter system is provided to allow quick changeover to the other system from the main control panel.

Charcoal Temperature - 2nd Stage

Each charcoal adsorber has a high temperature switch which alarms well below the ignition temperature of the charcoal. The inlet temperature of the gas is controlled, indicated, recorded, and alarmed by the temperature controller of the exhaust gas heater (E-2). The sensing element of this control system is located at the inlet of the filter system. In this manner AECC does indicate, record, and alarm the temperature of the charcoal adsorbers.

64. Has AECC made measurements of the off-gas when PVC's are incinerated to determine what the combustion products are? For example, is the major component Cl_2 or HCl? The off-gas concentration of chlorides will be a function of the scrubbing capability of the caustic solution on these compounds, whether a chemical reaction may occur with the scrub solution and the gas, and the combustion compounds from the incinerator. These items should be addressed in the determination of the potential corrosion effects of incineration of PVC's.

RESPONSE:

AECC has made test runs in the full-scale prototype dry waste processor at a bed temperature of 1500°F on simulated combustible wastes containing large amounts of PVC. The test feeds were: (1) a slurry of pure PVC powder in diesel containing 37.5% wt PVC, and (2) a composite trash containing approximately 25% wt PVC sheeting, 25% wt polyethylene sheeting, and 50% wt cardboard. The combustion products were analyzed in each case for certain products and found to be very similar, but the most complete analyses were performed when burning the diesel/PVC slurry feed. The average gas composition at the discharge of the dry waste processor when processing the PVC slurry feed is shown in Table 42.

The stream was not analyzed for HCl or Cl_2 because of the lack of appropriate instruments. However, the total concentration of chlorine in the stream was calculated, based on the known feed composition, to be approximately 0.59% vol (5900 ppm) as equivalent HCl (dry basis). Chemical equilibrium calculations at the processor operating conditions predict that the species HCl, Cl_2, and Cl should thus exist in approximately the following concentrations: 5874, 10, and 6 ppm, respectively. From the combination of chemical analyses and equilibrium calculations it is concluded that: (1) the dominant chlorine-containing combustion product of PVC is HCl, (2) Cl_2 and Cl are present in only trace quantities relative to HCl, and (3) halocarbons, phosgene ($COCl_2$), and vinyl chloride are not detectable even at low concentrations (see Table 42).

64. Response (cont.)

TABLE 42

GAS COMPOSITION AT THE EXIT OF THE DRY WASTE PROCESSOR WHEN PROCESSING A DIESEL/PVC SLURRY TEST FEED

Components	Concentration (dry basis)
O_2, % volume	12.8 ± 0.3
CO_2, % volume	5.9 ± 0.3
CO, ppm	27 ± 10
NO, ppm	14 ± 1
NO_x, ppm	15 ± 1
SO_x, ppm	29 ± 7
Hydrocarbons, ppm	12 ± 1
Halocarbons, ppm	< 0.3 [a]
Phosgene, ppm	< 0.04 [a, b]
Vinyl Chloride, ppb	< 0.75 [a]
HCl, Cl_2	Not analyzed

a. This species could not be detected at the limit of detectability by the method employed.

b. The Threshold Limit Value (TLV) for phosgene in the work place is 0.1 ppm according to the American Conference of Industrial Hygienists, 1975.

64. Response (cont.)

The normal feed to the dry waste processor is far more restricted with respect to chlorine (5000 ppm chloride limit) than the previously described test feed. Therefore, the equivalent HCl concentration should not exceed 300 ppm at the exit of the processor and, after cool down and mixing with the off-gas from the dryer, the concentration of chlorine-containing species should not exceed 125 ppm as equivalent HCl (see Response to Question 40). Depending upon whether the chemical equilibrium given by the equation below is assumed to be frozen at average processor operating conditions or to shift as the off-gas is cooled and diluted with dryer off-gas, the concentration of Cl_2 at the inlet to the first-stage venturi scrubber is calculated to be about 10 parts per **billion** or 10 parts per **trillion**.

