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In-Plant Source Term Measurements at Turkey Point Station - Units 3 and 4

Prepared by *J. W. Mandler, S. T. Croney, N. C. Dyer, C. V. McIsaac, A. C. Stalker
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ABSTRACT

This report presents data obtained at Turkey Point Units #3 and #4 as a part of the in-plant source term measurement program in operating pressurized water reactors (PWR's). The work was conducted for the Office of Nuclear Regulatory Research in support of the Effluent Treatment Systems Branch of the Office of Nuclear Reactor Regulation. The primary objective of this program is to provide the Nuclear Regulatory Commission (NRC) with operational data that can be used in evaluation of plant designs for liquid and gaseous waste treatment systems.

Data presented were obtained at the Turkey Point Power Station operated by Florida Power and Light, located south of Miami, Florida. In-plant measurements were conducted during the time period from November, 1977 through May, 1978. This plant is the third in a planned series of six operating PWR's to be studied, two from each of the major PWR vendors. Data from all plants will be combined and interpreted to provide a data base for radioisotope inventory in plant systems, radioactive waste treatment system performance, and source terms for both liquid and gaseous systems.

One of the primary objectives in performing measurements at Turkey Point was to study primary-to-secondary leaks if they occurred and to determine partition factors in steam generators. The opportunity to study primary-to-secondary leaks occurred twice during the in-plant measurement period. Results of these studies together with measurements performed on the liquid and gaseous systems at Turkey Point are presented.

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1. INTRODUCTION

1.1 Objectives of the In-Plant Measurement Program

The primary objective of the in-plant source term measurement study at operating pressurized water reactors (PWR's) is to provide the Nuclear Regulatory Commission (NRC) with operational data that can be used in evaluation of plant designs for liquid and gaseous waste treatment systems. This evaluation requires a knowledge of the sources and quantities of radioactive waste materials generated at a nuclear power reactor during normal operation including anticipated operational occurrences, how these sources vary with plant design, the radioisotope inventory in plant systems, how radioactive materials move through plant systems, and radioactive waste treatment system performance.

Specific objectives of the in-plant measurement study are:

1. Obtain data on the inventory of radioisotopes present (i.e., locations, concentrations, etc.) in operating reactor plant systems during normal operation and anticipated operational occurrences.

2. Study radioactive waste treatment system performance and determine decontamination factors (DF's) for demineralizers, evaporators, filters, and gaseous cleanup systems.

3. Detect and measure primary-to-secondary leaks and determine isotopic partition factors for steam generators and main condenser.

4. Obtain data on radioisotope concentrations in fuel pool waters and perform a tritium balance during refueling.

5. Determine the releases of radioactive materials in the gaseous and liquid effluents.

6. Estimate annual release of airborne activity from the auxiliary building ventilation system, process gas system, and containment buildings.

7. Provide additional source term information so that the parameters used in calculational models (1) can be updated as necessary.

Measurements are to be made during the three stages of plant operation (i.e., power generation prior to refueling, during refueling operations, and power generation following refueling) so that the data can be used to estimate equipment performance and radioactivity releases over the lifetime of a nuclear power plant.

The In-Plant Source Term Measurement Program is being carried out by the Idaho National Engineering Laboratory (INEL) and is a joint effort involving EG&G Idaho, Inc., and Allied Chemical Corp. In order to provide a data base for currently operating PWR's, a total of 6 PWR's will be studied, 2 from each of the major vendors (Westinghouse, Combustion Engineering, and Babcock & Wilcox). In-plant measurements were initiated during the summer of 1976. During 1976 and 1977 measurements were made at the Fort Calhoun Station, Blair, Nebraska (operated by Omaha Public Power District) and at the Zion Station, Zion, Illinois (operated by Commonwealth Edison Co.). Results of these measurements are reported in references 2 and 3. This is a report on the results of measurements at Units #3 and #4 of the Turkey Point Power Station.

1.2 Turkey Point

1.2.1 In-Plant Measurements at Turkey Point

The measurement program at Turkey Point was initiated in November, 1977. First, sample points and locations in the liquid and gaseous process streams were selected. This was accomplished by examining the piping and instrument diagrams (P&ID's) to determine where samples should be taken, discussing the proposed sample points with plant personnel, inspecting the actual systems to verify the efficacy of the sample points and locations. Results were used to generate a measurement plan for the specific studies to be made at Turkey Point. The NRC Mobile Laboratory was then moved to Turkey Point on 11/1/77. Actual in-plant measurements began on 11/8/77.

In-plant measurements at Turkey Point spanned the period 11/8/77 to 6/1/78. Samples from both liquid and gaseous process streams were collected and analyzed using the procedures described in reference 4. During this 7-month period, Unit #3 was down for refueling from 11/24/77 to 2/17/78, and Unit #4 was down for steam generator repairs from 2/14/78 to 3/9/78.

One of the main objectives at Turkey Point was to study primary-to-secondary leaks if they occurred and to determine partition factors in steam generators and attempt an iodine balance around the secondary system. The opportunity to study primary-to-secondary leaks occurred during the in-plant measurement study at Turkey Point. During November, 1977 steam generator C on Unit #3 had a primary-to-secondary leak and steam generator A on Unit #4 developed a leak during January-February, 1978.

1.2.2 Description of Turkey Point

The Turkey Point Generating Station, operated by Florida Power and Light (FPL), is located on the western shore of Biscayne Bay, about 25 miles south of Miami, Florida. Two gas- and oil-fired generating plants, Turkey Point Units #1 and #2, and two nuclear power plants, Turkey Point Units #3 and #4, share the site. Units #3 and #4 are identical pressurized light water reactors supplied by Westinghouse. Each unit has a generating capacity of 2200 MWt and a gross electrical power output of 760 MWe. Unit #3 reached initial criticality in 10/72 and began commercial operations in 12/72 while Unit #4 reached criticality in 6/73 and began commercial operations in 9/73.

Each nuclear unit consists of a pressurized water reactor, reactor coolant system, secondary system, spent fuel storage pool, and associated auxiliary fluid systems. The reactor coolant system has three coolant loops, each with a vertical U-tube steam generator with integral moisture separaters. The auxiliary systems are used to charge the reactor coolant system, add makeup water, purify reactor coolant water, provide chemicals for corrosion inhibition and reactivity control, cool system components and the spent fuel storage pool, remove residual heat when the reactor is shut down, and provide for emergency coolant injection.

Some components of the auxiliary and waste treatment systems are shared by Units #3 and #4. These shared systems and components include the holdup tanks (used for reactor letdown solution), boric acid tanks, primary water storage tanks, refueling water storage tanks, base-cation demineralizers (FPL nomenclature for cation demineralizers used to remove pH control chemicals upstream of the boric acid evaporator), boric acid evaporator and condensate demineralizer, waste holdup tank, radwaste evaporator and condensate demineralizer, evaporator concentrates holding tank, and monitor tanks.

Figures 1.1 and 1.2 show simplified schematic diagrams of the liquid and solid systems and the gaseous waste treatment system, respectively, at Turkey Point. The Piping and Instrument Diagrams (P&ID), which contain more details for each system, can be found in Appendix B, Figures B.1-B.16.

For purposes of measurement, Turkey Point was divided into two major systems - liquid and gas. The liquid system was subdivided into six basic subsystems - reactor coolant, secondary, letdown or chemical and volume control system (CVCS), boric acid recovery, liquid radwaste, and spent fuel pit cleanup. The gas system was subdivided into three basic subsystems - auxiliary building ventilation, process gas, and containment. Each of these subsystems and the data obtained are discussed in detail in the following sections of this report. Sample and data handling procedures are discussed in Appendix A. Appendix B contains the measured data.

1.2.3 Plant Data

Wherever possible, plant data were collected to supplement the data obtained during the measurements and to help interpret the measurements. Plant operational data used to characterize samples included the control room logs (each unit), the auxiliary building operator log, the radwaste building operator log, the daily water reports (both primary and secondary), plus information obtained in discussions with plant personnel.

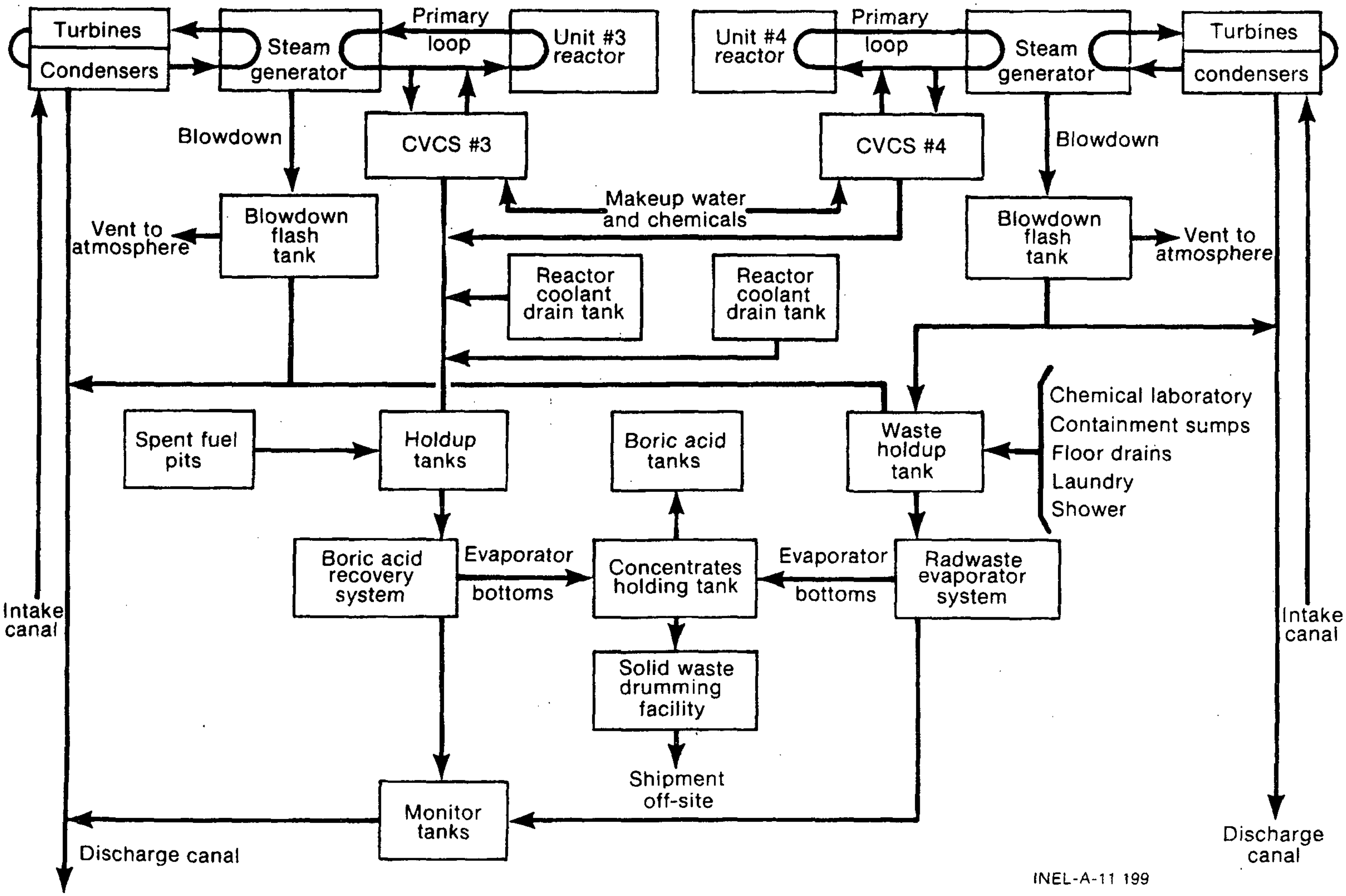
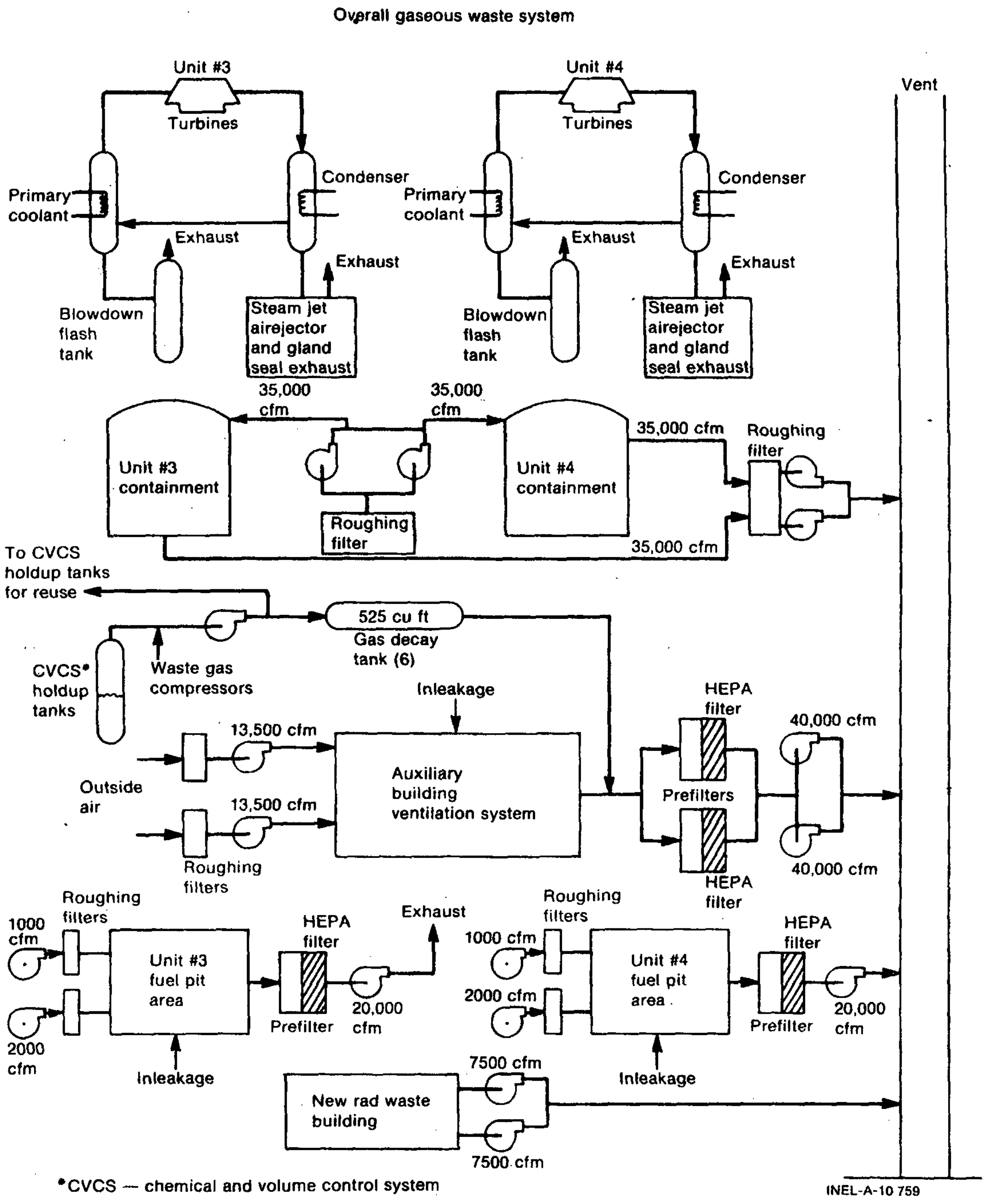


Figure 1.1

Diagram of Liquid and Solid Systems


Overall gaseous waste system

*CVCS — chemical and volume control system

Figure 1.2
Diagram of Gaseous Radwaste System

Information obtained from the control room log includes power level, reactor coolant flow, steam generator flow and level, reactor coolant temperature and pressure, and rod position. This information was tabulated either hourly or every 4 hours throughout the day. Plots of power level for Units #3 and #4 during the period 11/1/77 to 6/1/78 are shown in Figures 2.1 and 2.2, respectively.

Information obtained from the auxiliary building operator log and the radwaste building operator log included tank levels, pressure drop across the letdown demineralizers, spent fuel pit level and water temperature, and waste gas decay tank pressure. This information was tabulated every 4 hours throughout the day. Tank level information pertinent to source term measurements is shown in Appendix B, Figures B.17 to B.21.

Also included in the operators' logs were times when monitor tanks were filling or were on recirculation prior to discharge, times when a reactor coolant drain tank was transferred to a containment sump, times when evaporator bottoms were transferred and where they were transferred, times when liquids were transferred to holdup tanks, operational status of the evaporators and spent fuel pit demineralizers, and miscellaneous status information concerning systems and components.

The daily water reports for the primary system provided information such as letdown flow rate, pH, conductivity, and boron and lithium concentrations for both Units #3 and #4. The daily water reports for the secondary system contained total blowdown rates, pH, and conductivity for steam generator water together with pH, conductivity, and chromate and phosphate concentrations in the makeup water.

Results of radiochemical analyses of reactor coolant samples performed by plant personnel were also obtained. Tables B.8 and B.9 in Appendix B list ^{131}I and ^{3}H concentrations in Unit #3 and #4 reactor coolant as measured by FPL. Since the results of replicate samples indicated good agreement between FPL and INEL (see Appendix A), the ^{131}I concentrations were used to supplement INEL data. The ^{131}I concentrations shown in Figures 2.1 and 2.2 include both INEL and FPL data.

2. SUMMARY AND CONCLUSIONS

2.1 General Plant Operation During In-Plant Measurements

Measurements were conducted at Turkey Point from 11/1/77 to 6/1/78. During this 7-month period, Unit #3 was down for refueling from 11/24/77 to 2/17/78. In addition, outages of shorter duration occurred during 3/21-25/78 and on 4/20/78 and 5/11/78, and during 5/19-22/78. At the beginning of the measurement period, Unit #4 was down for steam generator repairs. Power operations resumed on 11/12/77. This unit was down again for steam generator repairs from 2/14-3/9/78. Shorter outages occurred on 12/9/77, 12/17/77, 12/26-27/77, and 1/25/78. Figures 2.1 and 2.2 show the power levels for Units #3 and #4, respectively, during the measurement period.

2.2 Liquid Systems

2.2.1 Description of Liquid Systems

Figures 2.3 and 2.4 show simplified block diagrams of the liquid systems at Turkey Point. For measurement purposes, the liquid system has been divided into six basic subsystems:

1. reactor coolant
2. secondary
3. letdown or chemical and volume control system (CVCS)
4. boric acid recovery
5. liquid radwaste
6. spent fuel pit cleanup.

The systems are, however, interrelated. Reactor coolant is cleaned up by the letdown demineralizers and is then returned to the core. Reactor coolant can also be diverted to the reactor coolant drain tank and to the holdup tanks and the boric acid recovery system (boric acid evaporator and condensate demineralizer). Radwaste water is drained into the waste holdup tank and from there to the radwaste evaporator and condensate demineralizer. Effluent from both condensate demineralizers is routed to the monitor tanks where it is sampled prior to release from the plant. Spent fuel pit water is treated by the spent fuel pit demineralizer.

2.2.2 Reactor Coolant

Reactor coolant samples were obtained from Unit #3 during the period 11/9/77 to 6/1/78 and from Unit #4 during 12/2/77 to 5/23/78. For Unit #3, this encompassed the three stages of operation - power generation prior to refueling, refueling operations, and power generation following refueling. Unit #4 was in power generation during the in-plant measurement period.

Figures 2.1 and 2.2 show the power level and ^{131}I concentration in reactor coolant for Units #3 and #4, respectively, for the period 11/1/77 to 6/1/78. Data obtained by FPL are included in these plots. It should

Figure 2.1

Unit #3 Power Level and ^{131}I Concentrations in Reactor Coolant

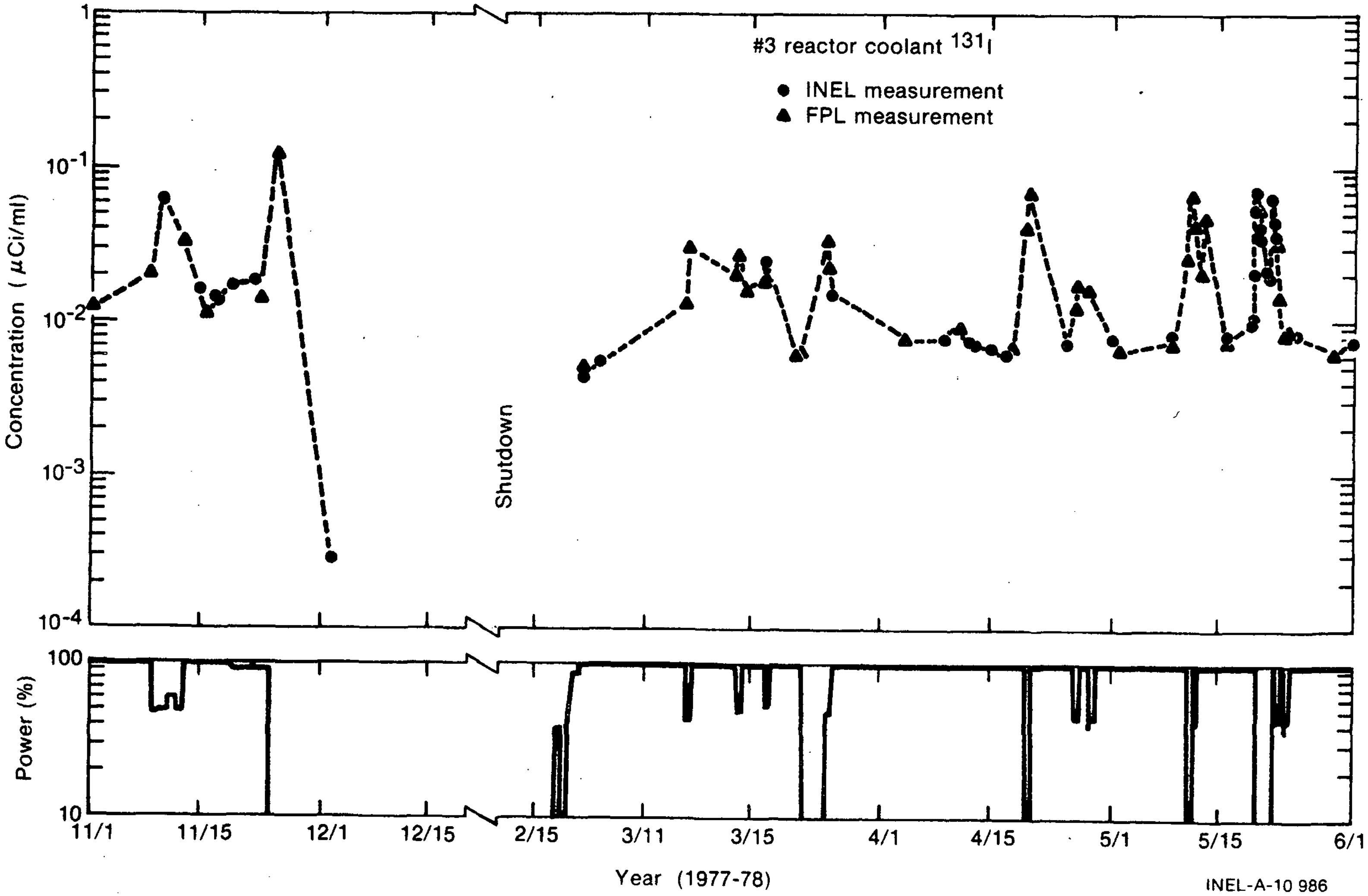


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Figure 2.2

Unit #4 Power Level and ^{131}I Concentrations in Reactor Coolant

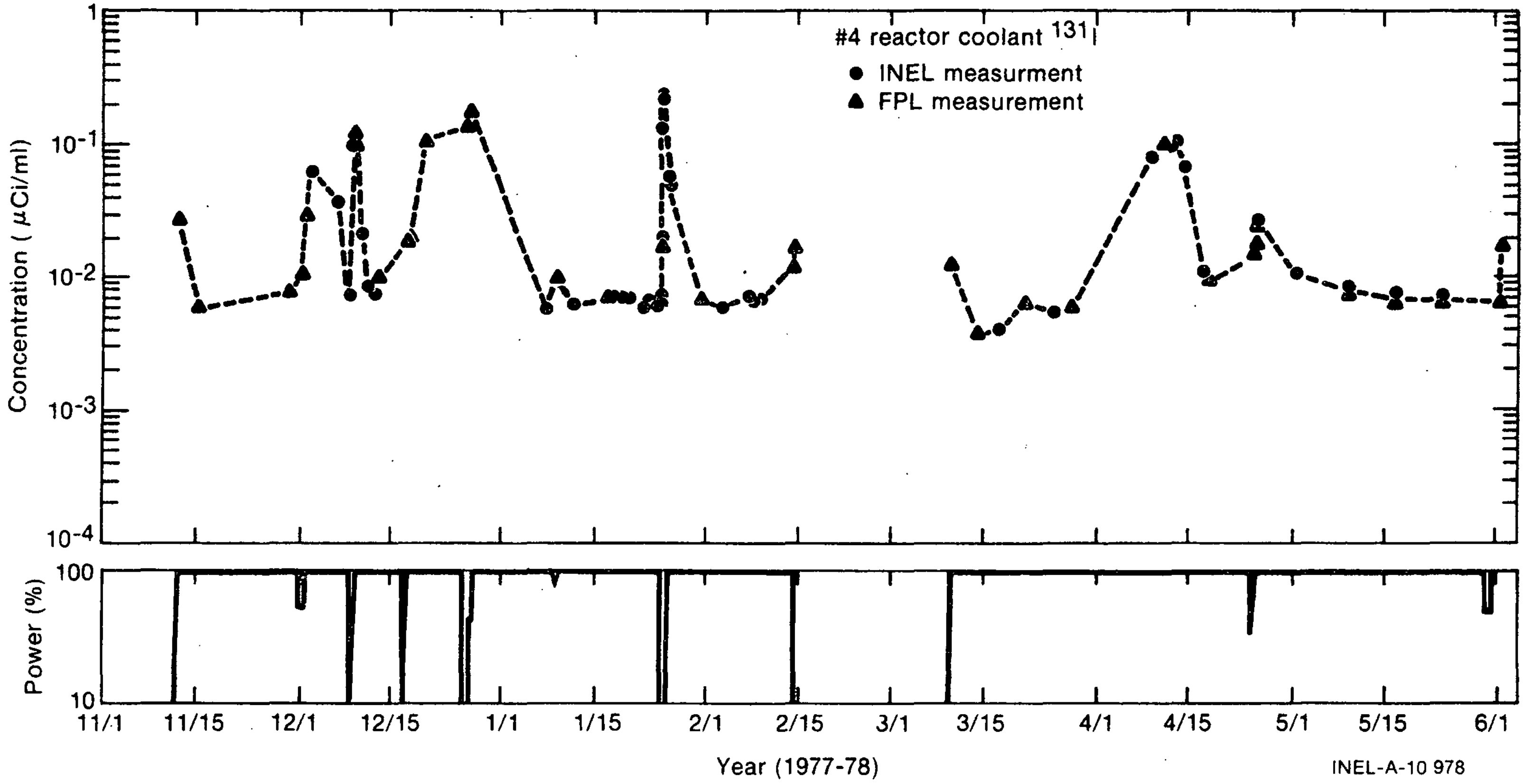

Figure 2.3

Simplified Block Diagram of Reactor Coolant, Letdown, and Fuel Pit Cleanup Systems

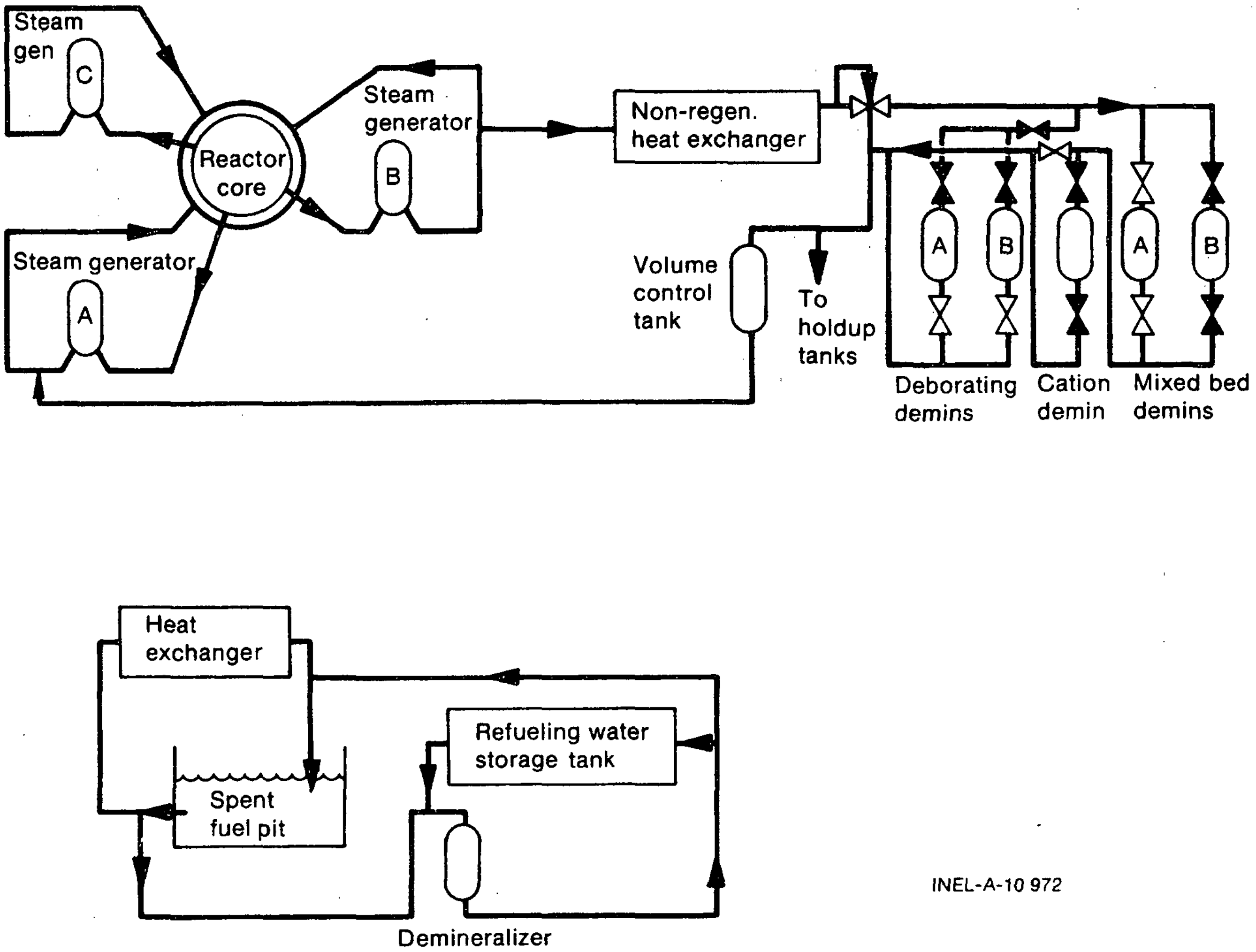

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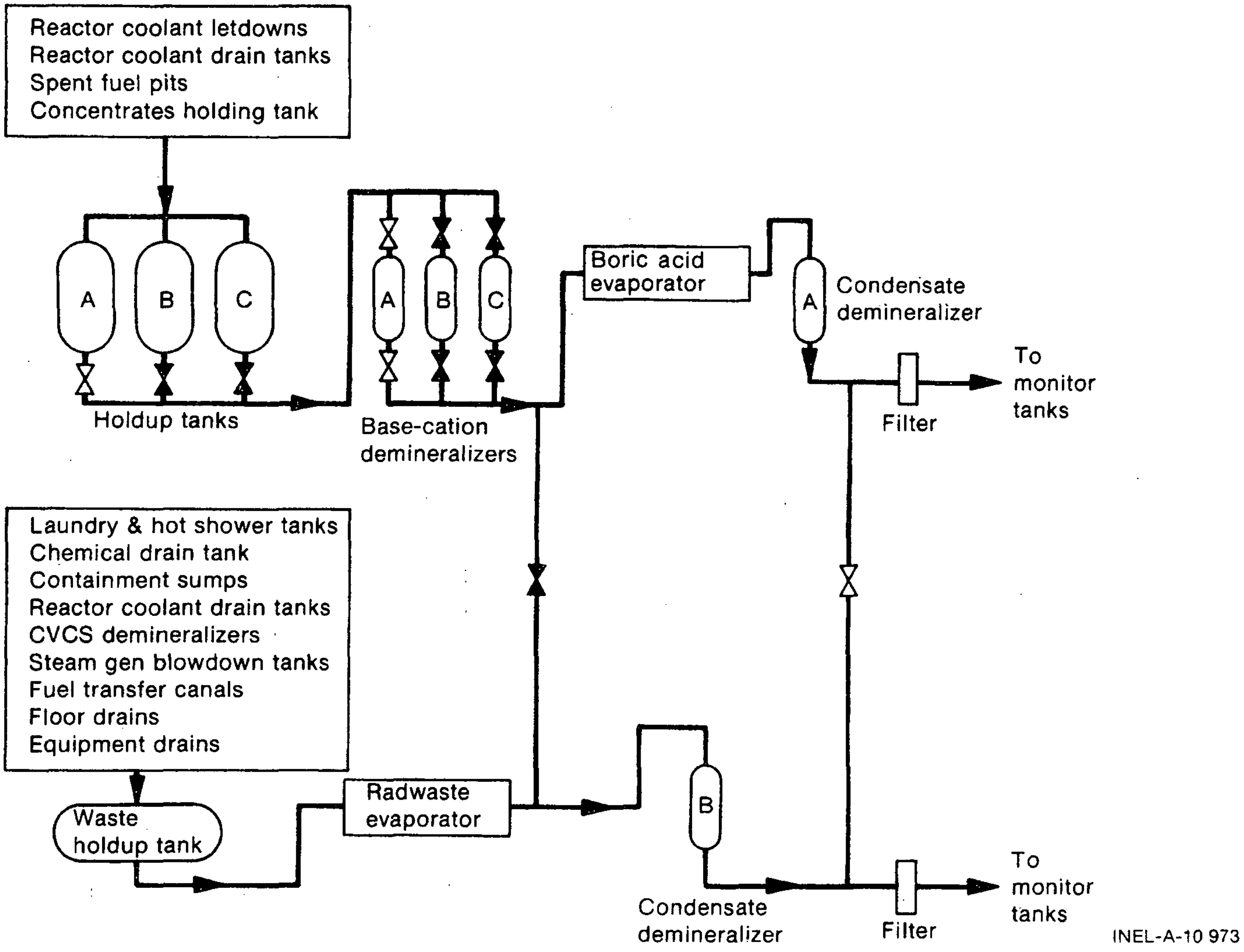
Figure 2.4

Simplified Block Diagram of Boric Acid Recovery and Radwaste Systems



be noted that the dashed lines are not intended to indicate the ^{131}I concentration between measurement points. Their purpose is only to aid in determining trends. The data in these figures indicate that in both units the ^{131}I concentration spiked (i.e., increased dramatically) not only upon reactor shutdown and startup, but each time the power was altered. A small spike was even observed after the power was reduced in Unit #3 from 100% to 90% on 11/19/77. This sensitivity to power change was not observed during measurements at Zion, where the reactor exhibited definite iodine spikes upon shutdown and startup, but only small changes in iodine concentration when only a power change occurred (3).

In order to provide more information on the spiking phenomenon, reactor coolant samples were obtained on approximately an hourly basis during two hot shutdowns. On 1/25/78, Unit #4 underwent a hot shutdown that lasted almost 12 hours. Iodine, cesium, and barium and the crud-associated radionuclides (e.g., Co, Zn) exhibited spiking during this shutdown. The longer-lived radionuclides reached their maximum concentrations about 5 hours after power reduction began (about 3 hours after 0% power was reached). Iodine-131, ^{137}Cs, and ^{58}Co peaked at concentrations 38, 4.5, and 31 times the pre-spike levels, respectively.

Unit #3 underwent a hot shutdown on 5/19/78 that lasted until 5/22/78. The iodine, cesium, and cobalt radionuclides exhibited spiking upon shutdown. Concentration of the longer-lived iodines reached a maximum about 6 hours after power reduction began (about 2-1/2 hours after 0% power was reached). Iodine-131 peaked at a concentration 7.5 times its pre-spike level, while ^{137}Cs and ^{58}Co peaked later and showed smaller increases. Of the gaseous fission products, only ^{133}Xe exhibited an increase in concentration after shutdown. Immediately after startup on 5/22/78 the cesiums and the longer-lived iodines exhibited spiking, but the magnitudes of the spikes were not as great as during shutdown (^{131}I reached a concentration 3 times its pre-spike level). The crud-associated radionuclides showed only slight indications of spiking.

During the spiking study, it was found that after shutdown, the ^{132}I concentration initially spiked, quickly returned to pre-spike levels, and then followed the ^{132}Te half life. This indicates that the source of the ^{132}I after the spike was ^{132}Te. This same phenomenon was observed in studies made at another power reactor (5). Because ^{132}Te was detected in the reactor coolant at only very low levels (insufficient to account for the ^{132}I), the tellurium must be attached to the surfaces of the reactor internal structures. This can explain why tellurium is not normally detected in reactor coolant.

In addition to spikes due to power changes, a higher than normal iodine level of long duration occurred in Unit #4 reactor coolant during 4/9-14/78 (see Figure 2.2). This elevated level was caused by the letdown demineralizer for Unit #4 being bypassed. After the demineralizer was put back into operation again, the iodine, cesium, and crud-associated radionuclide concentrations dropped, but never decreased to previous levels. In addition, the iodine isotope ratios (ratios of $^{133, 135, 132, 134}I$ with ^{131}I) measured after the demineralizer had been put back into service showed a change (an increase of about 20%) from pre-bypass values. It is not known why these changes occurred. Mere bypassing of the letdown demineralizer would not be expected to cause this.

Average radionuclide concentrations in Unit #3 and #4 reactor coolant were obtained for non-spiking periods of power operation. These periods were 11/1-22/77 and 2/21-6/1/78 for Unit #3 (i.e., before and after refueling) and 11/12/77-3/28/78, 4/9-14/78, and 4/17-5/31/78 for Unit #4 (i.e., before, during, and after the elevation due to bypass of the letdown demineralizer). These average concentrations are presented in Tables 3.2 and 3.4. General observations of these concentrations are as follows. The levels of the gaseous fission products were higher in Unit #3 reactor coolant than in Unit #4 reactor coolant. The ^{131}I concentration was higher in Unit #3 prior to refueling but after refueling it dropped to about the level measured in Unit #4. Concentrations of the shorter-lived iodines were much higher (about an order of magnitude) in Unit #3 than in Unit #4. Unit #4, on the other hand, exhibited higher concentrations for all crud-associated radionuclides except ^{60}Co. Except for ^{132}I and ^{134}I, the radionuclide concentrations were lower in both units than the concentrations suggested by the ANSI N237-1976 standard.

Iodine isotope ratios in reactor coolant indicated that in Unit #3 the release mechanism for fission product release to the reactor coolant was dominated by recoil. The majority of the fission products would seem to originate from tramp uranium. This tramp uranium was probably released during an earlier fuel failure and plated out on the fuel rods and on the reactor core internals. The iodine isotope ratios in Unit #4 reactor coolant indicated that the fission product release was dominated by diffusion. This means that most of the fission products in Unit #4 reactor coolant were released from small defects in the fuel cladding.

2.2.3 Chemical and Volume Control System

Samples of inlet water to and outlet water from the demineralizers in the chemical and volume control systems for both Units #3 and #4 were obtained in order to study the operation of the demineralizers and determine decontamination factors (DF's). Unit #3 CVCS was studied during the period 2/21-5/25/78 and Unit #4 CVCS during 11/30/77-5/23/78. Demineralizer B in CVCS #3 contained relatively new resin during the measurement period (it had been in service for 25 days and had processed 7.5(3) bed volumes when measurements began).* Demineralizer A in CVCS #4 was older, having been in service 180 days and having processed 6.3(4) bed volumes when measurements began.

---

*In this report, the number in parentheses following a number presents the power of ten multiplier, i.e., 3.97(4) = 3.97×10^4.

The measurements carried out on the CVCS demineralizers indicate that the DF's for certain radionuclides tend to be directly related to inlet concentration. DF's for cesium and iodine were found to be highly correlated with inlet concentration while DF's for certain other radionuclides showed a lesser degree of correlation. This was especially evident during spikes in the reactor coolant concentration. As will be shown below (section 2.2.7), the same phenomenon was observed for other demineralizers at Turkey Point as well as at Zion and Fort Calhoun. The data base is not yet sufficient to determine the exact dependence of DF on inlet concentration; therefore, DF values that best represent the DF's over the range of observed inlet concentrations were determined. These "best value" DF's were obtained for each demineralizer by determining the average inlet and outlet concentrations and then using these average concentrations to obtain the DF's. This technique allows the estimation of DF's for those radionuclides not detected with any regularity in either the inlet or outlet streams. When the data base is sufficient to quantify the functional dependence between DF and inlet concentration, this function will be used in place of "best value" DF's because it is more representative of actual plant performance.

Table 2.1 lists the "best value" DF's for the radionuclides most frequently seen in CVCS demineralizer inlet and outlet samples. More detailed tabulations are contained in Tables 3.12 and 3.15.

2.2.4 Boric Acid Recovery and Radwaste Systems

At Turkey Point, the boric acid recovery system and liquid radwaste system are similar (see Figure 2.4). Both are fed by holdup tanks - 3 holdup tanks feed the boric acid recovery system while a single waste holdup tank feeds the radwaste system. In the boric acid recovery system, liquid flows from the holdup tanks, through the base-cation demineralizer, evaporator, condensate demineralizer, and filter and finally to the monitor tanks. In the radwaste system, liquid flows from the waste holdup tank directly to the evaporator, then through the condensate demineralizer and filter to the monitor tanks. Except for the base-cation demineralizers, the two systems are identical.

The boric acid recovery system normally processes reactor coolant quality water. This water is held for about 5-6 days which allows short-lived radionuclides to decay before processing. This water contains relatively long-lived radioisotopes and high boron concentrations. The radwaste system, on the other hand, has a shorter holdup time because the system has only one tank which can accept feed at the same time processing is occurring. Since, on occasion, water from the primary system obtained through the reactor coolant drain tank is processed, the radwaste system can contain more short-lived radionuclides and variable boron concentrations. The chemistry of this water is variable and sometimes contains high chromate concentrations. At times the radwaste system was used to process reactor coolant type water. In these cases, water from the reactor coolant drain tank was transferred to the containment sump and from there to the waste holdup tank. Also, during the early part of May, the boric acid recovery system was used to process water from spent fuel pit #3. For these operations, the cation resin in the base-cation demineralizer was replaced by a mixed-bed resin.

TABLE 2.1

"BEST VALUE"† DECONTAMINATION FACTORS FOR CVCS MIXED-BED DEMINERALIZERS

	"Best Value" Decontamination Factor	
Nuclide	CVCS #3 Demin. B	CVCS #4 Demin. A
^{131}I	2600	3600
^{133}I	1900	1100
^{135}I	2200	650
^{134}Cs	1.0	1.0
^{137}Cs	1.0	1.0
^{24}Na	2500	550
^{51}Cr	23	15
^{54}Mn	110	16
^{59}Fe	43	17
^{58}Co	69	13
^{60}Co	95	20
^{99}Mo	520	200
^{124}Sb	5.6	3.4

† "Best Value" DF = $\frac{\text{Average Inlet Concentration}}{\text{Average Outlet Concentration}}$

When the base-cation demineralizers were loaded with a mixed-bed resin, the DF's for ^{131}I and the cesiums were found to be highly correlated to the inlet concentration. This is the same observation that was made for the mixed-bed letdown demineralizers (see Section 2.2.3).

The measurements carried out on the two evaporators also showed that the DF (as measured by the ratio of the feed to distillate activities) was dependent upon the inlet concentration. For the radwaste evaporator, the DF's for ^{131}I, the cesiums, and the cobalts were found to be highly correlated with the feed concentrations for these isotopes. As with the mixed-bed demineralizers, DF tended to increase as the inlet concentration increased. For the boric acid evaporator the DF's for the cobalts showed a high degree of correlation with feed activities, but neither ^{131}I nor the cesiums showed this effect. When these measurements were made, however, the concentrations of iodine and cesium in the feed were very low.

Distillate concentration for this type of evaporator was found to be related to bottoms concentration rather than the feed concentration. In particular, it was found that when the concentration in the feed is drastically reduced the distillate and bottoms concentrations remained essentially constant. Hence the feed-to-distillate DF actually went to a value less than one whereas the bottoms-to-distillate ratio remained very large.

Since the data base is not yet sufficient to quantify the relationship between DF and feed concentration for evaporators, "best value" DF's were obtained by dividing the average inlet (or feed) concentration by the average outlet (or distillate) concentration for each radionuclide. Tables 2.2 and 2.3 list "best value" DF's for selected radionuclides in the various components of the boric acid recovery system and the radwaste system, respectively. More detailed tabulations of "best value" DF's for the boric acid recovery system and radwaste system can be found in Tables 4.7, 4.8, 4.12, and 4.14. For the boric acid recovery system, the DF's for the base-cation demineralizer and the evaporator were obtained from measurements made only while the demineralizer contained a cation resin (i.e., data obtained while the base-cation demineralizer was loaded with a mixed-bed resin were not included). The DF's for the condensate demineralizer and filter, however, were obtained using all the data obtained during the in-plant measurements.

2.2.5 Secondary System

One of the primary objectives in carrying out in-plant measurements at Turkey Point was to study steam generator leaks if they occurred. During the measurement period, leaks occurred in steam generator C of Unit #3 (November 1977) and in steam generator A of Unit #4 (January-February, 1978). Detailed studies of these steam generator leaks were made and lead to the following conclusions and observations.

Based on letdown demineralizer DF's for both plants, the iodine in the reactor coolant system is >99% ionic. The reducing conditions of the reactor coolant (i.e., hydrogen overcover together with reduction

TABLE 2.2

"BEST VALUE"† DECONTAMINATION FACTORS FOR BORIC ACID RECOVERY SYSTEM

Nuclide	"Best Value" Decontamination Factor for System Component Base-Cation Demin.	Evaporator	Condensate Demin.	Filter
^{131}I	1.6	50	11	1.1
^{134}Cs	> 900	---	1	1.4
^{137}Cs	> 280	---	1	1.9
^{58}Co	24	780	1	1.8
^{60}Co	19	310	2.6	1.8

TABLE 2.3

"BEST VALUE"† DECONTAMINATION FACTORS FOR RADWASTE SYSTEM

Nuclide	"Best Value" DF for System Component Evaporator	Condensate Demin.
^{131}I	24	4.6
^{133}I	410	-----
^{134}Cs	910	0.2
^{136}Cs	37	-----
^{137}Cs	1100	0.9
^{58}Co	510	170
^{60}Co	440	18

† "Best Value" DF = $\frac{\text{Average Inlet (or Feed) Concentration}}{\text{Average Outlet (or Distillate) Concentration}}$

due to thermal and radiation conditions) favors I^- as the principal iodine form (5,11). For this reason, iodine entering a steam generator from the reactor coolant is principally I^-. Measurements showed that all the activity entering the blowdown flash tank from steam generator blowdown leaves the flash tank in the liquid stream. Iodine activity released via the blowdown flash tank vent was below the detection limits of the measurements. Therefore, little, if any, iodine was vaporized and released through the flash tank vent. This indicates that iodine entered the secondary system in a nonvolatile form and remained nonvolatile in the steam generators and blowdown flash tank.

Measurements indicated that the average steam generator iodine partition factor for Unit #4 was 9 ± 4(-4). This very low partition factor indicates that there was very little volatile iodine in the secondary system. Because of insufficient data, the iodine partition factor for Unit #3 steam generators could not be determined. Another result that indicates that there was very little volatile iodine in the secondary system is the high fraction of iodine activity that entered the main feed via the high pressure (HP) drains. Measurements indicated that an average of 75% of the iodine activity in the feed came via the HP drains even though only 28% of the flow follows that path. This result is consistent with the conclusion that most of the iodine activity gets into the main steam entrained in moisture droplets because most of the moisture droplets should be removed by the moisture separator and this removed moisture is routed to the HP drain system.

Comparisons of $^{133}I/^{131}I$ ratios in the reactor coolant and the generator bottoms indicated that the age of the iodine in Unit #3 secondary was about 20 hours older than reactor coolant. In Unit #4, the age of the secondary water was about 8.5 hours older than reactor coolant.

Measurements indicated that the steam leaving the steam generators contained about the expected amount of moisture. The moisture entrainment fraction (i.e., moisture carryover) was measured to be 0.3%, which is approximately the steam generator design value (design carryover is 0.25%).

The primary to secondary leakage in the two units was different. Unit #3 had a steady-state leak which varied between 3 and 8 gallons per hour during the leak period (mid-August to late November 1977). The leak in Unit #4 increased constantly throughout the period of measurement, starting at 0.6 gallons per hour on 1/15/78 and increasing to about 20 gallons per hour on 2/14/78 before the unit was shut down for repairs.

The steam jet air ejector (SJAE) is the release point for iodine leaving the main condenser to the environment. Average daily releases measured during the period of primary-to-secondary leakage were

4.7(-4) µCi/sec for ^{131}I and 3.8(-4) µCi/sec for ^{133}I in Unit #3, and 1.8(-5) µCi/sec and 2.3(-5) µCi/sec for ^{131}I and ^{133}I, respectively, in Unit #4. Based on these release rates, the average percent of main steam iodine activity released via the air ejector is 1.3(-1)% for Unit #3 and 1.0(-1)% for Unit #4. This small fraction of iodine leaving the secondary system via the air ejector is consistent with the observation that there was very little volatile iodine in the secondary system. As measured by iodine species samplers, the bulk (approximately 90%) of the iodine which was discharged from the air ejectors was in the organic form.

The gland seal discharge which exhausts to atmosphere was not measured due to lack of a sampling point.

2.2.6 Spent Fuel Pit

The spent fuel pit (SFP) cooling system consists of a pump, heat exchanger, filter and a mixed-bed demineralizer. The pump draws water from the SFP, circulates it through the heat exchanger, and returns it to the SFP. Nominal flow through the cooling loop is 2000 gallons per minute. To maintain clarity and to remove any radioactive contaminants approximately 5 percent of the cooling loop flow is diverted through the filter and the mixed-bed demineralizer.

During February and April five sets of measurements were made on the Unit #3 spent fuel pit system to determine the mixed-bed demineralizer DF's. The mixed-bed demineralizer resin was replaced in January, 1978. A summary of the "best value" DF's for the most frequently observed radionuclides is presented in Table 2.4. Table 5.7 contains a more complete listing of "best value" DF's.

Samples were taken of the SFP, reactor coolant, and the refueling water storage tank (RWST) waters before and after transfer of fuel from Unit #3 core to the SFP. The data indicate that the total number of curies of ^3H in all the previously mentioned waters decreased from approximately 18 prior to fuel transfer to approximately 11 curies after fuel transfer. The balance is due to release via the monitor tanks.

2.2.7 General Conclusions - Demineralizers and Evaporators

The measurements carried out on the demineralizers and evaporators indicate a high degree of correlation between DF and inlet (or feed) concentration. Figures 2.5-2.8 show plots of DF vs. inlet concentration for selected radionuclides in demineralizers and evaporators. Included are data from Turkey Point and from the other two PWR's studied in the in-plant measurement program (2,3). In addition, all mixed-bed demineralizers (letdown, spent fuel pit, evaporator condensate demineralizers, and the base cation demineralizers at Turkey Point when loaded with mixed-bed resin) and all evaporators (boric acid and radwaste evaporators from all vendors studied) are included.