$$2\ HCl + 1/2\ O_2 \rightleftharpoons H_2O + Cl_2$$

Thus, with the normal limit of 0.5% wt on the chlorine content of the dry waste processor feed, the concentration of HCl at the exit of the dry waste processor and at the inlet to the first-stage venturi scrubber should not exceed 300 and 125 ppm, respectively. The corresponding concentrations of the Cl_2 should not exceed 0.03 and 0.01 ppm. From these data, it is concluded that HCl is the only chlorine-containing species of significance in the off-gas upstream of the venturi scrubbers. The corrosion potential of this gas stream, the materials selection for components in that service, and the corrosion allowances for those components are addressed in the Response to Question 14.

The first stage of scrubbing will remove virtually all of the HCl from the off-gas stream as discussed in the Responses to Questions 40 and 65. Thus, the incineration of PVC's does not present an off-gas corrosion problem after the off-gases pass the throat in the first venturi scrubber. The HCl is removed from the gas stream in the first venturi scrubber by reaction with the caustic scrub liquor and is converted to chloride ion (Cl^-). The resulting concentration of Cl^- in the scrub liquor should not exceed 2500 ppm. The 316 stainless steel used in the scrub loop components shows very good corrosion resistance to such scrub liquors at the operating temperature and pH of the VR System.

65. In your response to Question 40, you estimated the concentration of HCl in the off-gas, based upon a comparison of the partial pressure of SO_2 and HCl and the relative concentration of SO_2 and HCl in the liquid phase. It is not apparent how this correlates. The HCl and the SO_2 are in the gas phase and are scrubbed and chemically react with the scrub solution. Since the mechanical action and the chemical reaction result in the SO_2 being in the liquid scrub solution, how can the concentration of Cl_2 or HCl in the gas phase, determined from the partial pressure, be considered representative? (Q40)

RESPONSE:

The removal of SO_2 and HCl from the off-gas in the venturi scrubber is roughly controlled by the combination of phase equilibria and chemical equilibria given below.

$$SO_2(g) + H_2O(1) \rightleftharpoons SO_2(aq) + H_2O(1) \rightleftharpoons SO_3^{-2}(aq) + 2H^+(aq) + H_2O(1)$$

$$HCl(g) + H_2O(1) \rightleftharpoons HCl(aq) + H_2O(1) \rightleftharpoons Cl^-(aq) + H^+(aq) + H_2O(1)$$

The first step in each set of equilibria represents the gas/liquid phase equilibrium for SO_2 and HCl, respectively. Those equilibria are quantitatively defined by the partial pressure data given in Table 37 which accompanied the Response to Question 40. The relative partial pressure data also given in Table 37 simply indicate that HCl has a far stronger tendency to dissolve in water than does SO_2. Thus, the first step of the equilibria is shifted much farther to the right-hand side in the HCl case. The second step in each equilibrium reaction represents the ionization of the dissolved acid gas species and shows the effect of H^+ concentration (pH) on the ionization reactions. It is widely recognized that HCl(aq) has a greater tendency to ionize than does SO_2(aq); therefore, the second step of the HCl equilibria is also shifted farther to the right-hand side than it is in the case of SO_2. This again indicates a stronger tendency for HCl removal than for SO_2 removal. The second step in each equilibrium shows that high H^+ concentrations (solutions with low pH's) inhibit the ionization reaction or, conversely, caustic solutions (those with high concentrations of OH^- and low concentrations of H^+) favor the ionization reactions. It should also be noted that the ionization of the SO_2(aq) species is dependent on the square of the H^+ concentration while the ionization of the HCl(aq) species is dependent on the H^+ concentration of the

65. Response (cont.)

first power. Thus, the effective scrubbing of HCl is less dependent on the pH of the scrub solution than is the case of scrubbing SO_2.

Although the preceding discussion does not permit a quantitative prediction of the concentration of HCl in the off-gas, the comparisons of several parameters which control SO_2 and HCl scrubbing effectiveness clearly indicate HCl should be much more completely scrubbed from the off-gas than is SO_2. The HCl concentration in the scrubbed off-gas is, therefore, expected to be lower than that of SO_2 by several orders of magnitude.