TABLE 2.4

"BEST VALUE"† DECONTAMINATION FACTORS FOR SPENT FUEL PIT DEMINERALIZER

Nuclide	"Best Value" DF
^{131}I	2.5(0)
^{134}Cs	1.0(0)
^{137}Cs	1.0(0)
^{54}Mn	8.6(0)
^{55}Fe	3.7(0)
^{58}Co	8.3(1)
^{60}Co	1.2(2)
^{63}Ni	3.4(2)
^{90}Sr	1.0(2)
^{91}Y	1.4(1)
^{95}Nb	2.7(0)
^{124}Sb	1.5(0)
^{125}Sb	1.2(0)

† "Best Value" DF = $\frac{\text{Average Inlet Concentration}}{\text{Average Outlet Concentration}}$

Figure 2.5

^{60}Co Decontamination Factors for Mixed-Bed Demineralizers

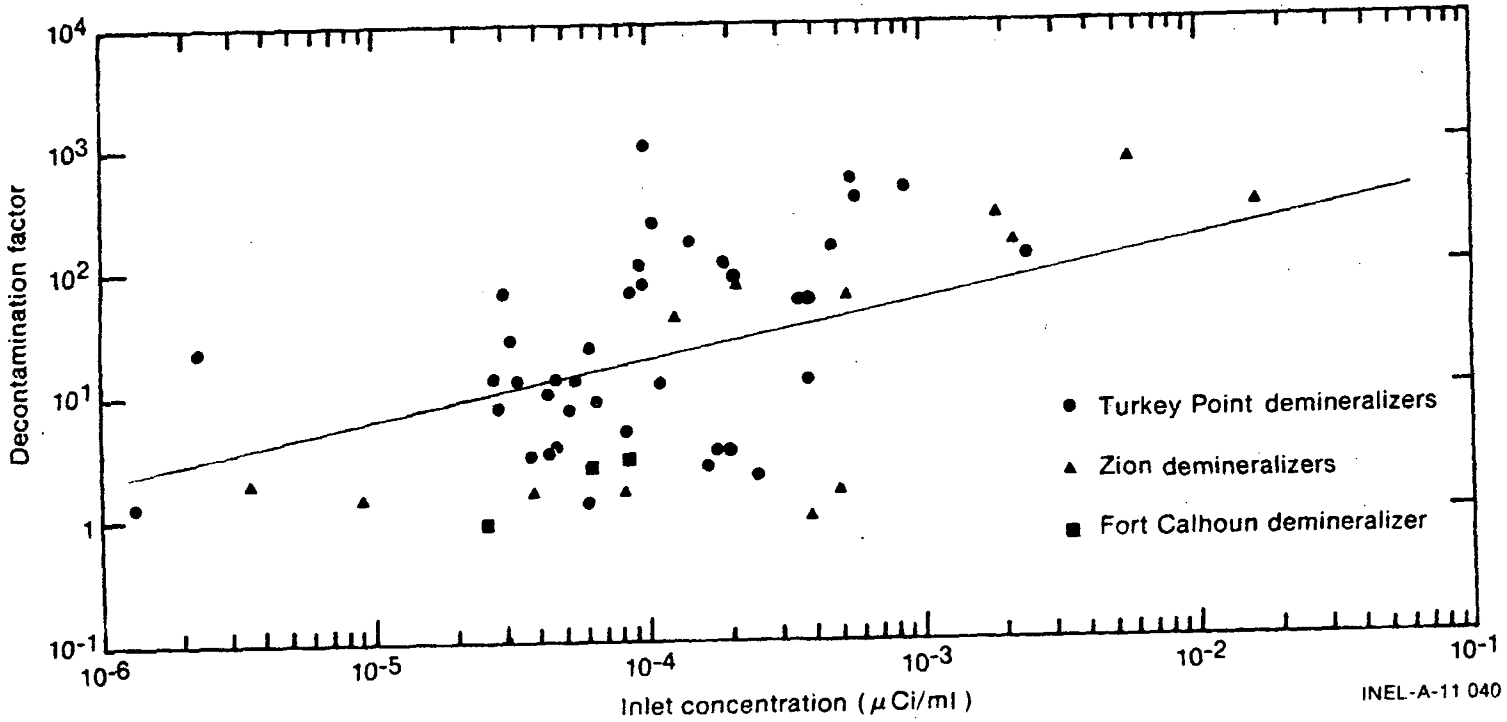


Figure 2.6

^{131}I Decontamination Factors for Evaporators

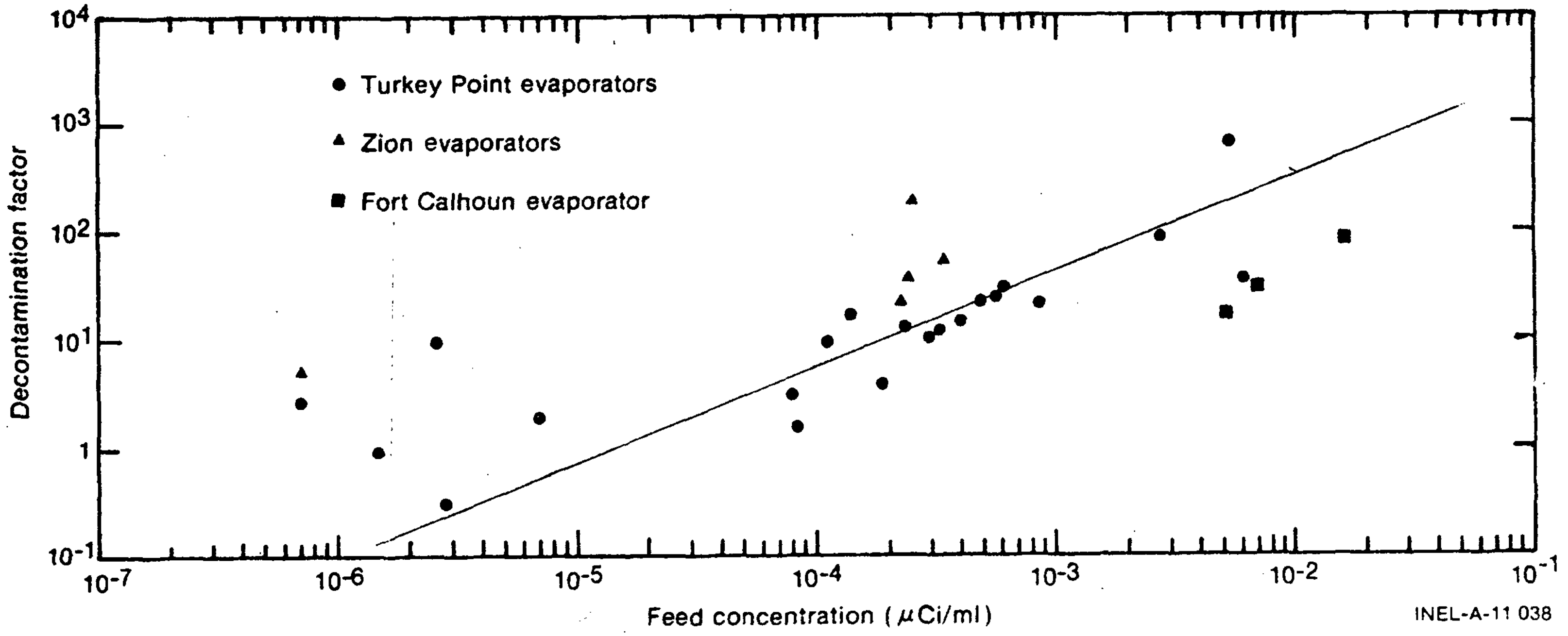


Figure 2.7

^{137}Cs Decontamination Factors for Evaporators

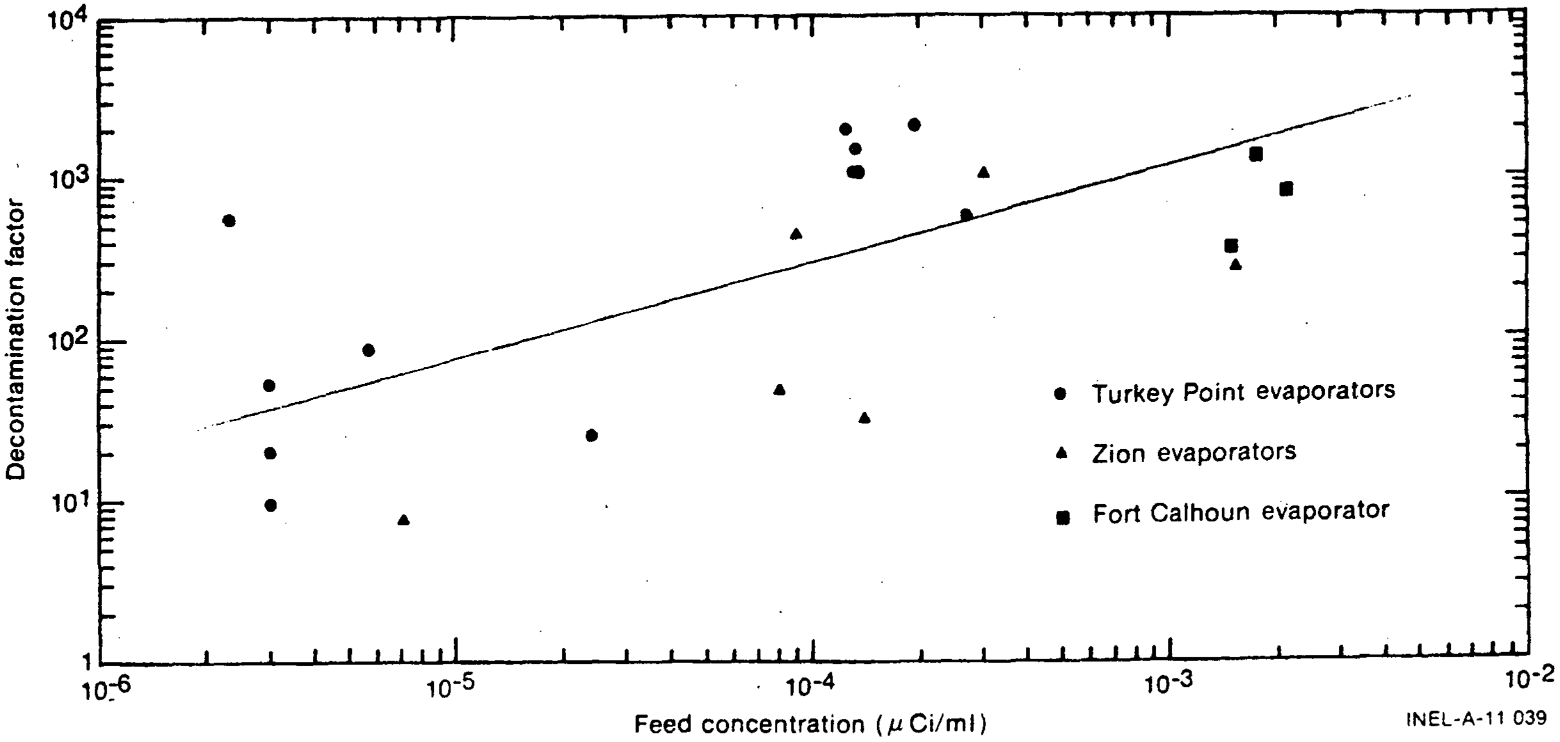
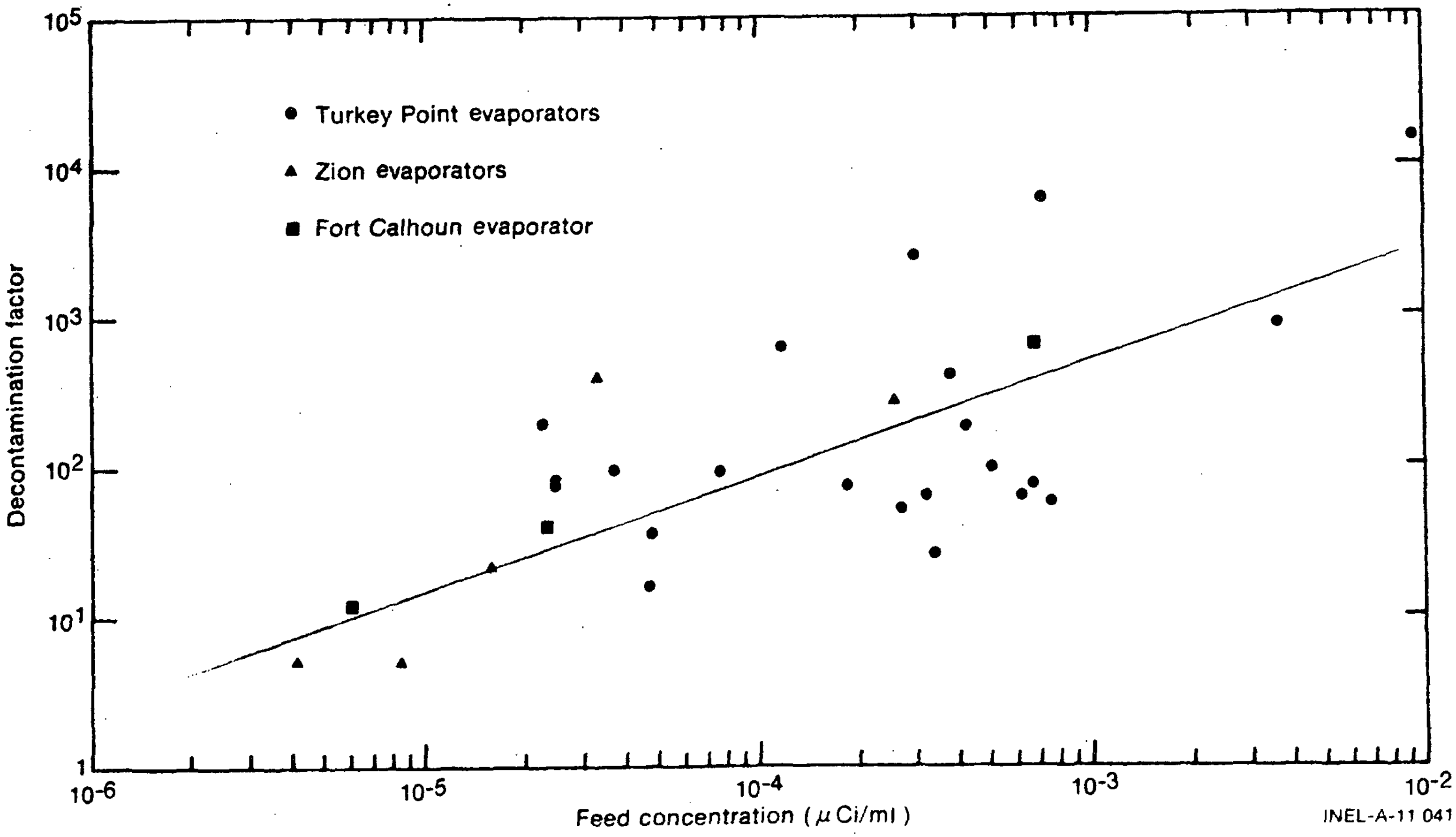


Figure 2.8

^{60}Co Decontamination Factors for Evaporators



Although the scatter of data points in Figures 2.5-2.8 is large (probably due to the variety of operating conditions, demineralizer bed lives, evaporator bottoms concentrations, etc.), the data indicate that the DF's for these radionuclides tend to increase with inlet (or feed) concentration. If the data in these figures are fit (via the method of least squares) with a straight line, i.e., an equation of the form

$$D = AC^B$$

where

C - inlet concentration

A,B - constants

D - decontamination factor,

the approximate slopes (i.e., constant B) obtained are 0.6 for ^{131}I and 0.5 for ^{60}Co in mixed-bed demineralizers, 0.6 for ^{131}I, 0.5 for ^{137}Cs, and 0.8 for ^{60}Co in evaporators. The straight lines in the figures show the fits of the above equation to the data. It must be emphasized that these results are based on a limited amount of data obtained under a variety of operating conditions. More data and more detailed analyses (including effects of operating conditions, demineralizer bed lives, evaporator bottoms concentrations, etc.) is required to verify that this relationship is generally applicable to all demineralizers and evaporators and to quantify the functional relationship between DF and inlet concentration. When the data base is sufficient to quantify the functional dependence between DF and inlet (or feed) concentration, the function will be used in place of "best value" DF because it is more representative of actual plant performance.

2.3 Gaseous Systems

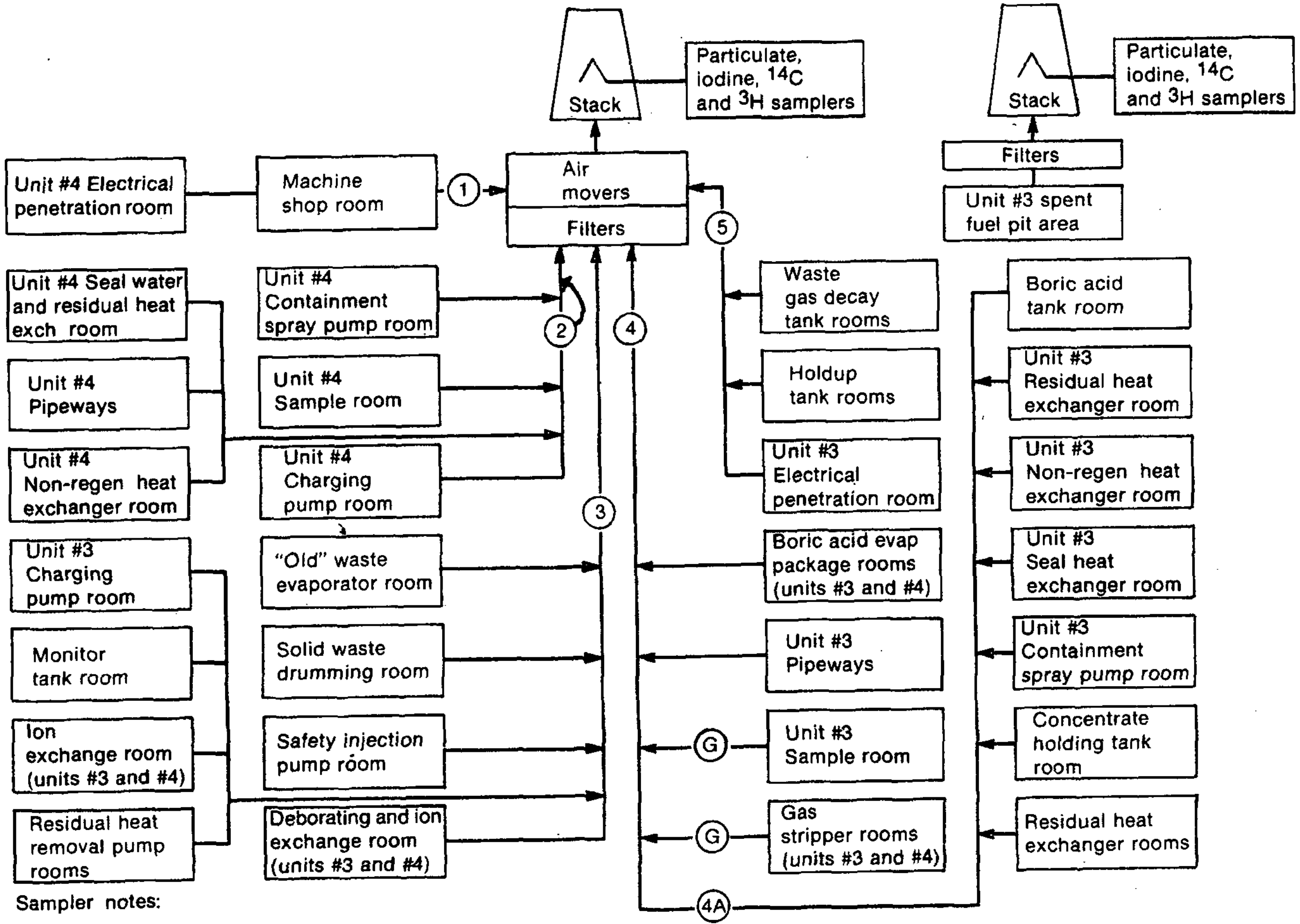
At Turkey Point there are five major areas or systems on the primary side which are potential sources of gaseous radioactivity. Potential gaseous source terms associated with the secondary system are discussed separately in section 2.2.5 above. The five major areas or systems associated with the primary side are the

1. auxiliary building,
2. containment buildings (Unit #3 and #4),
3. waste gas processing system,
4. the spent fuel pit areas (Unit #3 and #4), and
5. new radwaste building.

With the exception of the Unit #3 spent fuel pit area, all the potential sources feed into the plant's main exhaust stack. Unit #3 spent fuel pit area is independent and has its own exhaust stack. Figure 2.9 shows block diagrams of the auxiliary building and spent fuel pit #3 ventilation systems with sampler locations noted. For reference, Figure 1.2 presents the overall gaseous waste system at Turkey Point. Table 2.5 summarizes

Figure 2.9

Auxiliary Building and Spent Fuel Pit #3 Ventilation Systems



Sampler notes:

1. Circled numbers indicate longterm sampling stations with samplers for particulate and iodine.
2. Circled letters show short term sampler locations with particulate and iodine samplers.
3. Longterm samplers are indicated at both stack sample locations.

TABLE 2.5

AVERAGE RELEASE RATES[8] DURING COMBINED REFUELING AND NON-REFUELING PERIODS

(μCi/sec)

	Nuclides							
System	^{131}I	^{134}Cs	^{137}Cs	^{58}Co	^{60}Co	^{54}Mn	^{3}H	^{14}C
Stack	2.5(-2)	2.6(-4)	4.2(-4)	3.4(-3)	1.4(-3)	2.0(-4)	4.3(-1)	2.2(-1)
Auxiliary Building	2.3(-2) (92.5)[1]	2.5(-7) (<0.1)[7]	4.4(-7) (0.1)[7]	3.5(-7) (0.1)[7]	1.9(-7) (0.1)[7]	2.0(-8) (0.1)[7]	5.1(-2) (11.9)[2,4]	1.5(-1) (68.1)[2,4]
Containments (Units #3 & #4)[9]	1.9(-4) (0.7)	2.4(-6) (<0.1)	6.0(-6) (1.5)	1.0(-7) (<0.1)	9.5(-7) (0.1)	[3]	2.9(-1) (67.4)	4.6(-3) (2.1)
Waste Gas Processing System	3.8(-5) (0.1)	1.2(-11) (<0.1)[7]	2.7(-11) (<0.1)[7]	2.7(-10) (<0.1)[7]	9.2(-11) (<0.1)[7]	[3]	7.6(-4) (<1.0)	5.2(-2) (23.6)
Unit #4 Spent Fuel Area and New Radwaste Building	1.8(-3) (.72)[2,4]	2.6(-4) (99+)[2,4]	4.1(-4) (97.6)[2,4]	3.4(-3) (99+)[2,4]	1.4(-3) (99+)[2,4]	[3]	8.8(-2) (20.4)[4,5]	1.2(-2) (5.5)[4,5]
Unit #3 Spent Fuel Area[6]	4.8(-4)	[3]	5.0(-7)	[3]	[3]	[3]	8.8(-2)	1.2(-2)

---

[1] Numbers in parentheses below release rate values are percent of stack release rate.

[2] Calculated from differences of other sources which feed stack.

[3] Radionuclide not detected or insufficient data to calculate values.

[4] Areas not sampled for radionuclide.

[5] Value assumed to be the same value as Unit #3 spent fuel area (see section 5.3.1).

[6] The Unit #3 spent fuel area does not contribute to the stack releases; therefore, to obtain the total plant release rate the stack and Unit #3 spent fuel area release rates must be added. To obtain an extrapolated annual release (μCi) for any of the radionuclides the average release rate can be multiplied by the number of seconds per year, 3.15(7).

[7] Release rates have a DF of 100 applied for exhaust HEPA filters.

[8] All release rates are downstream of exhaust filter banks.

[9] Release rates from containment are for non-refueling interval only, no containment samples were taken of containment during refueling.

the average release rates for both Units #3 and #4 of measured activities during the in-plant measurement period at Turkey Point. From inspection of Table 2.5 it is apparent that the auxiliary building was the predominant source of ^{131}I during the in-plant measurement period. It contributed 92.5% of the total. Table 2.6 shows a breakdown of the data taken from sampling stations in the auxiliary building. Note that sampling station #4 was consistently the major contributor of ^{131}I from the auxiliary building . Sampling station #4 included among other things (Figure 2.9), the radwaste and boric acid evaporator (BAE) rooms, their associated gas stripper rooms, and the Unit #3 sample room. As is shown in section 8, the Unit #3 BAE room was the major source of ^{131}I in the auxiliary building. It should be noted here that the differences between the auxiliary building and stack releases are due to waste gas decay tank and containment purge releases as well as a 20% uncertainty in the measured values (see section 8.3.2).

Tables 2.7 and 2.8 present the combined average release rates during the non-refueling and refueling intervals. During both intervals the auxiliary building was the predominant source of ^{131}I. In fact, the only time an area other than the auxiliary building was a significant contributor to the stack ^{131}I release rate was during the refueling interval. Although samples were not taken of the containment atmospheres during refueling, the data indicate that the containments account for approximately 30% of the stack ^{131}I releases. This is supported by the facts that release rates from the waste gas processing system are insignifcant during both the refueling and non-refueling intervals and that the ^{131}I release from the Unit #4 spent fuel area and new radwaste building should be similar to the Unit #3 and spent fuel area. The Unit #3 spent fuel area ^{131}I release rate is insignificant compared to the stack ^{131}I release rate. During non-refueling periods, the major sources of ^{14}C and ^{3}H were the auxiliary and containment building, respectively. During refueling, a distribution similar to the non-refueling distribution for the two radionuclides is believed to exist, however, data are not available to determine an exact distribution. In all cases, the Unit #4 spent fuel and new radwaste building areas were the predominant sources of particulates (radiocesiums, radiocobalts and ^{54}Mn). The data indicate the solid waste solidification operation is the source of the particulates (see section 8.3.3).

Table 2.9 shows the ^{131}I and ^{3}H main stack release rates normalized to their respective average reactor coolant concentrations during the sampling intervals. The normalized release rates are the measured release rates divided by the average reactor coolant concentration. It should be pointed out that the ^{131}I normalized rates in Table 2.7 were calculated by including ^{131}I concentrations due to radioiodine spiking associated with reactor power transients. For comparative ^{131}I normalized release rates excluding ^{131}I reactor coolant spikes refer to Table 8.4. The average ^{131}I normalized release rate including spiking concentrations is 2.0 (μCi/sec)/(μCi/gm). If spiking is not included the average ^{131}I normalized rate is 2.9 (μCi/sec)/(μCi/gm). The ^{3}H average normalized release rate (including Unit #3 spent fuel area) is 2.95 (μCi/sec)/(μCi/gm). The normalized ^{131}I and ^{3}H averages quoted represent total plant releases.

TABLE 2.6

AUXILIARY BUILDING ^{131}I SOURCES

Sample Period	Stack Total (μCi/sec)	Auxiliary Building (total ^{131}I) (μCi/sec)	Percent of Total Auxiliary Building ^{131}I Releases					
			Station #1	Station #2	Station #3	Station #4	Station #4A	Station #5
11/10-11/21/77	4.00 ± 0.05(-2)	4.58 ± 0.03(-2)	0.5	1.3	3.6	94.5	N.S.	0.1
11/21-12/4/77[4]	1.04 ± 0.02(-2)	4.14 ± 0.02(-3)	1.8	7.5	7.2	83.3	N.S.	0.2
12/4-12/14/77[4]	1.74 ± 0.02(-2)	2.61 ± 0.04(-3)	2.9	23.3	2.6	64.8	N.S.	6.4
12/14-12/28/77[4]	6.77 ± 0.04(-2)	3.79 ± 0.01(-2)	0.4	15.4	3.6	80.7	N.S.	0.06
12/28-1/11/78[4]	4.39 ± 0.03(-2)	3.61 ± 0.01(-2)	0.3	3.0	3.2	93.4	N.S.	0.05
1/11-1/25/78[4]	3.39 ± 0.09(-3)	1.79 ± 0.03(-3)	1.2	8.4	6.5	83.7	48.2[1]	0.2
1/25-2/8/78[4]	7.66 ± 0.04(-2)	7.16 ± 0.02(-2)	0.6	1.5	0.9	96.8	34.9	0.2
2/8-2/22/78[4]	5.08 ± 0.04(-2)	4.41 ± 0.01(-2)	0.4	3.3	2.3	93.6	20.3	0.4
2/22-3/9/78	1.93 ± 0.02(-2)	1.20 ± 0.01(-2)	0.9	6.2	5.6	85.7	31.3	1.6
3/9-3/21/78	1.43 ± 0.02(-2)	1.89 ± 0.01(-2)	0.3	5.0	3.2	91.4	17.0	0.1
3/21-4/3/78	2.52 ± 0.01(-3)	1.10 ± 0.02(-3)	0.8	4.6	8.6	85.6	72.0	0.4
4/3-4/20/78	4.69 ± 0.09(-3)	3.30 ± 0.04(-3)	0.5	9.4	3.7	86.1	19.7	0.2
4/20-5/4/78	2.56 ± 0.02(-2)	2.80 ± 0.01(-2)	0.2	0.2	2.3	97.2	34.3	0.05
5/4-5/18/78	1.13 ± 0.05(-3)	1.09 ± 0.02(-4)[2]	1.1	2.2	1.5	26.7[2,3]	95.0	0.2
5/18-6/1/78	1.83 ± 0.06(-3)	3.9 ± 0.1(-4)[2]	0.8	2.3	1.3	75.0[2,3]	90.6	4.9

---

[1] Short sample period.

[2] Auxiliary building Iodine-131 total based on sample station #4A due to sampler malfunction at station #4 and consequently, the sum is low.

[3] The numbers represent the percent of the total stack releases.

[4] Samples associated with the refueling interval.

TABLE 2.7

AVERAGE RELEASE RATES DURING NON-REFUELING INTERVAL[5]

(μCi/sec)

System	$^{131}\mathrm{I}$	$^{134}\mathrm{Cs}$	$^{137}\mathrm{Cs}$	$^{58}\mathrm{Co}$	$^{60}\mathrm{Co}$	$^{54}\mathrm{Mn}$	$^{3}\mathrm{H}$	$^{14}\mathrm{C}$
Stack	1.4(-2)	2.7(-5)	4.6(-5)	5.5(-3)	1.3(-3)	2.3(-4)	5.7(-1)	1.8(-1)
Auxiliary Building	1.8(-2) (100)[7]	1.7(-8)[1] (0.2)	5.8(-8)[1] (1.3)	2.8(-7)[1] (0.0)	1.1(-7)[1] (0.0)	1.7(-8)[1]	1.6(-1)[4] (28.0)	1.4(-1)[4] (75.8)
Containments (Units #3 & #4)	1.9(-4) (0.0)	2.4(-6) (8.8)	6.0(-6) (13.0)	1.0(-7) (0.0)	9.5(-7) (0.0)	[2]	2.9(-1) (50.8)	4.6(-3) (2.5)
Waste Gas Processing System	5.7(-6) (0.0)	1.0(-11)[1] (0.0)	1.3(-11)[1] (0.0)	4.4(-11)[1] (0.0)	8.6(-11)[1] (0.0)	[2]	2.5(-4) (0.0)	2.5(-2) (13.9)
Unit #4 Spent Fuel Area and New Radwaste Building	[2,4]	2.5(-5)[4] (91.0)	4.0(-5)[4] (86.8)	5.5(-3)[4] (100)	1.3(-3)[4] (100)	[2]	1.2(-1)[3] (21.2)	1.4(-2)[3] (7.8)
Unit #3 Spent Fuel Area [6]	2.6(-4)	[2]	3.5(-7)	[2]	[2]	[2]	1.2(-1)	1.4(-2)

---

[1] Release rates have a DF of 100 applied for exhaust HEPA filters.

[2] Radionuclide not detected or insufficient data to calculate values.

[3] Value assumed to be the same value as Unit #3 spent fuel area (see section 5.3.1).

[4] Areas not sampled for radionuclide, values calculated from differences of other sources feeding the stack.

[5] All release rates are downstream of exhaust filter banks.

[6] The Unit #3 spent fuel area does not contribute to the stack releases; to obtain the total plant release rate the Unit #3 spent fuel area and the stack release rates must be added.

[7] Numbers in parentheses below the release rate values are percent of stack release rate.

TABLE 2.8

AVERAGE RELEASE RATES DURING REFUELING INTERVAL[2]

(μCi/sec)

System	^{131}I	^{134}Cs	^{137}Cs	^{58}Co	^{60}Co	^{54}Mn	^{3}H	^{14}C
Stack	3.9(-2)	5.0(-4)	8.8(-4)	1.3(-3)	1.5(-3)	8.9(-5)	3.2(-1)	3.0(-1)
Auxiliary Building	2.8(-2) (71.8)[4]	4.8(-7)[1] (0.1)	7.6(-7)[1] (0.1)	4.0(-7)[1] (0.0)	2.5(-7)[1] (0.0)	2.4(-8)[1] (0.0)	[5]	[5]
Containments (Units #3 & #4)	[5]	[5]	[5]	[5]	[5]	[5]	[5]	[5]
Waste Gas Processing System	3.1(-5) (0.0)	2.9(-12) (0.0)[1]	1.4(-11) (0.0)[1]	2.2(-10) (0.0)[1]	1.2(-11) (0.0)[1]	[6]	5.8(-4) (0.2)	2.7(-2) (9.0)
Unit #4 Spent Fuel Area and New Radwaste Building	[5]	[5]	[5]	[5]	[5]	[5]	2.9(-2) (9.1)[5,7]	9.8(-3) (3.3)[5,7]
Unit #3 Spent Fuel Area	7.5(-4)	[6]	6.0(-7)	[6]	[6]	[6]	2.9(-2)	9.8(-3)

---

[1] Release rates have a DF of 100 applied for exhaust HEPA filters.

[2] All release rates are downstream of the exhaust HEPA filters.

[3] The Unit #3 spent fuel area does not contribute to the stack releases; to obtain the total plant release rates the Unit #3 spent fuel area and the stack release rates must be added.

[4] Numbers in parenthesis below the release rate values are precent of stack release rate.

[5] Area not sampled for radionuclide.

[6] Radionuclide not detected.

[7] Value assumed to be the same value as Unit #3 spent fuel area.

TABLE 2.9

MAIN STACK ^{3}H AND ^{131}I NORMALIZED RELEASE RATES[10] AND EFFECTIVE PARTITION COEFFICIENTS

Date	Reactor Coolant Average ^{3}H (μCi/ml)[9]	Normalized ^{3}H Release Rate $\left(\frac{\mu Ci/sec}{\mu Ci/gm}\right)$[6,7]	Reactor Coolant Average ^{131}I (μCi/ml)[3]	Normalized ^{131}I Release[8] Rate $\left(\frac{\mu Ci/sec}{\mu Ci/gm}\right)$	EPF[5,7]
11/10-11/21	7.1(-2)	0.44	1.3(-2)	3.08	7.0
11/21-12/4	1.9(-1)	0.83	1.4(-2)	0.74	0.89
12/4-12/14	1.1(-1)[1]	4.4	1.3(-2)[1]	1.34	0.30
12/14-12/28	1.5(-1)[1]	4.5	1.2(-2)[1]	5.64	1.25
12/28-1/11	1.6(-1)[1]	0.94	8.3(-3)[1]	5.29	5.62
1/11-1/25	2.3(-1)[1]	0.83	6.5(-3)[1]	0.52	0.62
1/25-2/8	1.6(-1)[1]	1.5	1.4(-2)[1]	5.47	3.65
2/8-2/22	8.0(-2)	3.0	[4]	[4]	
2/22-3/9	1.3(-1)[2]	3.5	1.1(-2)[2]	1.75	0.50
3/9-3/21	1.4(-1)	1.6	1.2(-2)	1.19	0.74
3/21-4/3	1.5(-1)	1.8	1.2(-2)	0.21	0.12
4/3-4/20	2.2(-1)	7.7	3.2(-2)	0.15	1.9(-2)
4/20-5/4	2.3(-1)	1.4	1.2(-2)	2.13	1.52
5/4-5/18	1.85(-1)	0.11	1.0(-2)	0.11	1.0
5/18-6/1	2.0(-1)	5.0	8.6(-3)	0.21	4.2(-2)

---

[1] Unit #4 shutdown; Unit #3 reactor coolant concentrations used.

[2] Unit #3 shutdown; Unit #4 reactor coolant concentrations used.

[3] Reactor coolant average ^{131}I concentration includes spike concentrations. Also includes plant analyses.

[4] Insufficient reactor coolant analyses to calculate average reactor coolant concentration of release rate.

[5] Effective Partition Factor (EPF) is the ratio of normalized ^{131}I release rate to the normalized tritium release rate.

[6] The ^{3}H releases from the Unit #3 spent fuel pit (SFP) are not included in the above normalized ^{3}H release rates. Including the Unit #3 SFP area would increase the total plant normalized rates by approximately 17 percent. Therefore, the corrected normalized total plant release rate is 2.95 (μCi/sec)/(μCi/gm).

[7] One ml of reactor coolant sample weighs one gram, i.e., gram and ml are essentially interchangeable.

[8] The ^{131}I releases from the Unit #3 spent fuel area are not included in the above normalized ^{131}I release rates. However, since ^{131}I releases from the Unit #3 are less than 2 percent of the total plant ^{131}I releases the main stack ^{131}I normalized release rates represent total plant normalized rates.

[9] Average Unit #3 and #4 ^{3}H reactor coolant concentrations except as noted.

[10] Normalized release rates are for both Units #3 and #4.

Table 2.10 presents a summary of the average ^{131}I species distributions at Turkey Point. As indicated, with the exception of Unit #3 spent fuel pit area, where the species is HOI, the predominant iodine chemical species is organic iodine. This includes station #4 of the auxiliary building. The existence of organic iodine is normally associated with older iodines, i.e., farther removed in time from the primary coolant. Because of the close proximity of sample station #4 to the major ^{131}I source (i.e., #3 BAE), the predominant iodine species would not be expected to be organic. As #3 BAE processes primary coolant type water, one would expect a significant fraction of the iodine to be in the elemental form. However, as indicated the species is predominantly organic with very little elemental. This was also observed in the radwaste evaporator area at another plant (7). The controlling chemistry for this phenomenon is not known; however, one can postulate that a percentage (10%) of the iodine collected on the cleanup demineralizers is converted to an organic species and subsequently transferred to the BAE. Alternately, one could postulate that the organic iodine is formed in the bottoms of the BAE's. The latter postulation is supported (as discussed in section 8.3.2) by normalization of the ^{131}I releases to the BAE bottoms.

Table 2.11 presents the effective reactor coolant leakage rates into the containment and auxiliary buildings from both Units #3 and #4. The leakage rates are termed effective reactor coolant leakage rates as the leak rates are based on airborne radionuclide concentrations. For a given amount of reactor coolant leakage into the auxiliary or containment buildings only a fraction of the reactor coolant liquid vaporizes, the balance going to the waste drain tanks in the buildings. The amount of liquid that goes to the waste drain tanks is not included in the effective reactor coolant leak rates presented. As a result, the leak rates presented are lower than the actual reactor coolant leak rates. However, the leak rates calculated based on airborne concentrations represent more appropriate leak rates for predicting the gaseous radionuclide inventory in containment. For example, for a given radionuclide reactor coolant concentration and an effective leak rate for the same radionuclide, the actual amount of the radionuclide that leaks into the containment or auxiliary buildings and is vaporized can be predicted. This is significant in that it is the airborne radionuclide inventories which are available for release to the environment.

The approach taken in this study was to determine effective leak rates into the containment buildings based on ^{3}H and radioiodine and to calculate effective leak rates into the auxiliary building based on ^{3}H only. The auxiliary building effective leakage rates were based on ^{3}H only since effective partition factors (EPF's) greater than 1.0 were observed in the auxiliary building for the radioiodines. This approach was taken as EPF's should not exceed 1.0 (cf sections 8.3.6 and 8.3.2).

The average effective leakage rates into the auxiliary building in Table 2.9 are based on the average stack value (475 lbs/day, Table 8.12) and the percent ^{3}H coming from the auxiliary building (11.9%, Table 2.5). The effective leak rates from the Unit #3 and #4 containment buildings are an average of Unit #3 and #4 containments and are based on measurements of the containment building atmospheres.

TABLE 2.10

AVERAGE ^{131}I DISTRIBUTION AT TURKEY POINT
(percent)

Location	Particulate Filter	I_2	HOI	Organic
Stack	1.3	5.9	27.9	64.9
Auxiliary Building	2.5	9.2	24.3	64.0
#3 Spent Fuel Area	1.8	11.8	57.9	28.5
Waste Gas System	<1.0	<1.0	5.5	93.7
Containment Buildings	<1.0	3.6	11.1	84.2
Station #4	1.2	4.7	19.7	74.5

TABLE 2.11

AVERAGE EFFECTIVE LEAKAGE RATES OF REACTOR COOLANT INTO THE CONTAINMENT AND AUXILIARY BUILDING

(During Refueling and Non-refueling Combined)

	Based on ^{3}H	Based on ^{131}I
Auxiliary Building (lbs/day)	56	---
Containment Buildings (percent/day)	2.7(-2)	8.7(-4)

The following are conclusions based on the measurements made at Turkey Point:

1. The average, total plant ^{3}H and ^{131}I normalized release rates are 2.9 and 2.9 (μCi/sec)/(μCi/gm), respectively. The normalized ^{131}I released rates do not include spikes in the ^{131}I reactor coolant concentrations. The ^{131}I release rate is nomimally a factor of 40 higher than the average total release rate observed in a study by Science Applications, Inc. (SAI) at three other PWR's (7), while the normalized ^{3}H release rate observed in this study was nominally a factor of 1.5 lower than the total release rate measured by SAI.

2. The auxiliary building is the major source of gaseous ^{131}I, ranging between nominally 70 and 90 percent of the total ^{131}I releases during both refueling and non-refueling.

3. Within the auxiliary building the #3 boric acid evaporator room is the major source of ^{131}I activity. It consistently accounts for more than 80% of the total auxiliary building releases.

4. Of the spent fuel and new radwaste areas, the waste gas processing system, and the containment buildings, only the containment buildings contribute significant quantities of ^{131}I compared to the auxiliary building. The containment buildings contribute approximately 30% of the plant ^{131}I releases during the refueling interval, the only time the containment buildings' contribution is significant.

5. The average iodine species distribution released to the environment via the plant stack is 64.9% organic, 27.9% HOI, 5.9% elemental, and 1.3% particulate. In the auxiliary building the average percent distribution of the sum of the sampling locations is 64.0 organic, 24.3 HOI, 9.2 elemental, and 2.5 particulate. The distribution in the major ^{131}I source (#3 boric acid evaporator room) of the auxiliary building is 74.5% organic, 19.7% percent HOI, 4.7% elemental, and 1.2% particulate.

6. The new radwaste building contributes greater than 95% of the extrapolated annual particulate releases (^{134}Cs, ^{137}Cs, ^{58}Co, ^{60}Co, and ^{54}Mn). It is believed to be due to the solid waste solidification operation.

7. The spent fuel areas combined with the containment buildings are the major sources of ^{3}H. The contributions from the containment range between 50 and 67 percent and the spent fuel areas range between 10 and 20 percent. Tritium from the auxiliary building was most significant during non-refueling, when it was 28 percent.

8. The ^{14}C releases are 70, 1, 24, and 5 percent, respectively, for the auxiliary building, containment buildings, waste gas processing system, and the spent fuel pit areas during the refueling and non-refueling combined. A similar distribution was observed during non-refueling.

9. The ^{131}I effective partition factors in some cases exceed a value of 1.0. This is indicative of a source of ^{131}I higher in concentration than the reactor coolant.

10. The average effective leak rate of reactor coolant (based on tritium) into the axuiliary building is approximately 56 pounds per day.

11. The best estimate of the effective reactor coolant leakage rate into the containment buildings is 5.4(-4) % per day for ^3H and 8.7(-4) % per day for ^{131}I.

3. REACTOR COOLANT AND LETDOWN SYSTEM

3.1 System Description and Sample Points

3.1.1 Reactor Coolant System

The reactor coolant system is used to circulate the heated, high-pressure reactor coolant from the reactor to the steam generators. For Turkey Point Units #3 and #4, this system consists of three loops, one for each of the steam generators. Figure 3.1 shows a simplified diagram of the reactor coolant system and applies to both units.

As shown in Figure 3.1, the available sample locations in the reactor coolant system are located on hotlegs A and B. The valving allows individual samples to be taken from each hotleg or a mixed sample from both hotlegs. Liquid flows from the hotleg(s) through a cooler and then to a reactor coolant sample sink for each unit.

Normal sampling procedure was to open the two valves to obtain a mixed sample from hotlegs A and B and allow liquid to recirculate for a minimum of 15 minutes. The sample line to the sink was then purged for a minimum of 10 minutes prior to collection of a sample.

Samples were taken by two methods. Most samples were collected in 50 ml bottles as described in the Source Term Procedures (4). Since an indeterminate amount of the noble gases may be lost from these samples, when noble gas concentrations were desired, a more specialized sampling technique was employed. This technique consisted of plumbing a 35 ml liquid bomb sampler in series with the sample line, purging the sampler for a minimum of 2 minutes, then closing the stopcocks to collect a sample that had retained its dissolved noble gases. Noble gas concentrations are reported only for reactor coolant samples obtained using the 35 ml liquid bomb sampler.

Reactor coolant samples were obtained from both units approximately weekly between 11/9/77 and 6/1/78. When the letdown system was being studied and spiking due to shutdown or startup was being investigated, more frequent sampling was utilized. Samples for analysis of beta-only-emitting radionuclides were obtained on a less frequent basis.

3.1.2 Letdown System

3.1.2.1 System Description

The chemical and volume control system (CVCS) provides a means of purifying and degassing reactor coolant. The system is used to control reactor coolant boron concentration and provides for the addition of corrosion inhibiting chemicals and makeup water to the reactor coolant.

Figure 3.1

Reactor Coolant System, Units #3 and #4

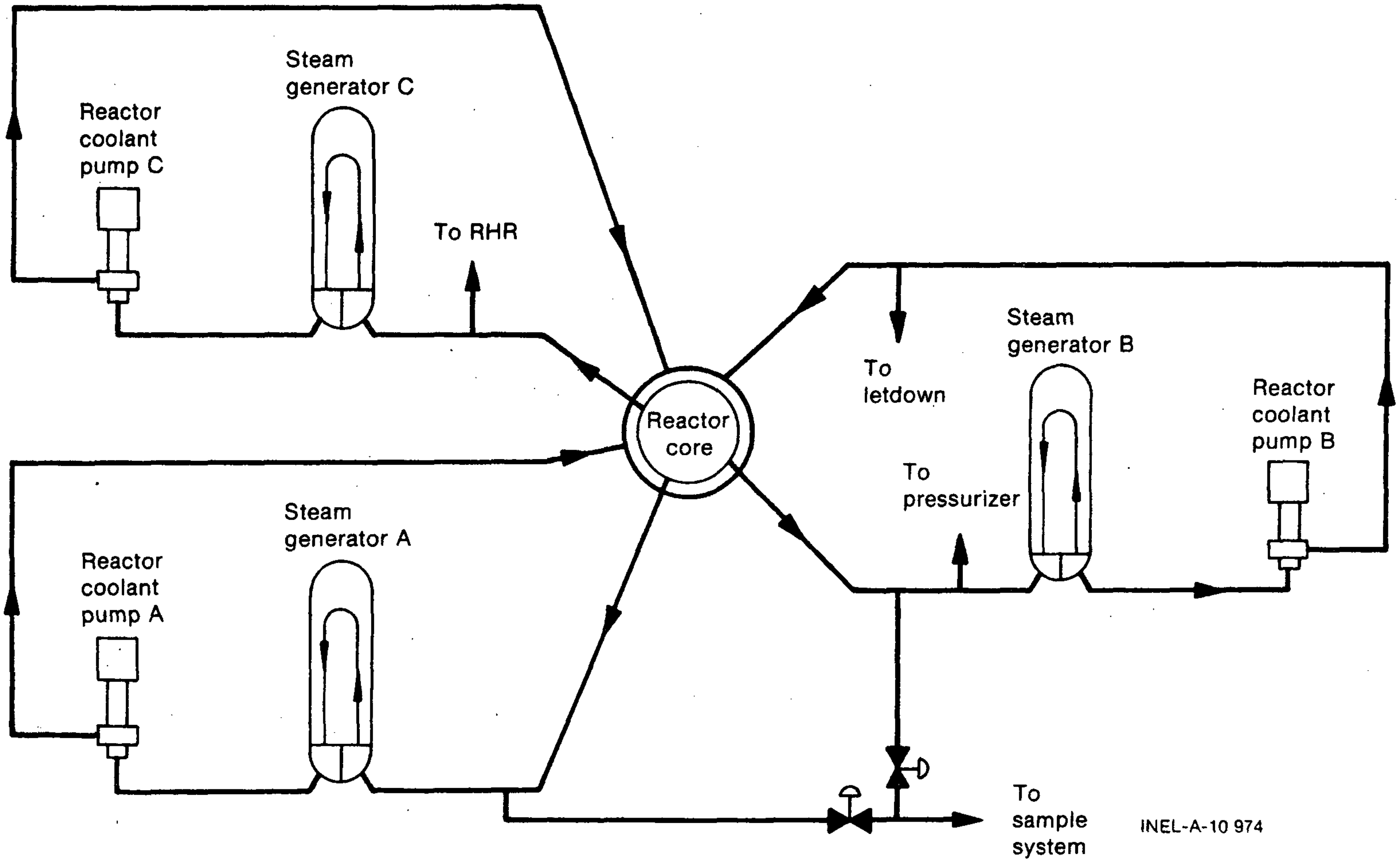


Figure 3.2 is a diagram of the CVCS purification system and applies to both Unit #3 and Unit #4. Table 3.1 is a summary of CVCS principal component information which also specifies which components are shared by Unit #3 and Unit #4.

Reactor coolant leaves the reactor coolant system by way of a letdown line located on the discharge side of reactor coolant pump B and enters the chemical and volume control system through the shell side of the regenerative heat exchanger. Coolant leaving the heat exchanger then passes through one of three letdown orifices, two of which are sized to allow 60 gpm flow and the third 45 gpm flow. The coolant then leaves containment and in the auxiliary building undergoes a second temperature reduction in the tube side of the non-regenerative heat exchanger. Component cooling water flows through the shell side of the non-regenerative heat exchanger, and the letdown stream outlet temperature is controlled automatically by a temperature control valve in the component cooling water outlet stream. The coolant is next further reduced in pressure by the low pressure letdown valve and is routed to one of two mixed-bed purification demineralizers.

The demineralized reactor coolant flows through the reactor coolant filter and enters the volume control tank through a spray nozzle. The filter, which houses three disposable synthetic filter elements, is designed for 98% retention of particulates larger than 25 microns. Hydrogen is supplied to the vapor space in the volume control tank for the purpose of removing oxygen from the reactor coolant. Periodically the tank is vented to the waste gas decay tanks to remove fission gases from the reactor coolant. Excessive rise of the volume control tank water level is prevented by automatic actuation of a three-way diversion valve, which routes the reactor coolant letdown flow to the holdup tanks.

The charging pumps return the coolant from the volume control tank to the reactor coolant system through the tube side of the regenerative heat exchanger. Also, the pumps supply high pressure water to the reactor coolant pump seals. Part of the flow enters the reactor coolant system through a labyrinth seal on the pump shaft and the remainder cools the lower radial bearing, passes through the seals, is cooled in the seal water heat exchanger, filtered, and returned to the volume control tank. Seal water inleakage to the reactor coolant system is compensated by continuous letdown of the reactor coolant system.

The makeup system supplies water to the reactor coolant system to compensate for normal reactor coolant system leakage, to adjust reactor coolant boron concentration, and to control reactor coolant chemistry. Makeup water to the reactor coolant system comes from the following sources: (1) the primary water storage tank for dilution; (2) boric acid tanks for boration; (3) refueling water storage tank for emergency makeup; (4) and the chemical mixing tank for hydrazine or pH control chemical addition. Small quantities of boric acid solution are metered from the discharge of a boric acid transfer pump for blending with primary water as makeup for normal leakage or for increasing the boron concentration.