66. In AECC-1-P-A it was indicated that the fluid bed dryer system and equipment was designed for specific activity levels up to 40 μCi/cc in the concentrator feed system and the materials of construction, lubricants, and organics which are subject to continuous radiation exposure, are compatible with a lifetime dose of 10^7 rads. What is the lifetime dose limit for the materials of construction, lubricants, and organics in the AECC-2-P system, and for what specific activity levels was it designed?

RESPONSE:

The lifetime dose limit for non-metallic materials of construction, lubricants, and organics in the AECC-2-P system is also 10^7 rads. Metal components, however, would have a lifetime dose limit well above this level. In general, the AECC-2-P system is capable of processing wastes having specific activity levels up to 40 μCi/cc, which is based on 1% failed fuel. The expected level for evaporator concentrates is 0.18 - 1.81 μCi/cc, as shown in Table 30. The specific activity of the dry active wastes is expected to be very low, about 0.02 μCi/cc (Table 30).

As a result of the review of the P&ID's for the VR System, a number of questions concerning instrumentation and control have been raised. These questions follow:

67. Shouldn't ROV-553 at the product conveyor (R-2) be shown in the normally closed position? If not, what will prevent the conveyor from jamming since the material will fill the discharge line from R-2, and since the valve to the Stock processing unit is shown as closed?

RESPONSE:

Refer to Figure 10, which is the current P&ID for the AECC VR System (AECC Drawing No. 1190504, Rev. J, 6 sheets). Note that Sheet 6 identifies the equipment and instrumentation symbols shown on Sheets 1 through 5. The product conveyor is no longer a part of the system and has been deleted. Bed material is now intermittently removed from the fluid bed dryer vessel via a simple acceleration chamber. See Sheet 4 of Figure 10.

67. Response (cont.

Figure 10. Piping and Instrumentation Diagrams (P&ID) for the AECC VR System (AECC Drawing No. 1190504, Revision J, Sheet 1 of 6)

67. Response (cont.

Figure 10. Piping and Instrumentation Diagrams (P&ID) for the AECC VR System (AECC Drawing No. 1190504, Revision J, Sheet 2 of 6)

67. Response (cont.

Figure 10. Piping and Instrumentation Diagrams (P&ID) for the AECC VR System (AECC Drawing No. 1190504, Revision J, Sheet 3 of 6)

67. Response (cont.

Figure 10. Piping and Instrumentation Diagrams (P&ID) for the AECC VR System
(AECC Drawing No. 1190504, Revision J, Sheet 4 of 6)

67. Response (cont.

Figure 10. Piping and Instrumentation Diagrams (P&ID) for the AECC VR System (AECC Drawing No. 1190504, Revision J, Sheet 5 of 6)

67. Response (cont.

Figure 10. Piping and Instrumentation Diagrams (P&ID) for the AECC VR System (AECC Drawing No. 1190504, Revision J, Sheet 6 of 6)

68. Why wasn't a flow-indicating device placed in the piping from the dry waste processor to the gas/solids separator and from the fluid bed dryer to the gas/solids separator? Wouldn't you want to have this information?

RESPONSE:

The flows to the dryer and dry waste processor are accurately measured, controlled, and alarmed. The deviation in flow at the exhaust of these vessels due to process variations is less than 10%. The gas/solids separator has a wide range of operation without affecting its collection efficiency. AECC does not believe there is any need to directly measure the actual inlet gas flows to the gas/solids separator.

69. Isn't an instrument $\frac{TE}{29A}$ and $\frac{TE}{29B}$ required for D-1?

RESPONSE:

TSH/29A and TSH/29B are gas filled temperature switches which are used to alarm high temperature in the charcoal adsorbers. Since these switches are preset at the manufacturer, there is no temperature element TE/29A and TE/29B.