Fiqure 3.2

Chemical and Volume Control System, Turkey Point Plant Units #3 and #4

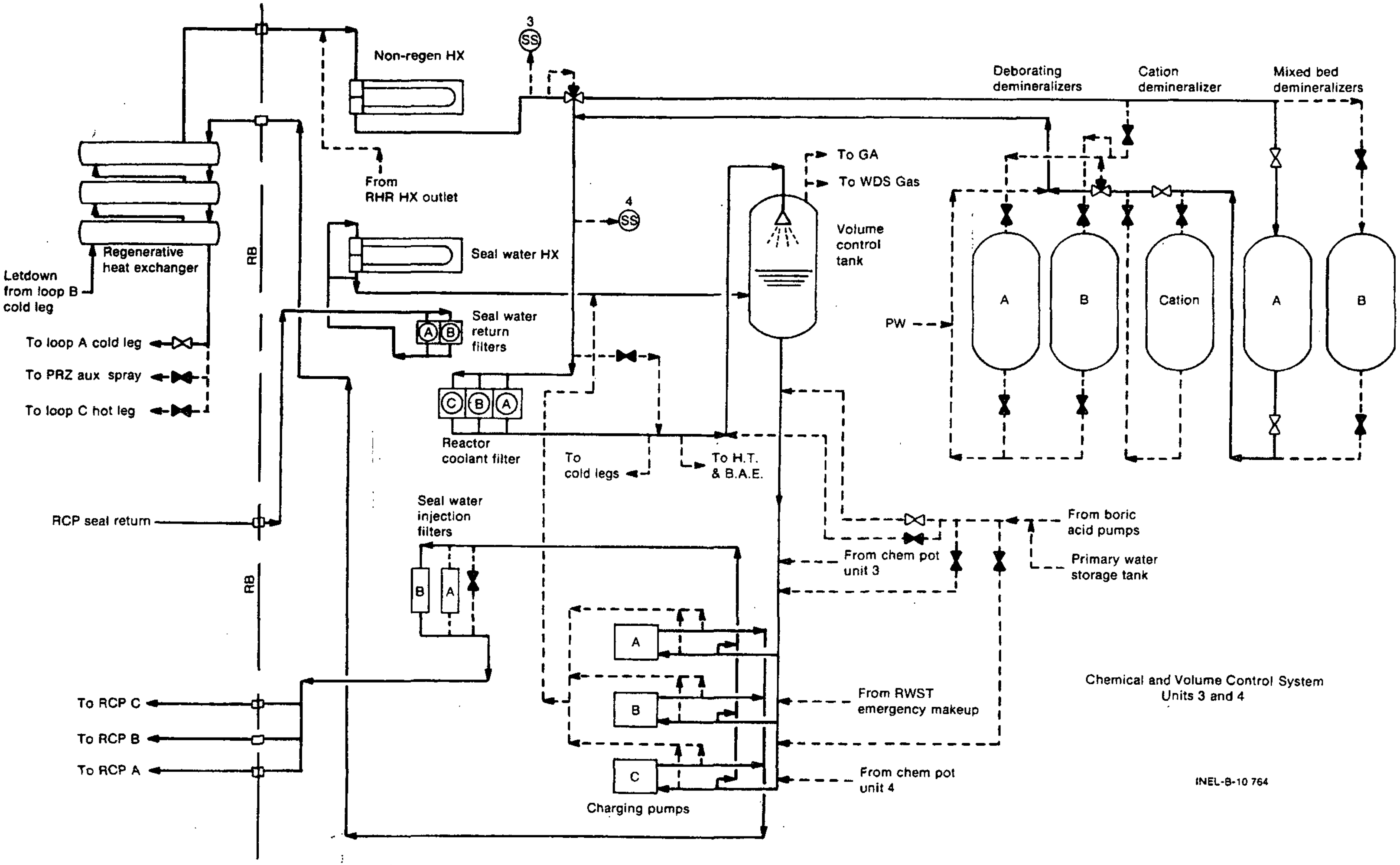


TABLE 3.1

PRINCIPAL CVCS COMPONENT DATA SUMMARY

	Quantity[1]	Heat Transfer Btu/hr	Letdown Flow lb/hr	Letdown ΔT °F	Design Pressure psig, shell/tube	Design Temperature F, shell/tube
Heat Exchangers						
Regenerative	1	8.65×10^6	29,826	265	2485/2735	650/650
Non regenerative	1	14.8×10^6	29,826	163	150/600	250/400
Seal water	1	2.17×10^6	126,756	17	150/150	250/250
Excess letdown	1	4.75×10^6	12,400	360	150/2485	250/650

	Quantity[1]	Type	Capacity Each gpm	Head	Design Pressure psig	Design Temperature F
Pumps						
Charging	3	Pos. displ.	77	2385 psi	3000	250
Boric acid transfer	4*	Canned	60	235 ft	150	250
Holdup tank recirculation	1*	Centrifugal	500	100 ft	150	200
Monitor tank	2*	Centrifugal	100	150 ft	150	200
Concentrates holding tank transfer	2*	Canned	20	150 ft	75	250
Gas stripper feed	3*	Canned	25	185 ft	150	200
Gas stripper bottom	2	Canned	12.5	93 ft	75	300

	Quantity[1]	Type	Volume, Each	Design Pressure psig	Design Temperature F
Tanks					
Volume control	1	Vert.	$300\ ft^3$	75 Int/15Ext	250
Charging pump accum.	3	Vert.	$100\ in^3$	3000	250
Boric acid	3*	Vert.	7500 gal	Atmos.	250
Chemical mixing	1	Vert.	6.0 gal	150	250
Batching	1*	Jacket Btm.	800 gal	Atmos.	250
Holdup	3*	Horizontal	$13,000\ ft^3$	15	200

TABLE 3.1 (Cont'd)

	Quantity[1]	Type	Volume	Design Pressure psig	Design Temperature F
Tanks (continued)					
Concentrates holding	1*	Vertical	925 gal	Atmos.	250
Monitor	2*	Diaphragm	10,000 gal	Atmos.	150

	Quantity[1]	Type	Resin Volume ft^3	Flow gpm	Design Pressure psig	Design Temperature F
Demineralizer Vessels						
Mixed bed	2	Flushable	30	109	200	250
Cation bed	1	Flushable	20	60	200	250
Base and cation ion exchangers	3*	Flushable	30	25	150	250
Evaporator condensate	2*	Fixed	30	25	200	250
Deborating	2	Fixed	43	120	200	250

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[1] Quantity per unit unless otherwise specified.

* Shared or capable of being shared by Unit 3 and Unit 4.

Two flushable mixed-bed demineralizers serve the CVCS to remove fission and corrosion products from the reactor coolant. They are placed in parallel in the letdown stream at the head of a demineralizer train that also includes one cation demineralizer and two anion deborating demineralizers. The cation demineralizer is charged with resin in the hydrogen form and is used intermittently to control the concentrations of lithium and cesium. Input to the cation demineralizer is the effluent from one of the mixed-bed demineralizers. When a deborating demineralizer is in service, which would normally be near the end of a core life, it receives the effluent of a mixed-bed demineralizer and passes deborated reactor coolant to the volume control tank via the reactor coolant filter. The purpose of the reactor coolant filter is to protect against resin fines.

Each mixed-bed demineralizer holds 30 ft^3 of Li-OH resin, and each bed has a surface area of 5.4 ft^2 and a depth of 5.5 ft. Turkey Point purchases resins from three vendors and sometimes mixes resins from different vendors when charging the mixed-bed demineralizers. Mixed Bed 'B' of Unit #3 was charged on 6/8/77, and put in service 1/20/78. Mixed Bed 'A' of Unit #4 was charged on a date unknown and put in service 5/10/77. These mixed beds remained in service throughout the sampling period.

3.1.2.2 Sample Points

The available valid sample locations in the CVCS purification systems of Units #3 & #4 were (1) downstream from the non-regenerative heat exchanger; upstream from the three-way diversion valve which is used to divert letdown to the holdup tanks; upstream from the purification demineralizers train and (2) downstream from the purification demineralizer train; upstream from the reactor coolant filter. No valid sample point was available downstream from the reactor coolant filter of either unit. Liquid samples of the letdown streams of Units #3 & #4 were taken at their respective reactor coolant sample sinks.

3.1.2.3 Sample Collection

Sample lines were purged for a minimum of 10 minutes prior to collection of mixed-bed demineralizer inlet and outlet samples. Usually less than two minutes elapsed between inlet and outlet collection times. Inlet samples were collected in 50 ml volumes on all sample dates and during December, 1977, 800 ml samples were taken concurrently for the purpose of resin concentration. In addition, 450 ml inlet samples were taken concurrently during April, 1978. Volumes of outlet samples were 450 ml with the exception of those samples taken in December, 1977, and February, 1978, which had volumes of several liters and were taken at the same time for the purpose of resin concentration.

3.2 Discussion of Measurement Data - Reactor Coolant

3.2.1 Radionuclide Concentrations in Reactor Coolant

Reactor coolant samples were obtained from Unit #3 during the period from 11/9/77 to 6/1/78. This period encompassed the three stages of Unit #3 operation - power generation prior to refueling, refueling operations, and power generation following refueling. During power operations, samples were obtained by the method described in Section 3.1.1. During refueling, however, samples were obtained either through the RHR system or directly from the reactor cavity (i.e., a dip sample). Results of analyses of these samples are contained in Appendix Tables B.1, B.2, B.3, B.5, B.6, B.8, and B.11.

Figure 2.1 shows plots of the power level and ^{131}I concentration in reactor coolant for Unit #3. Data obtained by FPL are included. It should be noted that the dashed lines are not intended to indicate the ^{131}I concentration between measurement points (e.g., the indicated shapes of most spikes are inaccurate due to the limited number of data points). Their purpose is to aid in determining trends. Examination of Figure 2.1 indicates that the ^{131}I concentration in Unit #3 reactor coolant spiked not only upon reactor shutdown and startup but each time the power was altered. A small spike was even observed after a power reduction from 100% to 90% on 11/19/77. If spikes are ignored, the average ^{131}I level before refueling was about 1.5(-2) μCi/ml and about 7(-3) μCi/ml after refueling. No attempt was made to obtain an average ^{131}I concentration that included the contribution due to spikes. In order to obtain such a time-weighted average, all spikes must be well characterized as to intensity and duration. This information, however, was obtained only for two spikes (see Section 3.2.3).

Table 3.2 lists average (i.e., arithmetic mean) radionuclide concentrations in Unit #3 reactor coolant measured during non-spiking periods prior to refueling and after refueling. The methods used to obtain these averages and others in this report are discussed in Appendix A. No attempt was made to obtain average radionuclide concentration for the refueling period because of the large variations in concentration. These variations are due to several factors including (1) radioactive decay, (2) the addition of 4 gal. of peroxide to the reactor coolant at shutdown to dissolve crud, and (3) the mixing of reactor coolant with water from the fuel pool and refueling water storage tank for Unit #3. An indication of the large reduction in concentration of the short-lived radionuclides due to reactor shutdown and refueling can be obtained by a comparison of the concentrations obtained during refueling (Table B.2) with the corresponding data obtained before and after refueling (Tables B.1 and B.3).

Inspection of Table 3.2 indicates that as a result of refueling the iodine concentration was reduced by about a factor of two, rubidium decreased by about 50%, and cesium decreased by approximately a factor of two. No trend in the concentrations of crud-associated radionuclides is discernible. A reduction in iodine, rubidium, and cesium levels after refueling is expected because the new fuel should contain fewer leaks than the older fuel that it replaced. Examination of the iodine ratios before and after refueling (see Tables 3.3 and 3.3A), indicates that in both cases the release mechanism for fission products appears to

TABLE 3.2

AVERAGE RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT REACTOR POWER OPERATIONS (NON-SPIKING) - UNIT #3

	Measured Prior to Refueling† 11/1/77 - 11/22/77		Measured After Refueling†† 2/21/78-6/1/78	
Nuclide	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{85m}Kr	**	**	1.8(-2)	1.5-2.3(-2)
^{85}Kr	**	**	<4(-5)	†††
^{87}Kr	**	**	3.4(-2)	2.6-4.1(-2)
^{88}Kr	**	**	4.7(-2)	3.9-6.3(-2)
^{131m}Xe	**	**	<2(-3)	†††
^{133m}Xe	**	**	4.3(-3)	1.2-8.7(-3)
^{133}Xe	**	**	2.0(-1)	0.5-3.1(-1)
^{135m}Xe	**	**	1.1(-1)	0.5-3(-1)
^{135}Xe	**	**	1.5(-1)	1.2-1.9(-1)
^{137}Xe	**	**	3(-2)	2-4(-2)
^{138}Xe	**	**	1.1(-1)	0.9-1.3(-1)
^{84}Br	**	**	1.6(-2)	1.4-2.2(-2)
^{131}I	1.5(-2)	1.1-1.8(-2)	6.9(-3)	4.3-8.8(-3)
^{132}I	1.9(-1)	1.7-2.2(-1)	9.5(-2)	0.4-1.15(-1)
^{133}I	1.2(-1)	1.1-1.3(-1)	5.6(-2)	5.3-6.1(-2)
^{134}I	3.4(-1)	3.3-3.5(-1)	1.8(-1)	1.63-1.97(-1)
^{135}I	2.1(-1)	2.0-2.2(-1)	1.0(-1)	0.9-1.09(-1)
^{88}Rb	1.0(-1)	0.8-1.3(-1)	7.0(-2)	5.8-8.0(-2)
^{89}Rb	1.0(-1)	0.9-1.1(-1)	6.1(-2)	4.8-7.6(-2)
^{134}Cs	1.2(-3)	0.3-1.6(-3)	6.2(-4)	0.05-1.85(-3)
^{136}Cs	1.5(-4)	1.1-2.2(-4)	1.1(-4)	0.35-5.6(-4)
^{137}Cs	2.1(-3)	0.5-2.7(-3)	8.5(-4)	0.06-2.6(-3)
^{138}Cs	3.0(-1)	2.8-3.3(-1)	1.8(-1)	1.6-2.48(-1)
^{139}Cs	2.8(-1)	2.2-3.3(-1)	1.5(-1)	0.3-2.6(-1)
^{3}H	1.3(-1)	0.57-1.9(-1)	1.7(-1)	0.41-3.2(-1)
^{41}Ar	**	**	5(-3)	<0.05-2.3(-2)
^{14}C	**	**	4.6(-5)	2.5-6.7(-5)
^{24}Na	5.8(-3)	3.0-7.0(-3)	7.4(-3)	0.24-1.26(-2)
^{32}P	**	**	3.7(-3)	3.0-4.37(-3)
^{51}Cr	5(-5)	0.2-1.7(-4)	1.5(-4)	0.6-5.3(-4)
^{54}Mn	1.4(-5)	1.0-1.9(-5)	2.9(-5)	0.02-1.08(-4)
^{55}Fe	**	**	1.5(-5)	0.97-2.1(-5)
^{59}Fe	1.0(-5)	0.9-1.1(-5)	9(-6)	0.25-2.6(-5)
^{57}Co	9(-6)	0.6-1(-5)	2(-6)	<0.7-5.3(-6)
^{58}Co	4.7(-4)	0.1-1.5(-3)	4(-4)	0.01-1.16(-3)
^{60}Co	1.2(-4)	0.6-3.3(-4)	2(-4)	0.04-6.8(-4)
^{63}Ni	**	**	5.3(-6)	1.9-9.1(-6)
^{65}Zn	1.3(-5)	1.3-2.0(-5)	4(-6)	<1-9(-6)
^{89}Sr	**	**	1.9(-5)	1.76-2.11(-5)
^{90}Sr	**	**	2.1(-7)	0.17-4.1(-7)

TABLE 3.2 (cont'd)

AVERAGE RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT REACTOR POWER OPERATIONS (NON-SPIKING) - UNIT #3

Nuclide	Measured Prior to Refueling† 11/1/77 - 11/22/77		Measured After Refueling†† 2/21/78-6/1/78	
	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{91}Sr	8(-4)	0.3-1.3(-3)	3 ± 2(-4)	***
^{91}Y	**	**	5.85(-7)	5.8-5.9(-7)
^{93}Y	2.3(-3)	2-5(-3)	2(-3)	0.9-5(-3)
^{95}Zr	2.5(-5)	1.4-6.5(-5)	3.9(-5)	0.09-1.07(-4)
^{95}Nb	3.5(-5)	2.4-6.9(-5)	5.0(-5)	0.05-1.28(-4)
^{99}Mo	1.2(-3)	0.2-1.6(-3)	9.3(-4)	0.13-1.52(-3)
^{103}Ru	1.6(-5)	1.6-2.4(-5)	1.6(-5)	0.4-5.7(-5)
^{106}Rh	6 ± 2(-5)	***	2.3(-5)	0.05-1.0(-4)
^{110m}Ag	<2(-4)	†††	6(-6)	0.18-1.1(-5)
^{124}Sb	7(-6)	0.6-2.0(-5)	9(-6)	0.19-3.8(-5)
^{125}Sb	1.5±1.4(-5)	***	9(-6)	0.4-2.1(-5)
^{129m}Te	5 ± 5(-6)	***	5 ± 3(-5)	***
^{129}Te	<5(-3)	†††	2.1±0.2(-2)	***
^{131m}Te	3 ± 2(-4)	***	<2(-4)	†††
^{131}Te	**	**	7 ± 1(-3)	***
^{132}Te	2(-5)	0.3-4(-5)	3(-5)	0.16-1.3(-4)
^{139}Ba	1.1(-2)	0.6-1.7(-2)	1.5(-2)	0.3-1.9(-2)
^{140}Ba	9(-5)	0.4-1.9(-4)	2.1(-4)	0.16-6.0(-4)
^{140}La	2(-4)	0.2-7(-4)	3(-4)	0.01-2.3(-3)
^{141}Ce	1.4(-5)	1.4-2(-5)	5(-6)	0.2-3(-5)
^{143}Ce	<1(-5)	†††	<2(-5)	†††
^{144}Ce	<9(-6)	†††	1(-5)	<0.4-3(-5)
^{152}Eu	<2(-5)	†††	<4(-6)	†††
^{154}Eu	<5(-6)	†††	<2(-6)	†††
^{155}Eu	**	**	2 ± 1(-6)	***
^{187}W	<7(-5)	†††	1.5(-4)	0.8-3.0(-4)
^{239}Np	7(-5)	0.6-1.1(-4)	5(-5)	<0.2-1.8(-4)

** - Analysis not performed for radionuclide

*** - Radionuclide detected in only one sample, therefore, a range of measured concentrations was not obtained.

† - Data obtained from the following samples (see Appendix Table B.1)

1037, 11/14/77
1623, 11/16/77
1158, 11/17/77
1735, 11/18/77
1710, 11/21/77

^{131}I data includes the above samples and the following FPL samples (see Appendix Table B.8)

0200, 11/1/77
0105, 11/15/77
0936, 11/22/77

^{3}H data obtained from FPL samples obtained during period 11/3-21/77 (see Appendix Table B.8)

TABLE 3.2 (cont'd)

AVERAGE RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT REACTOR POWER OPERATIONS (NON-SPIKING) - UNIT #3

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†† - Data obtained from the following samples (see Appendix Table B.3)

1316, 2/21/78
1133, 2/23/78
0805-0806, 4/9/78
1824, 4/12/78
1126, 4/13/78
1123, 4/15/78
1000-1004, 4/17/78
1006-1009, 4/25/78
0918, 5/1/78
1013, 5/9/78
0951, 5/16/78
0923, 5/25/78
0938, 6/1/78

^{131}I data includes results from the above samples and the following FPL samples (see Appendix Table B.8)

2/21/78
0800, 3/21/78
2120, 3/21/78
0815, 4/4/78
4/11/78
0835, 4/18/78
0835, 5/2/78
5/9/78
0849, 5/16/78
1840, 5/23/78
0235, 5/24/78
0855, 5/30/78

Beta-only-emitting radionuclide data obtained from samples (see Appendix Table B.6)

1010, 4/25/78
0940, 6/1/78

^{3}H data includes FPL samples obtained during period 2/20-5/29/78 (see Appendix Table B.8)

††† - Radionuclide was not detected (only a detection limit was obtained). A range of measured concentrations, therefore, was not obtained.

be dominated by recoil. The majority of the fission products are, therefore, coming from tramp uranium. Examination of the iodine levels in the reactor coolant before and after refueling indicates that refueling had reduced the magnitude of the source of fission products by about a factor of two. Hence, much of the tramp uranium remained in the core after refueling.

Reactor coolant samples were obtained from Unit #4 from 12/2/77 to 5/23/78. During this period, the reactor was down for steam generator repairs for about 3 weeks (2/14 - 3/9/78). Results of analyses of samples obtained from Unit #4 can be found in Appendix Tables B.4, B.7, B.9, and B.10. Alpha analysis of a composite of samples obtained between 12/12/77 and 1/25/78 yielded a ^{238}Pu concentration of 5.4 ± 1.6(-9) µCi/ml and a ^{239,240}Pu concentration of 4.3 ± 1.4(-9) µCi/ml. Figure 2.2 shows plots of the power level and ^{131}I concentration in reactor coolant for Unit #4. As in the corresponding plots for Unit #3 (figure 2.1), FPL data has been included.

TABLE 3.3

IODINE RATIOS IN UNIT #3 REACTOR COOLANT

	Ratio Before Refueling	Ratio After Refueling
^{133}I/^{131}I	8.0	8.1
^{135}I/^{131}I	14.0	14.6
^{132}I/^{131}I	12.7	13.8
^{134}I/^{131}I	22.7	25.8

TABLE 3.3A

THEORETICAL IODINE RATIOS DUE TO RECOIL, DIFFUSION, AND EQUILIBRIUM FUEL FAILURE MECHANISMS

	Theoretical Ratio* for		
Ratio	Recoil	Diffusion	Equilibrium
^{133}I/^{131}I	16	5.1	1.7
^{135}I/^{131}I	29	5.4	1.0
^{132}I/^{131}I	26	2.9	0.31
^{134}I/^{131}I	54	3.7	0.25

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*Ratios are based on models in reference 8.

Examination of Figure 2.2 indicates that the ^{131}I concentration in Unit #4 spiked whenever the reactor power level was altered. Units #3 and #4, therefore, exhibit similar spiking characteristics. In addition to spikes due to power changes, a higher than normal iodine level of long duration was observed in samples obtained during the period 4/9-14/78. This elevation was caused by the letdown demineralizer for Unit #4 being bypassed for change out of the letdown filter. Although it is not known exactly when bypass of the demineralizer began, the shape of the elevation indicates that it probably began on 4/7 or 4/8/78.

Because of the letdown demineralizer bypass, average radionuclide concentrations in Unit #4 reactor coolant were obtained for three periods - before the bypass of the letdown demineralizer, during the 4/9-14/78 period of bypass, and after the demineralizer had been put back into service. These average concentrations (see Table 3.4) do not include data obtained during spikes due to changes in reactor power. Results from the sample obtained at 09:27 on 12/12/77, however, are included because this sample was obtained during a non-spiking period. This sample contained much higher levels of crud-associated radionuclides than other samples obtained from Unit #4 although iodine, cesium, rubidium, and sodium concentrations were normal. Although these anomalously high levels of crud-associated radionuclides certainly influence the averages and ranges given in Table 3.4, they were included because the sample was valid. In addition, FPL personnel indicated that they have observed similar "crud bursts" in reactor coolant at Turkey Point.

Examination of the average concentrations in Table 3.4 measured before and after the 4/9-14/78 bypass of the letdown demineralizer indicate increases in the levels of iodine, cesium, and most crud-associated radionuclides. For example, the average ^{131}I concentration exhibited a 23% increase. Concentrations of shorter-lived iodines increased by about 50% and ^{134}Cs and ^{137}Cs levels increased by about a factor of two. Most crud-associated radionuclides exhibited increased concentrations also. As expected, fission gas levels were essentially the same before and after the bypass of the demineralizer. It is not known why the average iodine, cesium, and crud-associated radionuclide levels showed increases after the period of demineralizer bypass. It would be expected that the levels of these radioisotopes would return to pre-bypass values soon after the demineralizer had been put back into operation.

An indication of fuel quality can be obtained from the iodine ratios. Table 3.5 lists the iodine ratios before and after the 4/9-14/78 demineralizer bypass. Examination of these ratios indicates that the release mechanism for fission products appears to be dominated by diffusion both before and after the demineralizer bypass (see Table 3.3A). It is not known why the iodine ratios were higher after the demineralizer bypass than before it. Mere bypassing of the letdown demineralizer would not be expected to cause this.

A comparison of the reactor coolant iodine activities for the two reactor units indicates that after refueling the release rate for ^{131}I

TABLE 3.4

AVERAGE RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT REACTOR POWER OPERATIONS (NON-SPIKING) - UNIT #4

	Measured During Period† 11/12/77-3/28/78		Measured During Period†† 4/9-14/78		Measured During Period††† 4/17-5/31/78	
Nuclide	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{85m}Kr	1.7(-2)	1.6-1.9(-2)	**	**	1.7(-2)	1.5-1.91(-2)
^{85}Kr	<2(-5)	††††	**	**	<8(-4)	††††
^{87}Kr	2.3(-2)	2.1-2.4(-2)	**	**	2.5(-2)	2.1-2.8(-2)
^{88}Kr	3.4(-2)	3.2-3.8(-2)	**	**	3.8(-2)	3.2-4.43(-2)
^{131m}Xe	4 ± 1(-4)	***	**	**	2(-4)	0.4-4(-4)
^{133m}Xe	6.7(-3)	5.3-7.9(-3)	**	**	6.6(-3)	5.7-8.0(-3)
^{133}Xe	2.1(-1)	1.3-2.7(-1)	**	**	2.2(-1)	1.9-3.0(-1)
^{135m}Xe	1.9(-2)	1.7-2(-2)	**	**	2.3(-2)	<2-3.2(-2)
^{135}Xe	1.2(-1)	1.02-1.49(-1)	**	**	1.2(-1)	1.1-1.4(-1)
^{137}Xe	*	*	**	**	1.2(-2)	0.6-1.9(-2)
^{138}Xe	3.3(-2)	2.3-4.4(-2)	**	**	4.0(-2)	2.9-4.7(-2)
^{84}Br	**	**	1.9(-3)	1.9-2.0(-3)	3.3(-3)	2.0-5(-3)
^{131}I	6.5(-3)	0.36-1.0(-2)	8.9(-2)	0.66-1.01(-1)	8.0(-3)	0.63-1.03(-2)
^{132}I	1.3(-2)	0.99-1.46(-2)	2.2(-2)	1.89-2.45(-2)	1.9(-2)	1.83-2.06(-2)
^{133}I	1.2(-2)	0.99-1.66(-2)	4.7(-2)	3.3-5.2(-2)	1.7(-2)	1.68-1.8(-2)
^{134}I	1.4(-2)	1.09-1.72(-2)	2.1(-2)	2.01-2.18(-2)	2.2(-2)	1.96-2.43(-2)
^{135}I	1.2(-2)	1.09-1.44(-2)	2.7(-2)	2.0-3.05(-2)	1.9(-2)	1.80-1.98(-2)
^{88}Rb	5.5(-2)	4.6-7.4(-2)	6.2(-2)	5.0-8(-2)	5.8(-2)	5.1-6.6(-2)
^{89}Rb	9.5(-3)	0.68-1.4(-2)	1.0(-2)	0.8-1.2(-2)	1.4(-2)	1.14-1.63(-2)
^{134}Cs	9.4(-4)	0.44-1.49(-3)	1.7(-3)	1.73-1.8(-3)	2.0(-3)	1.61-3.1(-3)
^{136}Cs	3.9(-5)	1.5-9(-5)	2.1(-4)	1.45-2.7(-4)	3.8(-5)	2.4-5.2(-5)
^{137}Cs	1.8(-3)	1.2-2.9(-3)	3.2(-3)	3.06-3.44(-3)	3.5(-3)	3.0-4.5(-3)
^{138}Cs	3.9(-2)	3.6-4.4(-2)	5.5(-2)	4.7-7(-2)	5.8(-2)	5.0-7.8(-2)
^{139}Cs	1.3(-2)	0.01-5(-2)	1.8(-2)	1.5-2.3(-2)	1.3(-2)	0.2-4(-2)

TABLE 3.4 (cont'd)

AVERAGE RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT REACTOR POWER OPERATIONS (NON-SPIKING) - UNIT #4

	Measured During Period[†] 11/12/77-3/28/78		Measured During Period[††] 4/9-14/78		Measured During Period[†††] 4/17-5/31/78	
Nuclide	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{3}H	1.3(-1)	0.15-2.5(-1)	2.1(-1)	***	2.3(-1)	1.6-3.2(-1)
^{41}Ar	6(-4)	0.5-1.05(-3)	**	**	<2(-4)	††††
^{14}C	1.9(-6)	1.22-3.2(-6)	**	**	9.5 ± 1.0(-6)	***
^{24}Na	5.6(-3)	4.2-7.6(-3)	2.2(-2)	1.64-2.43(-2)	9.3(-3)	0.84-1.16(-2)
^{32}P	9.7(-5)	0.36-1.58(-4)	**	**	8.2 ± 0.2(-3)	***
^{51}Cr	4.5(-4)	0.004-4.0(-3)	1.7 ± 0.6(-4)	***	6.3(-4)	0.06-1.8(-3)
^{54}Mn	7(-5)	0.019-6.0(-4)	1.3(-5)	0.53-2.1(-5)	1.7(-4)	0.15-5.0(-4)
^{55}Fe	2.0(-5)	0.38-5.3(-5)	**	**	9.8 ± 0.1(-4)	***
^{59}Fe	4.5(-5)	0.016-5.3(-4)	8(-6)	0.2-1.6(-5)	9(-5)	0.06-3.2(-4)
^{57}Co	1.1(-5)	0.13-8.0(-5)	<3(-6)		7(-6)	0.13-1.9(-5)
^{58}Co	1.3(-3)	0.007-1.2(-2)	7(-4)	0.26-1.14(-3)	2.9(-3)	0.26-8.5(-3)
^{60}Co	1.2(-4)	0.003-1.0(-3)	3.2(-5)	1.4-4.5(-5)	2.6(-4)	0.47-4.6(-4)
^{63}Ni	5.9(-6)	0.125-1.49(-5)	**	**	1.76 ± 0.06(-4)	***
^{65}Zn	8(-6)	0.16-4(-5)	3(-6)	2.9-3(-6)	1.9(-5)	<0.2-2.5(-5)
^{89}Sr	1.2(-5)	0.048-3.2(-5)	**	**	5.9 ± 0.2(-6)	***
^{90}Sr	2.4(-7)	0.2-6.3(-7)	**	**	4.3 ± 0.5(-7)	***
^{91}Sr	2 ± 2(-4)	***	<2(-4)		2 ± 2(-4)	***
^{91}Y	1.9(-7)	0.5-4(-7)	**	**	1.35 ± 0.09(-6)	***
^{93}Y	4(-4)	0.03-2.2(-3)	9 ± 4(-4)	***	<3(-4)	††††
^{95}Zr	4.5(-5)	0.013-4.6(-4)	2.5(-5)	1.0-5(-5)	8(-5)	0.17-1.6(-4)
^{95}Nb	4.2(-5)	0.02-4.4(-4)	1.5(-5)	0.83-2.3(-5)	1.1(-4)	0.11-2.2(-4)
^{99}Mo	1.7(-4)	0.001-1.08(-3)	1.3(-4)	1.2-1.5(-4)	1.3(-4)	0.71-1.7(-4)
^{103}Ru	8(-6)	0.10-3.5(-5)	4(-6)	3.5-9(-6)	2.2(-5)	0.6-6(-5)
^{106}Rh	<4(-6)	††††	<2(-5)		<2(-5)	††††
^{110m}Ag	3.4 ± 0.8(-5)	***	5(-6)	2.7-7(-6)	1.8(-5)	0.5-3(-5)

TABLE 3.4 (cont'd)

AVERAGE RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT REACTOR POWER OPERATIONS (NON-SPIKING) - UNIT #4

	Measured During Period† 11/12/77-3/28/78		Measured During Period†† 4/9-14/78		Measured During Period††† 4/17-5/31/78	
Nuclide	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{124}Sb	1.9(-5)	0.008 - 1.5(-4)	1.3(-5)	0.43-2.6(-5)	3.9(-5)	0.4-8.3(-5)
^{125}Sb	8(-6)	0.4-3.0(-5)	<8(-6)	††††	<6(-6)	††††
^{129m}Te	<3(-6)	††††	<6(-5)	††††	<3(-5)	††††
^{129}Te	<6(-3)	††††	<4(-3)	††††	<1(-2)	††††
^{131m}Te	<4(-5)	††††	1.6 ± 0.8(-3)	***	<2(-4)	††††
^{131}Te	**	**	<9(-4)	††††	<8(-4)	††††
^{132}Te	3(-5)	0.4-5(-5)	1.9 ± 0.9(-5)	***	3(-5)	<0.07-1.1(-4)
^{139}Ba	4.5(-3)	2.5-7.6(-3)	6(-3)	3.8-9(-3)	6.0(-3)	4-8(-3)
^{140}Ba	1.1(-4)	0.15-4.0(-4)	<2(-5)	††††	2.3(-5)	0.04-7.6(-3)
^{140}La	5(-5)	0.05-2(-4)	<1(-5)	††††	9(-4)	<0.03-3.4(-3)
^{141}Ce	6(-6)	0.3-2.5(-5)	<6(-6)	††††	1 ± 1(-5)	***
^{143}Ce	4 ± 4(-5)	***	<4(-5)	††††	<6(-5)	††††
^{144}Ce	7(-6)	0.15-3(-5)	<3(-5)	††††	<2(-5)	††††
^{152}Eu	<4(-6)	††††	<3(-5)	††††	<2(-5)	††††
^{154}Eu	5 ± 3(-6)	***	<2(-6)	††††	<2(-6)	††††
^{155}Eu	**	**	<9(-6)	††††	<6(-6)	††††
^{187}W	1(-4)	<0.2-5(-4)	<2(-4)	††††	<2(-4)	††††
^{239}Np	4(-5)	0.05-1.6(-4)	<5(-5)	††††	6 ± 4(-5)	***

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* - Radionuclide not detected

** - Analysis not performed for radionuclide

*** - Radionuclide detected in only one sample, therefore, a range of measured concentrations was not obtained.

TABLE 3.4 (cont'd)

AVERAGE RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT REACTOR POWER OPERATIONS (NON-SPIKING) - UNIT #4

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† - Data obtained from the following samples (see Appendix Table B.4)

0945, 12/8/77
1052, 12/11/77
0927, 12/12/77
1618, 1/7/78
2030, 1/11/78
1127, 1/18/78
1127, 1/19/78
1305, 1/20/78
1116, 1/22/78
1114, 1/23/78
1031, 1/24/78
0414, 1/25/78
0943, 2/3/78
0950, 2/7/78
0955, 2/8/78
1104, 2/9/78
1036, 3/17/78
1916-1935, 3/25/78

^{131}I data includes the above samples and the following FPL samples (see Appendix Table B.7)

11/15/77
0835, 11/29/77
0025, 12/13/77
1/17/78
0825, 1/31/78
0832, 3/14/78
3/21/78
0900, 3/28/78

Beta-only emitting radionuclide data obtained from samples (see Appendix Table B.7)

1610, 11/30/77
0929, 12/2/77
0933, 12/12/77

^{3}H data includes FPL samples obtained during period 11/7/77-4/3/78 (see Appendix Table B.9)

†† - Data obtained from the following samples (see Appendix Table B.4)

0903-0904, 4/9/78
1753, 4/12/78
1138, 4/13/78
1355, 4/14/78

^{131}I data includes the above samples and the following FPL sample (see Appendix Table B.9)

0919, 4/11/78

^{3}H data obtained from the following FPL sample (see Appendix Table B.9)

4/10/78

TABLE 3.4 (cont'd)

AVERAGE RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
REACTOR POWER OPERATIONS (NON-SPIKING) - UNIT #4

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††† - Data obtained from the following samples (see Appendix Table B.4)

1045-1046, 4/17/78
0909, 5/1/78
0921, 5/9/78
1012, 5/16/78
1030, 5/23/78

^{131}I data includes the above samples and the following FPL samples (see Appendix Table B.9)

4/18/78
0920, 5/9/78
5/16/78
0833, 5/23/78
0405, 5/31/78

Beta-only-emitting radionuclide data obtained from the 1025, 4/24/78 sample (see Appendix Table B.7)

^{3}H data includes FPL samples obtained during period 4/17-5/29/78 (see Appendix Table B.9)

†††† - Radionuclide was not detected (only a detection limit was obtained). A range of measured concentrations, therefore, was not obtained.

TABLE 3.5

IODINE RATIOS IN UNIT #4 REACTOR COOLANT

	Ratio Before 4/9-14/78 Demineralizer Bypass	Ratio After 4/9-14/78 Demineralizer Bypass
$^{133}I/^{131}I$	1.8	2.1
$^{135}I/^{131}I$	1.8	2.4
$^{132}I/^{131}I$	2.0	2.4
$^{134}I/^{131}I$	2.1	2.7

in Unit #3 was about the same as that in Unit #4. However, because the release mechanism was predominantly recoil in Unit #3 and diffusion in Unit #4, even after refueling the release rates for the other iodines were much higher in Unit #3 than in Unit #4.

A comparison of the average radionuclide concentrations in the two units indicates the following. In general, the levels of the gaseous fission products were slightly higher in Unit #3 reactor coolant. The levels of ^{133}Xe, however, were about equal in the two units. The ^{131}I concentration was higher in Unit #3 prior to refueling but after refueling it dropped to about the level measured in Unit #4. Concentrations of the shorter-lived iodine radionuclides were much higher (about an order of magnitude) in Unit #3 than in Unit #4. Unit #4 reactor coolant exhibited higher levels of crud-associated radionuclides (e.g., ^{51}Cr, ^{54}Mn, ^{55}Fe, ^{59}Fe, $^{57-60}$Co, ^{110m}Ag, ^{124}Sb) than did Unit #3. The only major crud radionuclide that exhibited higher concentrations in Unit #3 than in Unit #4 was ^{60}Co. The reason for this apparent anomalous behavior of ^{60}Co is not known. In general, the rubidium and the shorter-lived cesium concentrations were higher in Unit #3 reactor coolant.

3.2.2 Predicted Radionuclide Concentrations in Coolant Waters

The American Nuclear Society, Standards Committee Working Group ANS-18.1 has prepared a set of typical radionuclide concentrations for use in estimating the radioactivity in the principal fluid streams of a light water reactor over its lifetime (9). Expected radionuclide activity levels in the primary and secondary coolants for Turkey Point can be derived from the ANSI N237-1976 values by adjusting the parameters of the reference PWR to those of Turkey Point. Table 3.6 presents these expected activity levels and Table 3.7 lists the parameters used for adjustment of the reference PWR to Turkey Point. These parameters are for U-tube steam generators and assumes all volatile treatment (AVT) of the secondary coolant.

Although the techniques used to collect the data in the in-plant measurement study are capable of detecting all gamma-emitting radionuclides

TABLE 3.6

PREDICTED RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT AND SECONDARY COOLANT†

Nuclide	Reactor Coolant (µCi/gm)	Secondary Coolant **	
		Water (µCi/gm)	Steam (µCi/gm)
* ^{83m}Kr	1.9(-2)	Nil	8.1(-9)
^{85m}Kr	9.8(-2)	Nil	4.3(-8)
^{85}Kr	1.6(-1)	Nil	7.0(-8)
^{87}Kr	5.3(-2)	Nil	2.2(-8)
^{88}Kr	1.8(-1)	Nil	7.7(-8)
* ^{89}Kr	4.5(-3)	Nil	1.9(-9)
^{131m}Xe	1.0(-1)	Nil	4.5(-8)
^{133m}Xe	2.0(-1)	Nil	8.7(-8)
^{133}Xe	1.6(+1)	Nil	7.1(-6)
^{135m}Xe	1.2(-2)	Nil	5.0(-9)
^{135}Xe	3.1(-1)	Nil	1.4(-7)
^{137}Xe	8.0(-3)	Nil	3.5(-9)
^{138}Xe	3.9(-2)	Nil	1.7(-8)
* ^{83}Br	4.2(-3)	2.7(-7)	2.7(-9)
^{84}Br	2.3(-3)	3.2(-8)	3.2(-10)
* ^{85}Br	2.7(-4)	3.1(-10)	3.1(-12)
* ^{130}I	1.8(-3)	5.2(-7)	5.2(-9)
^{131}I	2.1(-1)	2.4(-4)	2.4(-6)
^{132}I	8.7(-2)	2.0(-5)	2.0(-7)
^{133}I	3.1(-1)	1.4(-4)	1.4(-6)
^{134}I	4.2(-2)	9.4(-7)	9.4(-9)
^{135}I	1.6(-1)	2.8(-5)	2.8(-7)
* ^{86}Rb	6.8(-5)	7.6(-8)	7.6(-11)
^{88}Rb	1.8(-1)	1.3(-6)	1.3(-9)
^{134}Cs	2.0(-2)	1.9(-5)	1.9(-8)
^{136}Cs	1.0(-2)	9.6(-6)	9.6(-9)
^{137}Cs	1.4(-2)	1.5(-5)	1.5(-8)
* ^{16}N	4.0(+1)	1.7(-6)	1.7(-7)
^{3}H	1.0(0)	1.0(-3)	1.0(-3)
^{51}Cr	1.5(-3)	1.5(-6)	1.5(-9)
^{54}Mn	2.4(-4)	3.7(-7)	3.7(-10)
^{55}Fe	1.3(-3)	1.3(-6)	1.3(-9)
^{59}Fe	7.8(-4)	9.4(-7)	9.4(-10)
^{58}Co	1.3(-2)	1.3(-5)	1.3(-8)
^{60}Co	1.6(-3)	1.7(-6)	1.7(-9)
^{89}Sr	2.7(-4)	3.7(-7)	3.7(-10)
^{90}Sr	7.8(-6)	9.4(-9)	9.4(-12)
^{91}Sr	5.5(-4)	1.1(-7)	1.1(-10)
* ^{90}Y	9.6(-7)	3.7(-9)	3.7(-12)
^{91}Y	5.0(-5)	5.6(-8)	5.6(-11)

TABLE 3.6 (cont'd)

PREDICTED RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT AND SECONDARY COOLANT

Nuclide	Reactor Coolant (µCi/gm)	Secondary Coolant	
		Water (µCi/gm)	Steam (µCi/gm)
* ^{91m}Y	3.2(-4)	4.8(-8)	4.8(-11)
^{93}Y	2.8(-5)	7.2(-9)	7.2(-12)
^{95}Zr	4.7(-5)	5.6(-8)	5.6(-11)
^{95}Nb	3.9(-5)	5.6(-8)	5.6(-11)
^{99}Mo	6.7(-2)	5.6(-5)	5.6(-8)
* ^{99m}Tc	4.1(-2)	5.3(-5)	5.3(-8)
^{103}Ru	3.5(-5)	3.7(-8)	3.7(-11)
* ^{106}Ru	7.8(-6)	9.4(-9)	9.4(-12)
* ^{103m}Rh	4.0(-5)	3.2(-8)	3.2(-11)
^{106}Rh	8.9(-6)	7.7(-9)	7.7(-12)
* ^{125m}Te	2.3(-5)	1.7(-8)	1.7(-11)
* ^{127m}Te	2.2(-4)	1.7(-7)	1.7(-10)
* ^{127}Te	7.1(-4)	3.6(-7)	3.6(-10)
^{129m}Te	1.1(-3)	1.1(-6)	1.1(-9)
^{129}Te	1.4(-3)	9.7(-7)	9.7(-10)
^{131m}Te	2.0(-3)	9.3(-7)	9.3(-10)
^{131}Te	9.8(-4)	7.9(-7)	7.9(-10)
^{132}Te	2.1(-2)	1.5(-5)	1.5(-8)
* ^{137m}Ba	1.4(-2)	1.2(-5)	1.2(-8)
^{140}Ba	1.7(-4)	1.7(-7)	1.7(-10)
^{140}La	1.2(-4)	1.5(-7)	1.5(-10)
^{141}Ce	5.5(-5)	5.6(-8)	5.6(-11)
^{143}Ce	3.2(-5)	1.7(-8)	1.7(-11)
^{144}Ce	2.6(-5)	3.7(-8)	3.7(-11)
* ^{143}Pr	3.9(-5)	3.7(-8)	3.7(-11)
* ^{144}Pr	2.9(-5)	3.1(-8)	3.1(-11)
^{239}Np	9.6(-4)	5.6(-7)	5.6(-10)

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† - Prediction based on ANSI N237-1976 Standard (9)

* - Radionuclide listed in ANSI N237-1976 but not directly measured at Turkey Point

** - Calculation assumes all volatile treatment chemistry for secondary water

TABLE 3.7

PARAMETER VALUES USED TO MODIFY N237 PREDICTED RADIONUCLIDE CONCENTRATIONS FOR TURKEY POINT UNIT #3 OR #4

Parameter	Symbol	Unit	Turkey Point Value Unit #3 or #4
Thermal Power	P	MWt	2200*
Steam flow rate (all generators)	FS	lbs/hr	9.6(6)*
Weight of water in reactor coolant system	WP	lbs	4.0(5)**
Weight of water in all steam generators	WS	lbs	2.6(5)***
Reactor coolant letdown flow (purification)	FD	lbs/hr	3.0(4)*
Reactor coolant letdown flow (yearly average for boron control)	FB	lbs/hr	3.0(2)*
Steam generator blowdown flow (total)	FBD	lbs/hr	3.2(4)*
Fraction of radioactivity in blowdown stream which is not returned to the secondary coolant system	NBD	------	1.0*
Flow through the purification system cation demineralizer	FA	lbs/hr	3.0(3)*
Ratio of condensate demineralizer flow rate to the total steam flow rate	NC	------	0.0*
Ratio of the total amount of noble gases routed to gaseous radwaste from the purification system to the total amount routed from the primary coolant system to the purification system (not including the boron recovery system)	Y	------	0.0*

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* Based on information obtained during measurement program

** Information from FSAR (10)

*** Information from NRC

present in any sample, some radionuclides treated in ANSI N237-1976 were not observed at Turkey Point (cf the radionuclides denoted with an asterisk in Table 3.6). These radionuclides were not observed because they were either not present in detectable quantities, they have very short half lives, or they emit only very low energy gamma rays. For example, ^{86}Rb and ^{130}I are present only in very small amounts because of their very low fission yields (about 2(-3)% for each isotope). In addition, their gamma rays are masked by gamma rays of about the same energy emitted by more abundant radionuclides. The radionuclides ^{16}N, ^{85}Br, and ^{89}Kr have very short half-lives which precluded their detection by the measurement techniques utilized in the in-plant studies. The radionuclides ^{83}Br and ^{83m}Kr could not be detected due to their very low gamma-ray energies. Other radionuclides such as ^{90}Y, ^{91m}Y, ^{99m}Tc, ^{103m}Rh, ^{106}Ru, ^{137m}Ba, ^{143}Pr, and ^{144}Pr could not be detected due to very low gamma-ray energies or interferences from other radionuclides but they are parents or daughters of radionuclides that were measured. The concentrations of these radionuclides can be estimated by assuming that they are in equilibrium with their parent or daughter. This assumption is valid when the reactor is producing power under steady state conditions.

Although attempts were made to measure the concentrations of the tellurium isotopes, they have not been observed with any consistency at Turkey Point. Tellurium-129m was detected in only 2 samples, ^{129}Te in 1 sample, and ^{131m}Te in 1 sample. Tellurium-132 was detected more frequently, but its concentration was about 3 orders of magnitude lower than predicted by ANSI N237-1976. There is evidence (see Section 3.2.3) that indicates that tellurium is fixed on the internal reactor core components.

In Table 3.8 the radionuclide concentrations predicted for Turkey Point reactor coolant are compared with the average concentrations actually measured for Units #3 and #4. Except for ^{132}I and ^{134}I, the measured radionuclide levels are generally lower than the predicted levels.

3.2.3 Spiking Studies

As noted in section 3.2.1, the data indicate that the iodine concentrations in the reactor coolant of both units spike whenever the reactor power is changed by about 10% or more. No data is available to indicate whether spiking occurs for power changes of less than 10%. In order to study the spiking phenomenon in more detail, reactor coolant samples were obtained on approximately an hourly basis during two hot shutdowns.

On 1/25/78 Unit #4 underwent a hot shutdown that lasted almost 12 hours. Power reduction began at 04:00 and reached 0% just after 06:00. Startup began at about 17:30 and 100% was reached at 19:00. Figure 3.3 shows plots of the concentrations of ^{131}I, ^{137}Cs, and ^{58}Co during the shutdown. Data obtained during the spike can be found in Appendix Table B.10.

[redacted]

^{131m}Xe	1.0(-1)	**	<2(-3)	4(-4)*	2(-4)
^{133m}Xe	2.0(-1)	**	4.3(-3)	6.7(-3)	6.6(-3)
^{133}Xe	1.6(+1)	**	2.0(-1)	2.1(-1)	2.2(-1)
^{135m}Xe	1.2(-2)	**	1.1(-1)	1.9(-2)	2.3(-2)
^{135}Xe	3.1(-1)	**	1.5(-1)	1.2(-1)	1.2(-1)
^{137}Xe	8.0(-3)	**	3(-2)	†	1.2(-2)
^{138}Xe	3.9(-2)	**	1.1(-1)	3.3(-2)	4.0(-2)
^{84}Br	2.3(-3)	**	1.6(-2)	**	3.3(-3)
^{131}I	2.1(-1)	1.5(-2)	6.9(-3)	6.5(-3)	8.0(-3)
^{132}I	8.7(-2)	1.9(-1)	9.5(-2)	1.3(-2)	1.9(-2)
^{133}I	3.1(-1)	1.2(-1)	5.6(-2)	1.2(-2)	1.7(-2)
^{134}I	4.2(-2)	3.4(-1)	1.8(-1)	1.4(-2)	2.2(-2)
^{135}I	1.6(-1)	2.1(-1)	1.0(-1)	1.2(-2)	1.9(-2)
^{88}Rb	1.8(-1)	1.0(-1)	7.0(-2)	5.5(-2)	5.8(-2)
^{89}Rb	††	1.0(-1)	6.1(-2)	9.5(-3)	1.4(-2)
^{134}Cs	2.0(-2)	1.2(-3)	6.2(-4)	9.4(-4)	2.0(-3)
^{136}Cs	1.0(-2)	1.5(-4)	1.1(-4)	3.9(-5)	3.8(-5)
^{137}Cs	1.4(-2)	2.1(-3)	8.5(-4)	1.8(-3)	3.5(-3)
^{138}Cs	††	3.0(-1)	1.8(-1)	3.9(-2)	5.8(-2)
^{139}Cs	††	2.8(-1)	1.5(-1)	1.3(-2)	1.3(-2)
^{3}H	1.0(0)	1.3(-1)	1.7(-1)	1.3(-1)	2.3(-1)
^{41}Ar	††	**	5(-3)	6(-4)	<2(-4)

TABLE 3.8 (cont'd)

COMPARISON OF PREDICTED AND MEASURED RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT

		Measured Concentration in Unit #3		Measured Concentration in Unit #4	
Nuclide	Predicted Concentration (μCi/ml)	Before Refueling (μCi/ml)	After Refueling (μCi/ml)	Before Bypass*** (μCi/ml)	After Bypass*** (μCi/ml)
^{14}C	††	**	4.6(-5)	1.9(-6)	9.5(-6)*
^{24}Na	††	5.8(-3)	7.4(-3)	5.6(-3)	9.3(-3)
^{32}P	††	**	3.7(-3)	9.7(-5)	8.2(-3)*
^{51}Cr	1.5(-3)	5(-5)	1.5(-4)	4.5(-4)	6.3(-4)
^{54}Mn	2.4(-4)	1.4(-5)	2.9(-5)	7(-5)	1.7(-4)
^{55}Fe	1.3(-3)	**	1.5(-5)	2.0(-5)	9.8(-4)*
^{59}Fe	7.8(-4)	1.0(-5)	9(-6)	4.5(-5)	9(-5)
^{57}Co	††	9(-6)	2(-6)	1.1(-5)	7(-6)
^{58}Co	1.3(-2)	4.7(-4)	4(-4)	1.3(-3)	2.9(-3)
^{60}Co	1.6(-3)	1.2(-4)	2(-4)	1.2(-4)	2.6(-4)
^{63}Ni	††	**	5.3(-6)	5.9(-6)	1.76(-4)*
^{65}Zn	††	1.3(-5)	4(-6)	8(-6)	1.9(-5)
^{89}Sr	2.7(-4)	**	1.9(-5)	1.2(-5)	5.9(-6)*
^{90}Sr	7.8(-6)	**	2.1(-7)	2.4(-7)	4.3(-7)*
^{91}Sr	5.5(-4)	8(-4)	3(-4)*	2(-4)*	2(-4)*
^{91}Y	5.0(-5)	**	5.8(-7)	1.9(-7)	1.35(-6)*
^{93}Y	2.8(-5)	2.3(-3)	2(-3)	4(-4)	<3(-4)
^{95}Zr	4.7(-5)	2.5(-5)	3.9(-5)	4.5(-5)	8(-5)
^{95}Nb	3.9(-5)	3.5(-5)	5.0(-5)	4.2(-5)	1.1(-4)
^{99}Mo	6.7(-2)	1.2(-3)	9.3(-4)	1.7(-4)	1.3(-4)
^{103}Ru	3.5(-5)	1.6(-5)	1.6(-5)	8(-6)	2.2(-5)
^{106}Rh	8.9(-6)	6(-5)†	2.3(-5)	<4(-6)	<2(-5)
^{110m}Ag	††	<2(-4)	6(-6)	3.4(-5)*	1.8(-5)
^{124}Sb	††	7(-6)	9(-6)	1.9(-5)	3.9(-5)
^{125}Sb	††	1.5(-5)*	9(-6)	8(-6)	<6(-6)
^{129m}Te	1.1(-3)	5(-6)*	5(-5)*	<3(-6)	<3(-5)
^{129}Te	1.4(-3)	<5(-3)	2.1(-2)*	<6(-3)	<1(-2)
^{131m}Te	2.0(-3)	3(-4)*	<2(-4)	<4(-5)	<2(-4)
^{131}Te	9.8(-4)	**	7(-3)*	**	<8(-4)
^{132}Te	2.1(-2)	2(-5)	3(-5)	3(-5)	<3(-5)