70. What instrumentation exists on the trash hoppers H-3A and H-3B?

RESPONSE:

The hoppers are identical and contain the following instrumentation:

a. Level switches - A high and low level switch is provided on each hopper to indicate the inventory of dry waste in the hoppers. High and low level alarms are provided to alert the operator as to the status of the hopper. Low level switch can also cause an automatic changeover of feed to the other hopper.

b. A pressure switch is provided to prevent opening the waste fill valve when the hopper is pressurized.

c. A pressure switch is provided to prevent feeding waste from the hopper to the dry waste processor when the hopper pressure is less than the dry waste processor pressure. This is designed to prevent backflow of bed material from the dry waste processor to the hopper.

71. Shouldn't the heater in decontamination tank T-5 be automatically shut off on a low level signal?

RESPONSE:

The heater is automatically shut off on the low level signal. In addition, the watt density of the heater is low enough to allow the heater to be operated in air without damage.

72. Why does a high temperature in the bed storage and transfer hopper (H-2) result in the sending of this material to the evaporator feed tank via the opening of valve ROV-544? (Sheet 4 of 5, Drawing 1190504).

RESPONSE:

It appears that interlocks shown on the P&ID are confusing. The high temperature switch in the H-2 hopper prevents operation of the rotary feeder valve ROV-541 at temperatures greater than 500°F to prevent damage to the valve. There is no connection between the switch and the drain valve ROV-544.

The drain valve is interlocked with the transfer system to prevent opening the valve when the C-3 blower is running. This is to prevent blowing air into the drain system. Also, the valve must be closed before bed material can be transferred to the dryer. Unfortunately when many interlocks are shown on a P&ID drawing, the drawing can become confusing in certain areas.

73. Why should you stop the product conveyor (R-2) on a low level in the fines hopper H-5 when you still have material coming from the discharge of the fluid bed dryer?

RESPONSE:

The product conveyor and fines hopper are no longer part of the system. They have been replaced with a pneumatic transfer system supplied with the solidification system

74. There should be a ΔP alarm (high and low) on the filters, F-4 and the ambient air inlet filter to dry waste processor air blower (C-2). Otherwise, there is no indication of loss of flow to the blower or a clogged filter. The ΔP indication on F-4 is not sufficient to warn the operators.

RESPONSE:

F-4 Filter - This filter is equipped with a ΔP indicator. It is recommended that this parameter be logged twice per shift. Since this filter is designed to operate about 3000 hours before plugging, the data gathered each shift will alert the operator to the filter condition.

Ambient Air Inlet Filter to Dry Waste Processor Blower C-2 - This filter is not equipped with a ΔP indicator. It is expected to operate about 3000 hours before plugging. It is recommended that this filter be visually inspected monthly and serviced by washing during the VR System annual maintenance.

In the worst case, if either filter plugged, the system would safely shut down on loss of gas flow or low pressure. The plugged filter could then be changed and the system restarted. It takes about one hour to change the F-4 filter and about 1/2 hour to service the blower inlet filter.

75. Does the failure of the fluid bed dryer air blower C-3 result in an automatic shutdown of the VR System?

RESPONSE:

Yes, please see Page 73 of the Topical Report No. AECC-2-P(NP) dated 10/15/79.

76. What type of training program will be instituted for the operators of the VR System and the maintenance personnel? How frequent will this training be? What is its duration? Will the operators be trained on a simulator, or one of AECC's prototypes or full-scale models?

RESPONSE:

AECC provides a detailed Operation and Maintenance Manual with each VR System for purposes of guiding and instructing the utilities' personnel in proper operation and maintenance procedures and practices. Field engineering services are also provided with each VR System. Normally, about 45 days of onsite consultative services are provided to: (1) support the system installation activity, (2) provide initial training for the utilities' operating and maintenance personnel, (3) aid in the startup of the system, and (4) support the acceptance testing activity. Additional training and support in the other service activities are also offered as options.

Initial onsite training has been given at the Byron Station on the actual installed VR System. The training was directed toward station supervisors and/or foremen responsible for operating and maintaining the radwaste facilities and toward station personnel responsible for the utility's internal training programs. This training program was specifically tailored to the VR System at the Byron Station. It consisted of both classroom instruction with visual aids and handouts and instruction in the field where the various components of the system are located. The program was eight days in duration and was conducted by three different engineer/instructors with 30 man-years of experience with the AECC VR System. Major topics included in the training program were as follows:

(1) Introduction and System Overview

(2) Process Flow Diagrams

(3) Equipment Descriptions

(4) Equipment Layout and General Arrangement

(5) Instruments and Control Loops (including setpoints and alarms)

(6) Process Recorders and Data Logs (including significance of the data)

(7) System Alarms (including causes and required actions)

(8) System Operating Modes

76. Response (cont.)

(9) **Startup and Shutdown Procedures**

(10) Feed Limitations

(11) Operation and Maintenance Manual

Direct operator and maintenance personnel training programs can be provided for the utilities or developed by the utilities with AECC assistance. AECC will, however, aid in the training of the first operators through the field engineering services provided to support the initial system startup and the system acceptance testing on nonradioactive test feeds. AECC will provide further operator training on the utility's own VR System using either nonradioactive test feeds or real waste feeds as may be requested by the utility. Subsequent periodic training will be available to the utility throughout the system operational life.

77. It would appear that both a low level <u>and</u> a high level alarm should be included on the contaminated oil storage tank. The low level would indicate that you are running out of feed to the incinerator and probably should be interlocked with the tank's pump. It would also allow you to start or increase the feed ratio of dry active waste. The high level alarm would prevent potential spills.

RESPONSE:

Please see the response to Question 55 which also deals with the contaminated oil storage tank. Both low-level and high-level alarms have been added to this tank.

78. You stated in your exceptions to Regulatory Position 4.3 of Regulatory Guide 1.143 that 1/2" schedule XX tubing would be utilized for the concentrated liquid waste feed stream lines, yet the piping and instrumentation drawing shows that the lines are 3/4", which is in conformance with the regulatory position. Is this exception to Regulatory Guide 1.143 still current?

RESPONSE:

AECC still seeks an exception to Regulatory Position 4.3 of Regulatory Guide 1.143, as stated in the Topical Report No. AECC-2-P(NP), page 49, Item 2, even though the piping and instrumentation drawing shows the 3/4" lines that are required by Regulatory Guide 1.143. AECC will not change to the 1/2" tubing or piping until permission is obtained from the NRC.

To eliminate delays at the Byron and Braidwood Stations AECC utilized 3/4" Schedule XX piping, which does conform to the Regulatory Guide 1.143, Position 4.3. However, this piping is not readily available, is expensive, and causes difficulties in connections to valves due to discontinuities at the interface. For future AECC VR System applications, it would be technically superior to use the 1/2" schedule XX tubing/piping.

79. The exception to Table 1 of Regulatory Guide 1.143 for the 0-15 psig tanks should be reviewed to see whether AECC still wishes to take exception. Regulatory Guide 1.143 does not require a stamp for ASME Code Section III, Class 3 items. See Footnote 3.

RESPONSE:

AECC still wishes to take exception to the Equipment Codes listed in Table 1 of Regulatory Guide 1.143 for the 0-15 psig tanks. AECC wants the option to design, fabricate, inspect, and test these tanks to ASME Code Section VIII, Division 1, including ASME Code Stamp. AECC feels that the quality provided by ASME Section VIII, Division 1 is greater than or equal to that provided by the modified Section III, Class 3 requirement. The reasons for our position are as follows:

(1) The use of ASME Code Section VIII, Division 1 for the 0-15 PSIG TANKS classification of Table 1 should be more than adequate, since Table 1 allows these same criteria for the more critical PRESSURE VESSELS classification.

(2) The ASME Code Stamp assures third party inspection of the vessels, whereas use of Section III, Class 3 without the Code Stamp eliminates the third party inspection.

(3) Radwaste hardware is classified as non-safety related. Within the nuclear industry it is recognized that ASME Section VIII, Division 1 conformance is adequate for radwaste hardware.

(4) The suppliers of Section III, Class 3 hardware are very limited. Therefore, costs are higher than for Section VIII, Division 1, with no increase in quality.