TABLE 3.8 (cont'd)

COMPARISON OF PREDICTED AND MEASURED RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT

Nuclide	Predicted Concentration (µCi/ml)	Measured Concentration in Unit #3		Measured Concentration in Unit #4	
		Before Refueling (µCi/ml)	After Refueling (µCi/ml)	Before Bypass*** (µCi/ml)	After Bypass*** (µCi/ml)
^{139}Ba	††	1.1(-2)	1.5(-2)	4.5(-3)	6.0(-3)
^{140}Ba	1.7(-4)	9(-5)	2.1(-4)	1.1(-4)	2.3(-5)
^{140}La	1.2(-4)	2(-4)	3(-4)	5(-5)	9(-4)
^{141}Ce	5.5(-5)	1.4(-5)	5(-6)	6(-6)	1(-5)*
^{143}Ce	3.2(-5)	<1(-5)	<2(-5)	4(-5)*	<6(-5)
^{144}Ce	2.6(-5)	<9(-6)	1(-5)	7(-6)	<2(-5)
^{152}Eu	††	<2(-5)	<4(-6)	<4(-6)	<2(-5)
^{154}Eu	††	<5(-6)	<2(-6)	5(-6)*	<2(-6)
^{155}Eu	††	**	2(-6)*	**	<6(-6)
^{187}W	††	<7(-5)	1.5(-4)	1(-4)	<2(-4)
^{239}Pu	9.6(-4)	<7(-5)	5(-5)	4(-5)	6(-5)*

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† - Radionuclide not detected

†† - Radionuclide not listed in ANSI N237-1976

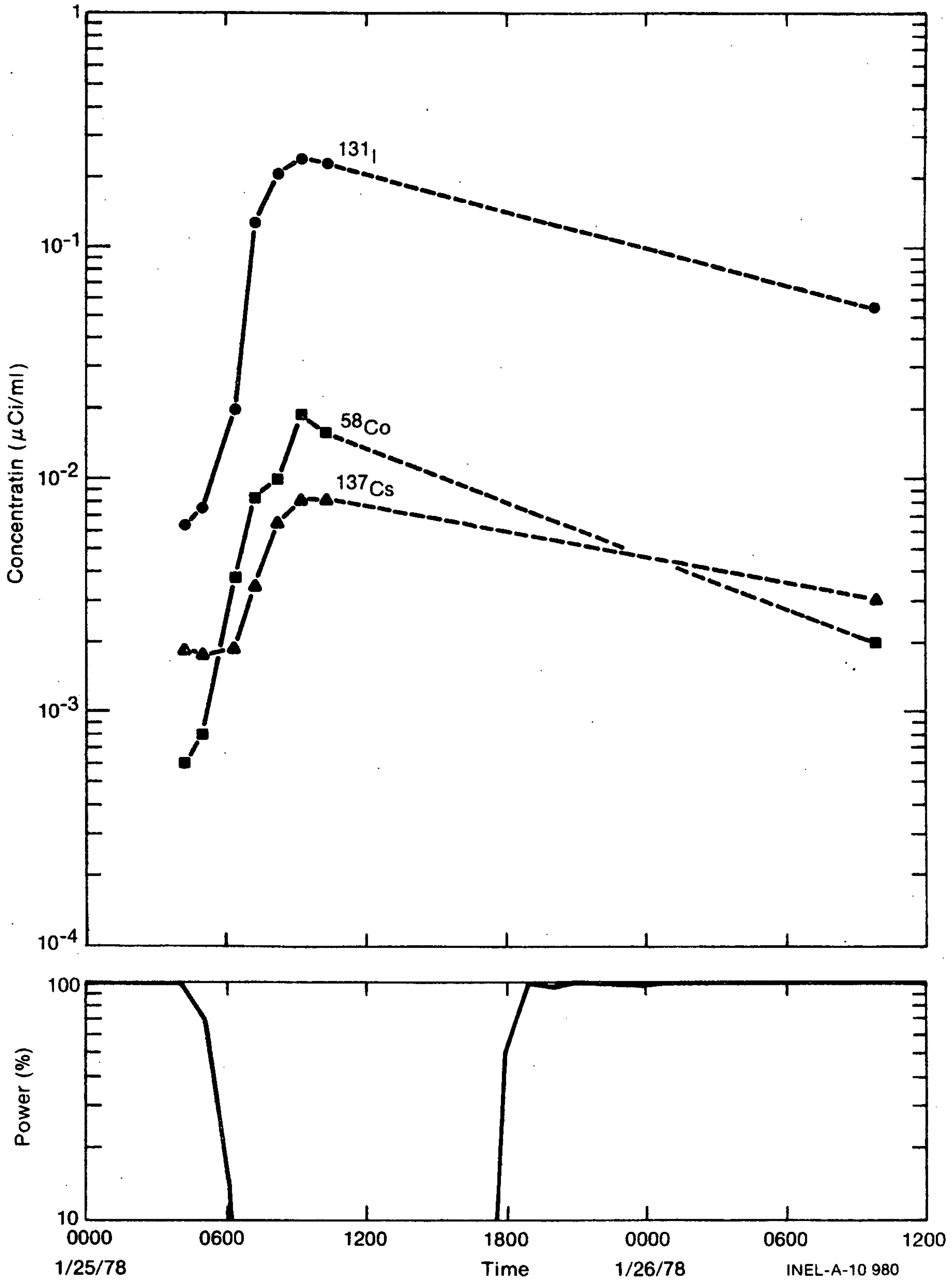
* - Radionuclide detected in one sample only

** - Measurement not made for radionuclide

*** - Measurements made during period before letdown demineralizer was bypassed and period after the letdown demineralizer was put back into operation.

Figure 3.3

Shutdown Spike - Unit #4, 1/25/78



As indicated in Figure 3.3 and by the data in Appendix Table B.10, spiking for most longer-lived radionuclides reached a maximum at about 09:17 (short-lived radionuclides reached a maximum earlier), about 5 hours after power reduction began and about 3 hours after 0% power was reached. Iodine-131, ^{137}Cs, and ^{58}Co peaked at concentrations of 38, 4.5, and 31 times the pre-spike levels, respectively. Most detected fission products and crud-associated radionuclides showed spiking except for the rubidiums. As expected, shorter-lived radionuclides exhibited spikes of smaller magnitudes (e.g., radioiodine inventory in the plenum is inversely proportional to half life) and soluble activation products (e.g., ^{24}Na) did not spike.

Unit #3 underwent a hot shutdown on 5/19/78 that lasted until 5/22/78. Power reduction began at 20:00 on 5/19/78 and 0% was reached at about 23:30. Startup began at about 04:30 on 5/22/78 and full power was reached at 06:00. Figures 3.4 and 3.5 show plots of the concentrations of ^{131}I, ^{137}Cs, and ^{58}Co during the shutdown and startup, respectively. Data obtained during this hot shutdown can be found in Appendix Table B.11.

As indicated in Figure 3.4 and Appendix Table B.11, the concentrations of the longer-lived iodines reached a maximum at about 01:46, 5/20/78, almost 6 hours after power reduction began and about 2-1/2 hours after 0% power was reached. Iodine-131 peaked at a concentration 7.5 times its pre-spike level. Cesium-137 and ^{58}Co peaked later than did ^{131}I and showed smaller increases over pre-spike levels (about 4 for ^{137}Cs and 1.8 for ^{58}Co). Of the gaseous fission products, only ^{133}Xe exhibited an increase after shutdown. Most fission products and crud-associated radionuclides exhibited spiking upon shutdown. Sodium-24, however, did not spike.

Immediately after startup on 5/22/78 the longer-lived iodine isotopes and the cesiums exhibited spiking, but the magnitudes of the spikes were not as great as during shutdown. Iodine-131 reached a concentration 3 times its pre-spike level and ^{137}Cs reached a concentration about 2.6 times its pre-spike level. The crud-associated radionuclides gave only slight indications of spiking and ^{24}Na did not spike at all.

One additional observation that can be made about the reactor coolant radionuclide concentrations during the hot shutdown of Unit #3 is that ^{132}I decayed with a half-life much longer than 2.3 hours. Table 3.9 lists the measured ^{132}I concentrations as a function of time after shutdown together with decay corrected concentrations obtained using the ^{132}I and ^{132}Te half lives. The data indicate that after recovering from the spike, the decay of the ^{132}I concentration followed the ^{132}Te half life. This indicates that the source of the ^{132}I after the spike was ^{132}Te. Moreover, because ^{132}Te was detected in the reactor coolant at levels orders of magnitude below predicted (see Tables 3.6 and B.11), the tellurium must be attached to the surfaces of the reactor internal structures. This explains why tellurium is not normally detected in reactor coolant.

Figure 3.4

Shutdown Spike - Unit #3, 5/19-20/78

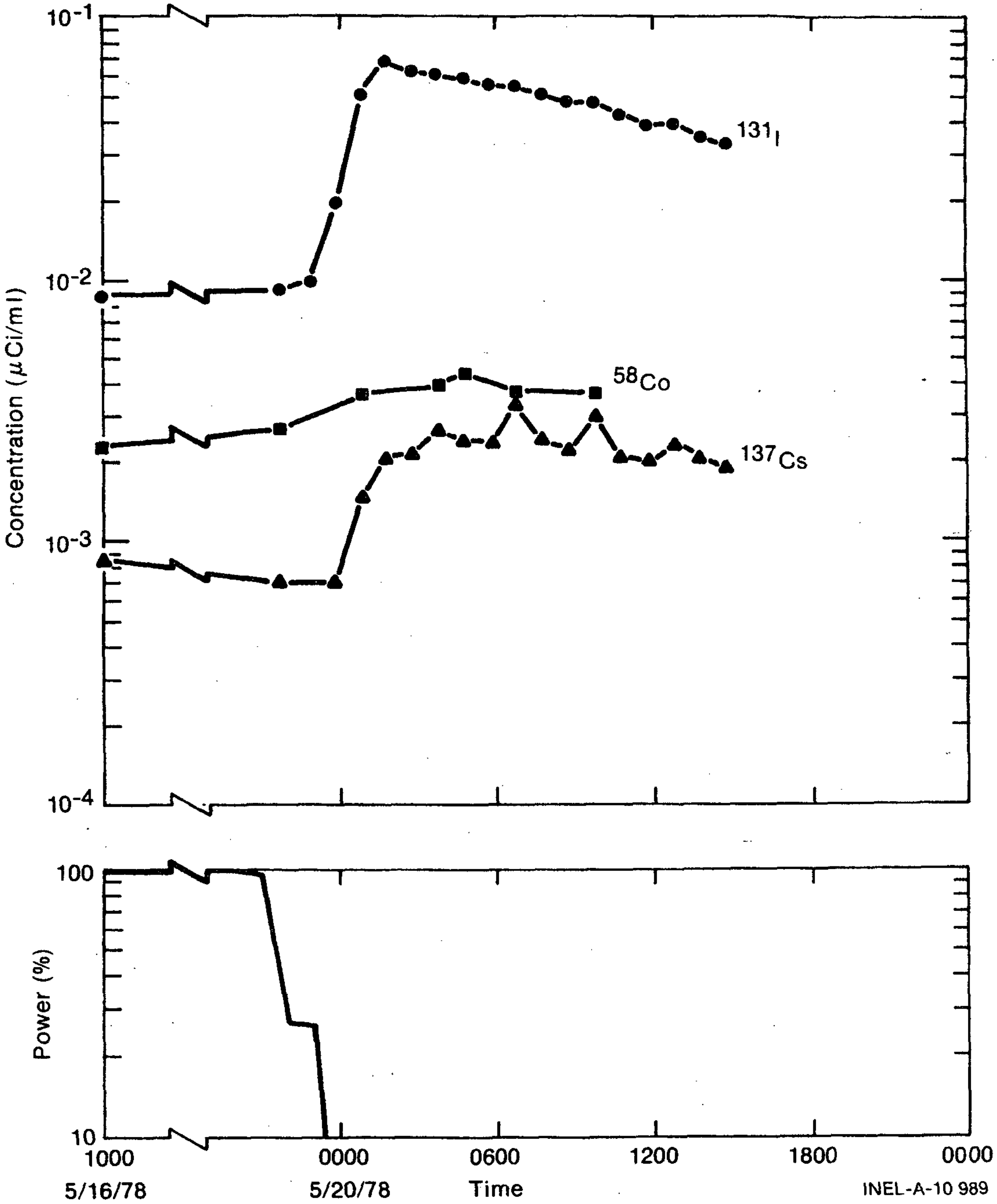


Figure 3.5

Startup Spike - Unit #3, 5/21-22/78

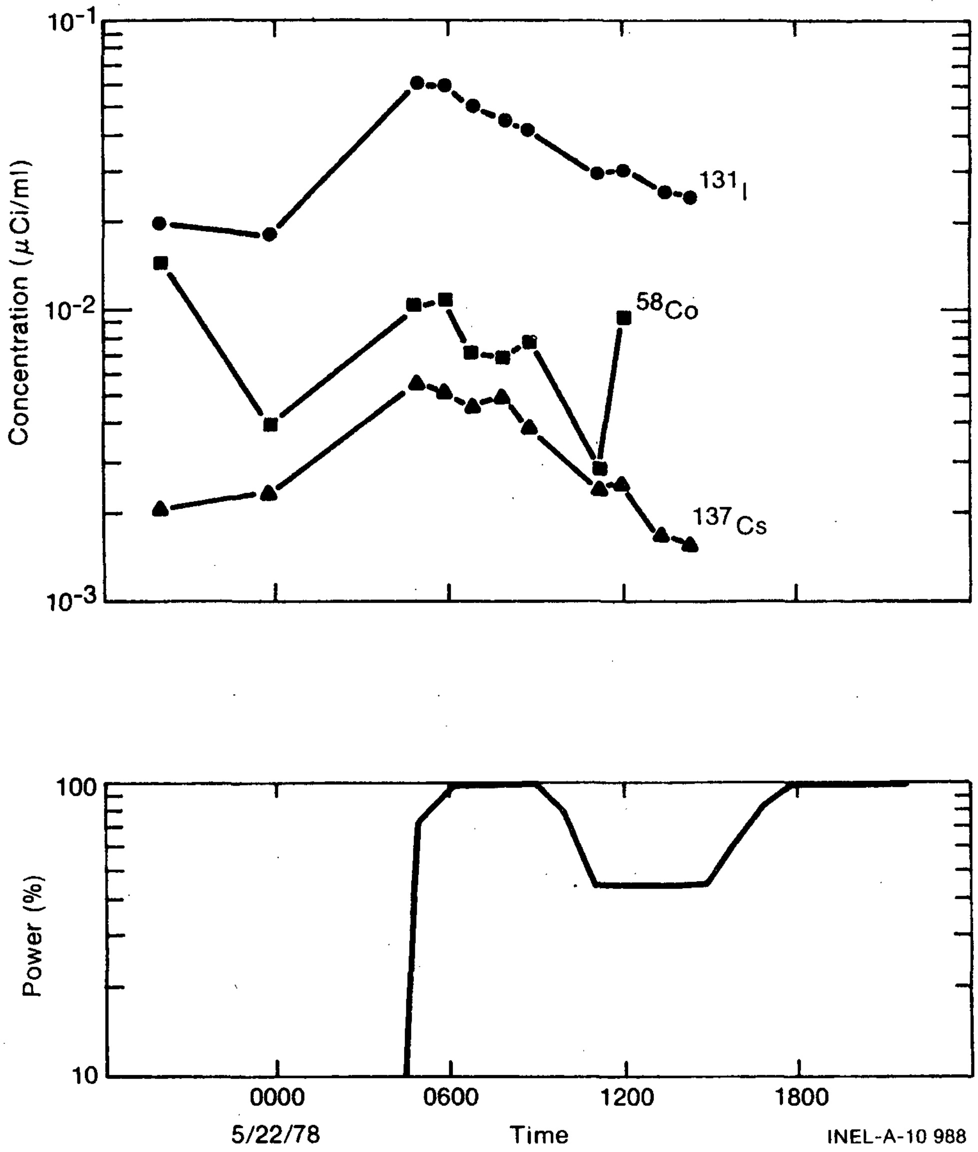


TABLE 3.9

^{132}I CONCENTRATIONS IN REACTOR COOLANT FOR SHUTDOWN SPIKE
UNIT #3 5/19-20/78

Time	Date	Concentration	Concentration Corrected* Using ^{132}I Half life	Concentration Corrected* Using ^{132}Te Half life
2141	5/19/78	1.03 ± 0.03(-1)	1.03 ± 0.03(-1)	1.03 ± 0.03(-1)
2251	5/19/78	1.11 ± 0.02(-1)	1.58 ± 0.03(-1)	1.12 ± 0.02(-1)
2352	5/19/78	1.04 ± 0.03(-1)	2.01 ± 0.06(-1)	1.06 ± 0.03(-1)
0051	5/20/78	1.30 ± 0.02(-1)	3.38 ± 0.05(-1)	1.34 ± 0.02(-1)
0146	5/20/78	1.41 ± 0.05(-1)	4.82 ± 0.17(-1)	1.46 ± 0.05(-1)
0248	5/20/78	1.29 ± 0.04(-1)	6.04 ± 0.19(-1)	1.35 ± 0.04(-1)
0340	5/20/78	1.19 ± 0.02(-1)	7.21 ± 0.12(-1)	1.25 ± 0.02(-1)
0440	5/20/78	1.13 ± 0.02(-1)	9.26 ± 0.16(-1)	1.20 ± 0.02(-1)
0540	5/20/78	1.09 ± 0.02(-1)	1.21 ± 0.02(0)	1.17 ± 0.02(-1)
0640	5/20/78	1.05 ± 0.01(-1)	1.57 ± 0.02(0)	1.14 ± 0.01(-1)
0740	5/20/78	1.00 ± 0.01(-1)	2.02 ± 0.02(0)	1.09 ± 0.01(-1)
0840	5/20/78	9.6 ± 0.1(-2)	2.63 ± 0.03(0)	1.06 ± 0.01(-1)
0940	5/20/78	9.6 ± 0.1(-2)	3.55 ± 0.04(0)	1.07 ± 0.01(-1)
1045	5/20/78	1.01 ± 0.02(-1)	5.19 ± 0.10(0)	1.13 ± 0.02(-1)
1140	5/20/78	9.1 ± 0.1(-2)	6.15 ± 0.07(0)	1.03 ± 0.01(-1)
1247	5/20/78	9.2 ± 0.2(-2)	8.79 ± 0.19(0)	1.05 ± 0.02(-1)
1345	5/20/78	9.1 ± 0.2(-2)	1.15 ± 0.03(1)	1.05 ± 0.02(-1)
1440	5/20/78	8.8 ± 0.2(-2)	1.47 ± 0.03(1)	1.02 ± 0.02(-1)
2005	5/21/78	7.7 ± 0.1(-2)	9.67 ± 0.13(4)	1.16 ± 0.02(-1)

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* Decay corrected to 2141, 5/19/78

3.3 Discussion of Measurement Data - Letdown Demineralizers

3.3.1 Unit #3

Table 3.10 lists dates and times of sampling of the Unit #3 CVCS mixed-bed demineralizer B inlet and outlet for the determination of decontamination factors (DF's). Also listed are the power level, letdown flow rate, number of bed volumes that passed through the demineralizer, and reactor coolant chemistry information for each sample date. Figure 3.6 presents these parameters graphically. The increase in reactor coolant boron concentration on 5/21/78 was the result of boration during zero-power operation.

The sampling period for the Unit #3 letdown started on 2/21/78 and ended 5/25/78. During this 94-day period, twelve sample sets were collected. Following refueling, Unit #3 was brought up to 100% power on 2/20/78. The Unit #3 reactor experienced two trips and also underwent five power reductions from April through May, 1978. Power reduction and escalation account for the higher than average inlet concentrations measured on 4/27-29/78 and on 5/21/78.

Inlet and outlet concentrations and decontamination factors of all measured radionuclides for the Unit #3 CVCS mixed-bed demineralizer B are presented in Appendix B, Table B.12. Table 3.11 lists DF's for all measurements on Unit #3 CVCS demineralizer and Figures 3.7 to 3.10 are graphs of inlet concentrations and decontamination factors of selected nuclides. On 2/21/78, 4 days after startup following refueling, decontamination factors for ^{58}Co, ^{60}Co, ^{95}Zr, ^{134}Cs, and ^{137}Cs were considerably higher than their respective average values while the DF's of ^{124}Sb and ^{125}Sb were considerably lower than their average values. On 2/21/78 and 2/23/78 the inlet concentrations measured for ^{124}Sb and ^{125}Sb were considerably higher than the concentrations measured in the reactor coolant. The reason for this is not known. Inlet concentrations of the above nuclides decreased dramatically from 2/21/78 to 2/23/78 while outlet concentrations increased slightly, resulting in DF's on 2/23/78 which were lower roughly in proportion to the percentage decreases in inlet concentrations. The increases in outlet concentrations from 2/21/78 to 2/23/78 imply a decrease in the number of free ion-exchange sites and/or increases in the contributions to outlet concentrations from ion-exchange processes in which the radionuclides of interest were replaced by other (non-radioactive) ions.

The reduction to zero power on 5/20-21/78 caused moderate spikes in reactor coolant radionuclide concentrations when measured on 5/21/78. These spikes in inlet concentrations were accompanied by increases in DF's for most radionuclides. Reactor coolant radionuclide concentrations decreased on 5/25/78 to near their 5/19/78 values and concurrently the DF's of ^{95}Zr, ^{131}I, ^{124}Sb, ^{134}Cs, and ^{137}Cs decreased.