80. The charcoal adsorbers and the HEPA filters should be tested with the frequency noted in Regulatory Guide 1.140 (see Table 32 of Amendment 1).

RESPONSE:

AECC intends that the charcoal adsorbers and the HEPA filters will be tested with the frequency noted in Regulatory Guide 1.140, or more frequently in the event filter element changeout is required.

Regulatory Position C.5.b, C.5.c, and C.5.d indicate varying testing frequencies ranging from testing initially to testing at intervals of approximately 18 months thereafter. Table 32 of Amendment 1 to AECC Topical Report No. AECC-2-P(NP) indicated that the HEPA filter elements and the charcoal adsorber media would likely be changed twice each year. AECC recommends, therefore, consistent with Regulatory Guide 1.140 that the airflow distribution tests for the HEPA filters and iodine adsorbers, the in-place DOP test for the HEPA filters, and the leak-test for the activated carbon adsorber be conducted whenever these filter elements are changed.

81. What is the amount of liquid which could be contained in the scrubber preconcentrator sump and its associated piping into and out of the preconcentrator?

RESPONSE:

The capacity of the scrubber preconcentrator including venturi and sump is 188 gallons. The associated piping into and out of the preconcentrator has a capacity of 18 gallons additional. The total inventory is 206 gallons.

82. The VR System does not include redundant waste feed pumps, scrubber preconcentrator recirculating pumps, dryer feed pumps, condensate pumps, and various air blowers. The lack of redundancy raises concerns with respect to system availability because those components which are not redundant are critical to the operation of the system. Explain why these components are not redundant.

RESPONSE:

Pumps - The VR System does not include redundant pumps due to the nature of the concentrated wastes that are pumped. Any redundant pump, while not operating, will contain concentrated liquid in dead legs at the inlet and outlet. It is strongly felt that when the redundant pump might be required for operation, it would fail to operate properly due to plugs having formed in the dead legs as a result of crystallization of the concentrated solutions in cold spots or settling of particulate. The AECC approach to maintain system availability with respect to pumps is as follows:

(1) Utilize installed remote water flush of pumps prior to maintenance in compliance with ALARA philosophy;

(2) Maintain spare parts in inventory for ready maintenance. Spare parts for these pumps include bearings and seals.

Blower - The blower and blower motor have been among the most reliable mechanical components in the AECC VR System based on several thousand hours of operation in the full-scale prototype system located in Sacramento, California. Rather than supply a redundant blower/motor at great cost, the AECC approach to maintaining system reliability is to have blower bearings and motor bearings as available spare parts. The blower/motor coupling is also stocked as a spare part. Furthermore, the blower is equipped with a vibration switch which alarms on the main control panel to warn the operator of a developing problem. He can then schedule maintenance on the blower or motor.

83. The staff also questions why a redundant waste feed filter or a bypass around the filter was not provided. If this filter is out of service, no liquid can pass to the VR System for processing. Explain how this potential problem will be handled.

RESPONSE:

The F-3 waste feed filter is a large mesh wire screen device designed to trap foreign objects in the liquid waste that could cause component or nozzle plugging. This filter is located upstream of the waste feed tanks. Typically, two waste feed tanks are provided with an AECC VR System. One waste feed filter provides filtered liquid waste to both tanks. In this manner the system can draw liquid waste for processing from one tank while the other tank (off-line) is being filled. As a result of this operational philosophy, the waste feed filter is not part of the dynamic (operating) VR System.

A redundant waste feed filter F-3 or a bypass around this filter is not provided because other means have been provided for servicing this filter. The F-3 filter can be readily backflushed from the main control panel in the event of high pressure drop. If backflushing does not resolve the problem, then the filter strainer can be removed and replaced with a spare strainer from inventory.

References

8.* "Identification of Radwaste Sources and Reduction Techniques", C.P. Deltete, G.S. Daloisio, and R.B. Wilson, Gilbert Associates Inc., and M.D. Naughton, Electric Power Research Institute, NP-3370, January 1984.

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*References 1 through 7 are contained in the Topical Report No. AECC-2-P(NP) and Amendment 1 to AECC-2-P(NP).