The fluctuations of DF from one sample date to the next are such that it is difficult to assess the logical diminishing of bed ion-removal

TABLE 3.10

UNIT #3 LETDOWN SAMPLE INFORMATION

Sample Date	Sample Time	Power Level (%)	Letdown Flow Rate (gpm)	Days Demin in Service	Bed Volumes Thru Demin (x 10⁴)	Boron (ppm)	pH @ 25°C	Cond. (μmhos)
2/21/78	13:52	99	45	25	0.75	867	6.13	5.7
2/23/78	12:21	100	45	27	0.80	848	6.04	6.7
4/12/78	18:21	100	55	75	2.43	712	6.88	16.5
4/13/78	11:21	100	53	76	2.45	732	6.98	14.0
4/15/78	11:17	100	53	78	2.53	703	6.98	13.7
4/27/78	13:54	100	55	90	2.99	673	6.58	11.8
4/29/78	09:45	100	55	92	3.05	681	6.61	11.2
5/9/78	10:15	100	53	102	3.40	678	6.73	12.5
5/16/78	09:55	100	54	109	3.66	605	6.85	10.1
5/19/78	21:20	97% 21:00 27% 22:00	52	112	3.78	599	6.68	9.85
5/21/78	20:00	0	55	114	3.85	728	6.6	10.1
5/25/78	09:10	100	50	118	3.97	589	6.55	8.30

Figure 3.6

Unit #3 Letdown Operational Information

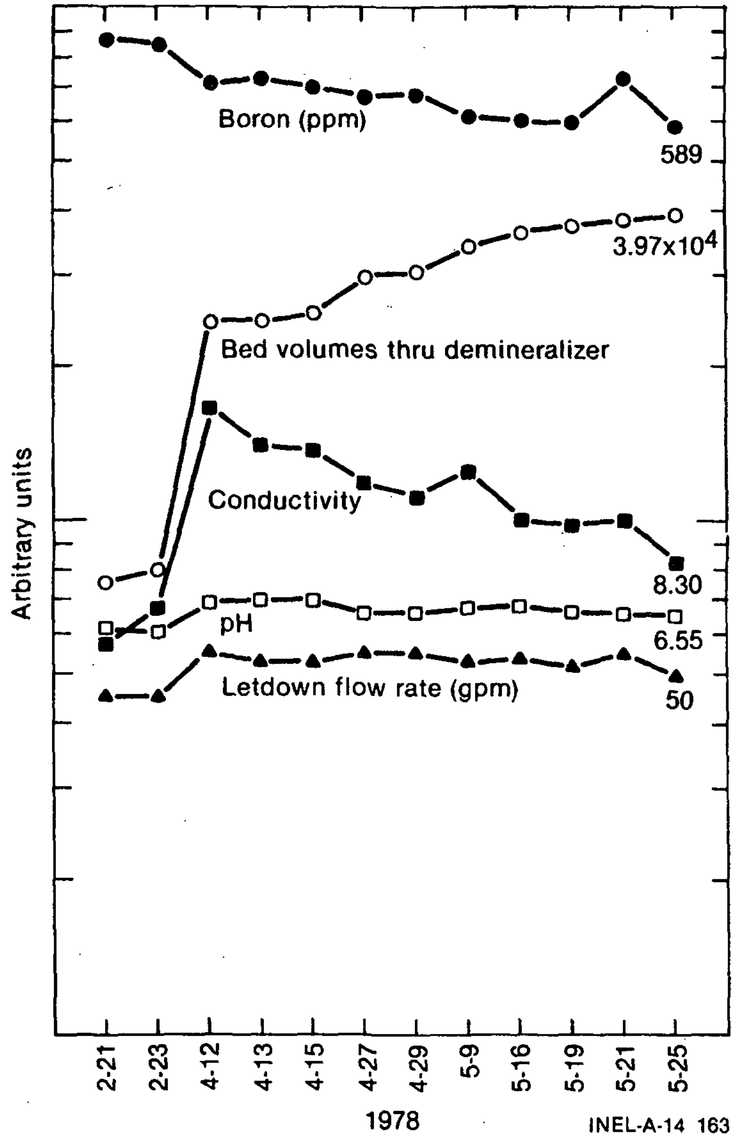

TABLE 3.11

DF's FOR UNIT #3 CVCS MIXED BED B DEMINERALIZER

Nuclide	13:52 2/21/78	12:21 2/23/78	18:21 4/12/78	11:21 4/13/78
^{131}I	3.1 ± 0.3(3)	2.8 ± 0.7(3)	2.7 ± 0.4(3)	6.2 ± 1.1(2)
^{132}I	2.3 ± 0.2(4)	>4.3(2)	4.0 ± 1.5(2)	>8.0(2)
^{133}I	6.3 ± 0.4(2)	2.5 ± 0.3(3)	2.6 ± 0.5(3)	8.3 ± 0.5(2)
^{134}I	4.5 ± 0.3(3)	>8.1(2)	>1.9(3)	>1.4(3)
^{135}I	3.2 ± 0.5(3)	5.4 ± 1.7(3)	>7.8(2)	1.4 ± 0.5(3)
^{88}Rb	2.7 ± 0.3(0)	2.6 ± 0.3(0)	1.13 ± 0.02(0)	3.7 ± 0.2(0)
^{89}Rb	2.1 ± 0.3(1)	1.9 ± 0.3(1)	>4.7(1)	3.1 ± 0.4(1)
^{134}Cs	1.34 ± 0.04(1)	2.59 ± 0.07(0)	1.1 ± 0.05(0)	9.7 ± 0.7(-1)
^{136}Cs	9.4 ± 4.3(2)	3.6 ± 3.4(2)	6.2 ± 1.2(0)	4.9 ± 0.6(0)
^{137}Cs	1.27 ± 0.03(1)	2.85 ± 0.07(0)	1.04 ± 0.05(0)	1.0 ± 0.1(0)
^{138}Cs	1.5 ± 0.1(1)	8.7 ± 0.4(0)	4.2 ± 0.1(0)	5.3 ± 0.3(0)
^{139}Cs	>6.3(1)	>4.2(1)	*	*
^{24}Na	>6.8(4)	>1.6(4)	1.5 ± 0.6(3)	1.0 ± 0.3(3)
^{51}Cr	3.0 ± 1.2(2)	>1.6(2)	>1.4(1)	>1.3(1)
^{54}Mn	3.4 ± 0.5(2)	3.3 ± 0.8(2)	8.1 ± 0.4(2)	>1.7(2)
^{59}Fe	6.7 ± 1.2(1)	>8.7(1)	>5.7(1)	>2.0(1)
^{57}Co	4.5 ± 1.6(1)	6.4 ± 2.7(0)	*	*
^{58}Co	2.4 ± 0.1(2)	5.5 ± 0.2(1)	1.6 ± 0.2(2)	4.0 ± 0.3(1)
^{60}Co	4.4 ± 0.2(2)	8.6 ± 0.4(1)	2.3 ± 0.07(2)	6.3 ± 0.5(1)
^{65}Zn	>1.2(2)	>3.1(1)	*	*
^{84}Br	**	**	>1.1(1)	>1.2(1)
^{91}Sr	>3.5(4)	>5.3(3)	>1.4(2)	>1.3(2)
^{91m}Y	**	**	>3.7(1)	>6.6(1)
^{93}Y	>7.2(3)	>1.7(3)	>1.0(2)	>5.2(0)
^{95}Zr	6.2 ± 0.7(1)	4.3 ± 0.8(1)	>1.6(1)	>9.5(0)
^{95}Nb	2.1 ± 0.8(2)	4.3 ± 0.9(1)	8.6 ± 3.9(0)	*
^{99}Mo	2.8 ± 0.2(3)	2.0 ± 0.3(3)	>3.5(2)	>2.5(2)
^{103}Ru	8.2 ± 2.6(1)	4.3 ± 0.8(1)	>8.4(0)	>5.2(0)
^{106}Ru	<1.3(1)	>2.9(2)	*	*
^{110m}Ag	1.7 ± 0.4(3)	>7.6(0)	*	*
^{124}Sb	9.4 ± 0.5(-1)	1.9 ± 0.1(-1)	3.6 ± 0.8(0)	2.4 ± 1.0(0)
^{125}Sb	9.4 ± 0.2(-1)	1.56 ± 0.06(-1)	>1.7(0)	*
^{129}Te	*	>3.2(0)	*	*
^{129m}Te	*	*	*	*
^{131}Te	**	**	>7.9(0)	*
^{132}Te	5.8 ± 1.0(1)	7.6 ± 2.3(0)	>1.6(1)	>1.1(1)
^{139}Ba	2.4 ± 0.1(0)	2.5 ± 0.1(0)	1.4 ± 0.1(0)	2.1 ± 0.1(0)
^{140}Ba	>6.9(3)	>4.1(3)	>6.1(2)	>3.1(2)
^{140}La	>4.8(2)	>1.6(2)	>1.7(1)	>2.2(1)
^{141}Ce	>4.0(1)	>1.8(1)	*	*
^{144}Ce	<1.1(1)	*	>7.1(1)	>1.7(1)
^{187}W	>1.1(3)	>4.8(2)	>3.8(1)	>5.8(1)
^{239}Np	3.8 ± 1.7(2)	1.2 ± 0.5(2)	*	*

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* Radionuclide not detected

** Radionuclide not measured

TABLE 3.11 (cont'd)

DF's FOR UNIT #3 CVCS MIXED BED B DEMINERALIZER

Nuclide	11:17 4/15/78	13:54 4/27/78	09:45 4/29/78	10:15 5/9/78
^{131}I	3.8 ± 1.9(3)	3.5 ± 0.7(3)	>8.9(3)	4.9 ± 2.3(3)
^{132}I	>1.3(3)	2.7 ± 0.9(3)	>1.1(3)	*
^{133}I	5.7 ± 1.5(3)	5.8 ± 1.7(2)	4.1 ± 1.4(3)	>3.8(3)
^{134}I	>1.4(3)	>4.7(3)	>1.6(3)	>1.3(3)
^{135}I	>7.5(2)	>1.1(3)	>4.6(2)	>1.4(3)
^{88}Rb	2.3 ± 0.1(0)	1.57 ± 0.05(0)	1.64 ± 0.05(0)	3.0 ± 0.1(-1)
^{89}Rb	2.8 ± 0.3(1)	6.9 ± 0.7(1)	3.4 ± 0.4(1)	>3.2(1)
^{134}Cs	9.7 ± 0.1(-1)	1.05 ± 0.02(0)	9.1 ± 0.2(-1)	9.4 ± 0.2(-1)
^{136}Cs	5.3 ± 0.2(0)	2.4 ± 0.7(0)	<3.4(0)	3.5 ± 0.5(0)
^{137}Cs	1.06 ± 0.02(0)	1.16 ± 0.02(0)	9.1 ± 0.2(-1)	1.02 ± 0.02(0)
^{138}Cs	9.4 ± 2.3(0)	1.02 ± 0.02(1)	5.9 ± 0.1(0)	4.23 ± 0.07(0)
^{139}Cs	>2.7(1)	>3.0(1)	1.6 ± 0.8(1)	>5.9(0)
^{24}Na	>1.9(3)	>1.4(3)	>2.6(3)	>3.1(3)
^{51}Cr	*	<2.8(-1)	*	*
^{54}Mn	1.5 ± 0.5(2)	7.3 ± 1.3(1)	>1.3(3)	>1.6(2)
^{59}Fe	>1.8(1)	>1.1(1)	>5.2(1)	>1.7(1)
^{57}Co	*	*	*	*
^{58}Co	4.9 ± 0.6(1)	6.8 ± 0.3(0)	1.0 ± 0.2(2)	1.6 ± 0.3(2)
^{60}Co	1.1 ± 0.3(2)	1.23 ± 0.05(1)	7.5 ± 0.6(1)	9.9 ± 1.0(2)
^{65}Zn	*	*	>1.8(1)	*
^{84}Br	>1.9(1)	>2.8(1)	>1.2(1)	*
^{91}Sr	>5.6(1)	>9.1(1)	>2.5(1)	>4.1(1)
^{91m}Y	>1.5(1)	>3.6(1)	>2.2(1)	*
^{93}Y	>1.0(1)	>1.0(2)	*	>3.3(2)
^{95}Zr	>1.5(1)	4.9 ± 0.6(0)	9.3 ± 4.9(0)	>3.8(0)
^{95}Nb	8.6 ± 2.7(0)	3.0 ± 0.6(0)	6.8 ± 2.3(0)	>2.0(0)
^{99}Mo	>2.5(2)	5.9 ± 0.8(1)	>3.4(2)	>6.1(2)
^{103}Ru	>2.2(0)	3.2 ± 1.2(0)	>8.7(0)	*
^{106}Ru	*	>5.1(1)	3.4 ± 2.9(0)	*
^{110m}Ag	>1.2(1)	*	*	*
^{124}Sb	3.4 ± 1.4(0)	4.2 ± 0.9(0)	3.8 ± 1.1(0)	4.7 ± 2.0(0)
^{125}Sb	>1.7(0)	*	>1.6(1)	*
^{129}Te	*	>1.3(1)	>1.8(0)	**
^{129m}Te	*	>1.1(2)	>3.4(2)	>8.5(-6)
^{131}Te	*	*	*	*
^{132}Te	>4.1(0)	>1.2(1)	>3.9(0)	>4.5(0)
^{139}Ba	3.2 ± 0.1(0)	3.7 ± 0.5(0)	1.7 ± 0.1(0)	2.00 ± 0.05(0)
^{140}Ba	>2.2(2)	9.8 ± 0.3(0)	3.5 ± 0.2(1)	1.9 ± 0.9(2)
^{140}La	>1.4(2)	*	<7.6(1)	<3.4(2)
^{141}Ce	*	*	*	>1.4(0)
^{144}Ce	*	*	>9.1(0)	>2.1(1)
^{187}W	>2.1(1)	*	>3.8(0)	*
^{239}Np	*	*	*	*

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* Radionuclide not detected
** Radionuclide not measured

TABLE 3.11 (cont'd)

DF's FOR UNIT #3 CVCS MIXED BED B DEMINERALIZER

Nuclide	09:55 5/16/78	21:20 5/19/78	20:00 5/21/78	09:10 5/25/78
^{131}I	1.1 ± 0.1(3)	2.3 ± 0.1(3)	5.4 ± 0.3(3)	4.8 ± 1.8(3)
^{132}I	2.6 ± 1.0(3)	>8.1(4)	>4.8(4)	>7.7(2)
^{133}I	2.9 ± 0.4(3)	2.5 ± 0.8(4)	>6.0(2)	>3.2(3)
^{134}I	>1.4(3)	>1.4(5)	*	>1.9(3)
^{135}I	>2.3(3)	>7.8(4)	>3.8(2)	>5.6(2)
^{88}Rb	*	3.0 ± 0.6(3)	**	3.52 ± 0.09(0)
^{89}Rb	>1.2(0)	>7.4(3)	**	2.9 ± 0.3(1)
^{134}Cs	1.04 ± 0.01(0)	9.7 ± 0.2(-1)	3.65 ± 0.06(0)	1.20 ± 0.02(0)
^{136}Cs	6.6 ± 0.3(0)	8.5 ± 0.4(0)	6.0 ± 0.1(1)	1.21 ± 0.07(1)
^{137}Cs	1.07 ± 0.01(0)	1.05 ± 0.01(0)	3.67 ± 0.04(0)	1.34 ± 0.09(0)
^{138}Cs	4.52 ± 0.07(0)	2.4 ± 0.3(4)	**	5.81 ± 0.2(0)
^{139}Cs	*	>1.4(3)	**	>1.9(1)
^{24}Na	1.7 ± 0.6(3)	>2.2(4)	>7.8(2)	>6.8(2)
^{51}Cr	>1.1(1)	>1.1(1)	>7.8(1)	9.0 ± 3.4(1)
^{54}Mn	1.8 ± 0.4(2)	3.2 ± 0.3(1)	4.4 ± 0.8(2)	2.30 ± 0.08(1)
^{59}Fe	>3.9(1)	>2.3(1)	>1.5(2)	>2.1(1)
^{57}Co	<1.4(0)	>3.3(0)	>2.0(1)	<8(-1)
^{58}Co	1.7 ± 0.1(2)	4.29 ± 0.05(1)	2.00 ± 0.02(2)	4.3 ± 1.7(2)
^{60}Co	1.6 ± 0.4(2)	1.1 ± 0.4(2)	1.5 ± 0.1(2)	>1.6(1)
^{65}Zn	*	*	>5.2(1)	>8.0(0)
^{94}Br	**	**	**	**
^{91}Sr	>1.2(2)	>2.1(3)	>1.2(2)	>1.5(1)
^{91m}Y	>2.6(1)	>4.7(2)	>2.8(3)	>2.1(1)
^{93}Y	*	*	>1.8(3)	>8.0(1)
^{95}Zr	*	>2.9(1)	8.1 ± 3.5(1)	5 ± 2(0)
^{95}Nb	>3.1(1)	8.1 ± 1.8(0)	3.2 ± 0.3(1)	4.1 ± 0.5(0)
^{99}Mo	>4.7(2)	>5.1(2)	>3.1(3)	>3.6(2)
^{103}Ru	>7.9(0)	>6.0(0)	>9.1(1)	>1.1(1)
^{106}Ru	*	*	*	*
^{110m}Ag	*	>5.5(0)	>3.4(1)	*
^{124}Sb	6.3 ± 1.6(0)	6.2 ± 1.1(0)	1.24 ± 0.07(1)	4.0 ± 0.4(0)
^{125}Sb	*	*	<3.0(1)	>2.6(0)
^{129}Te	>3.0(0)	**	**	*
^{129m}Te	*	<6.8(0)	*	<3.6(0)
^{131}Te	>1.6(0)	*	*	>6.4(0)
^{132}Te	>5.2(0)	>1.2(1)	>4.5(1)	>1.2(0)
^{139}Ba	3.3 ± 0.2(0)	>2.3(2)	**	4.6 ± 0.3(0)
^{140}Ba	2.5 ± 0.5(2)	6.1 ± 0.6(1)	3.7 ± 0.3(2)	2.9 ± 0.6(2)
^{140}La	>1.3(3)	*	3.5 ± 0.1(2)	*
^{141}Ce	*	*	*	<1.2(0)
^{144}Ce	*	*	*	*
^{187}W	*	*	*	*
^{239}Np	>1.5(1)	*	*	*

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* Radionuclide not detected
** Radionuclide not measured

Figure 3.7

^{131}I and ^{133}I Inlet Concentrations and DF's for Unit #3 CVCS Mixed-Bed B Demineralizer

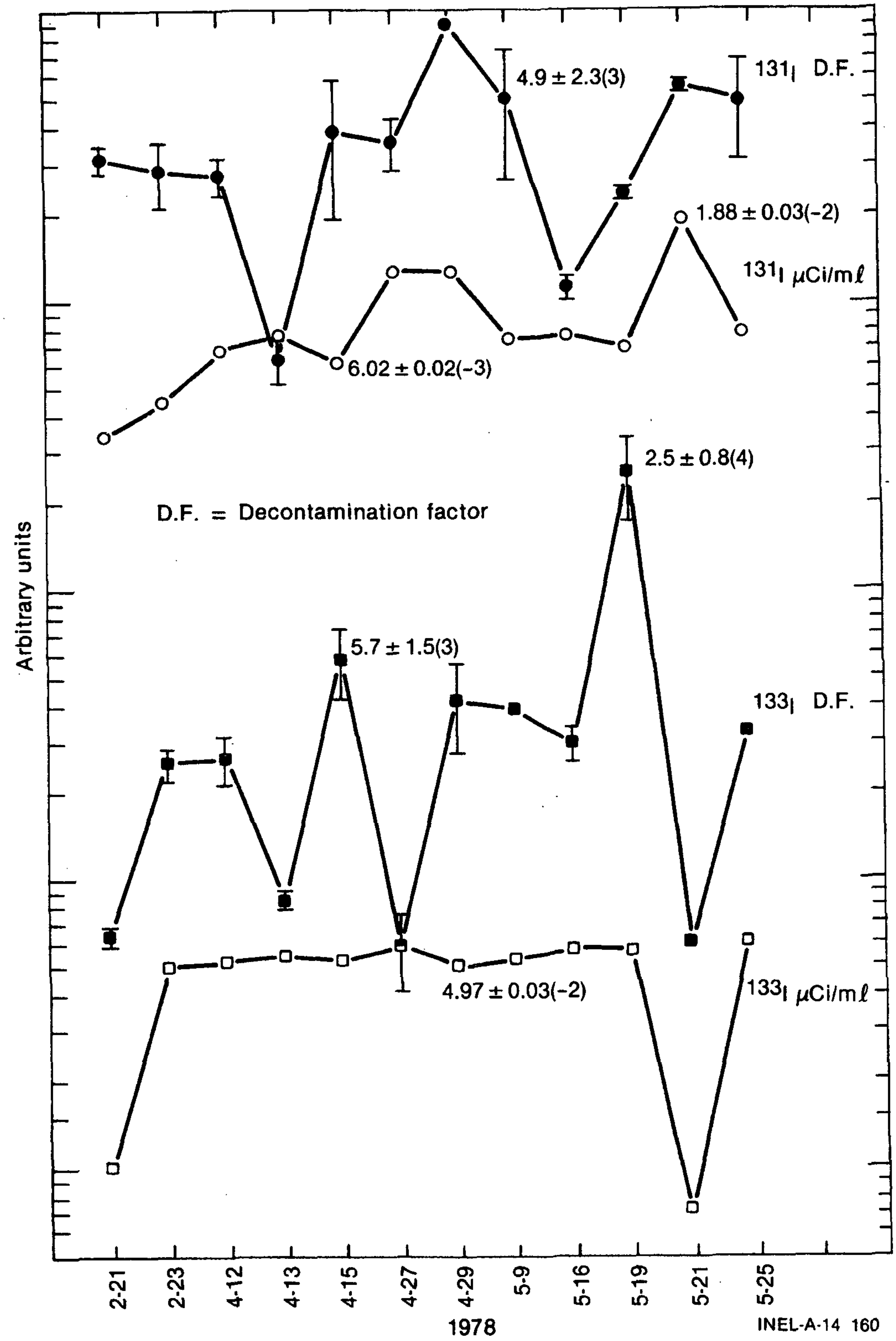


Figure 3.8

^{134}Cs and ^{137}Cs Inlet Concentrations and DF's for Unit #3 CVCS Mixed-Bed B Demineralizer

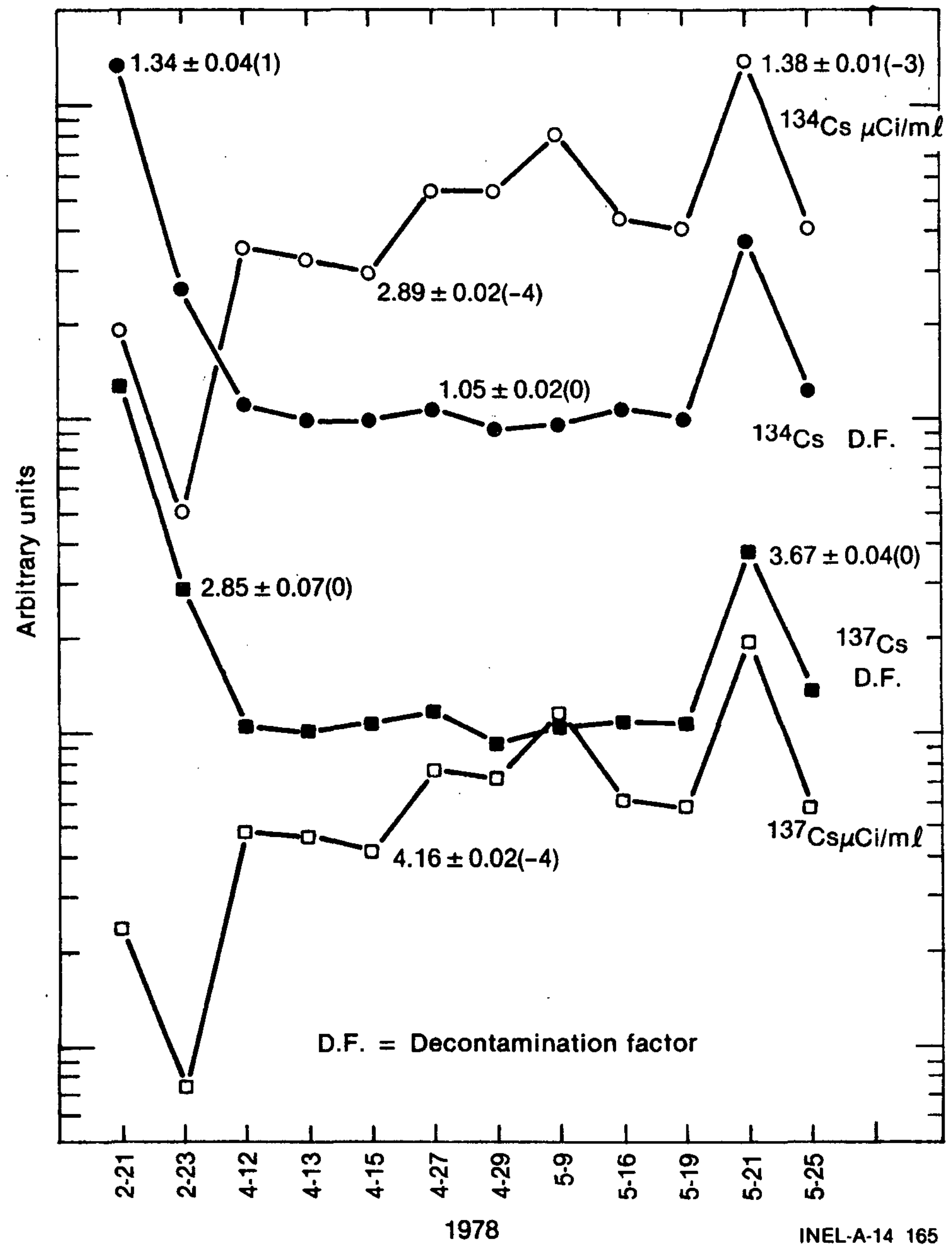


Figure 3.9

^{58}Co and ^{60}Co Inlet Concentrations and DF's for Unit #3 CVCS Mixed-Bed B Demineralizer

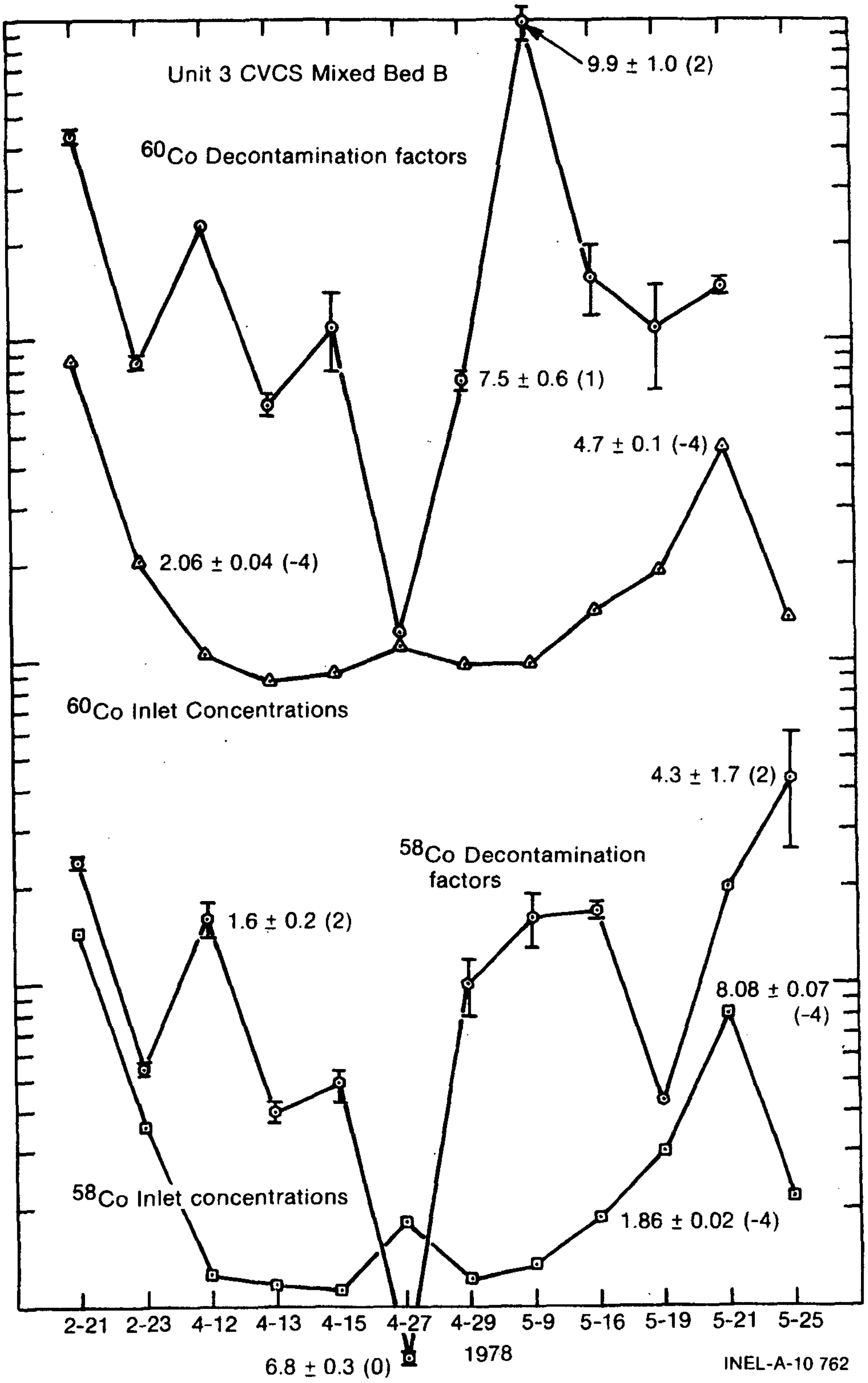
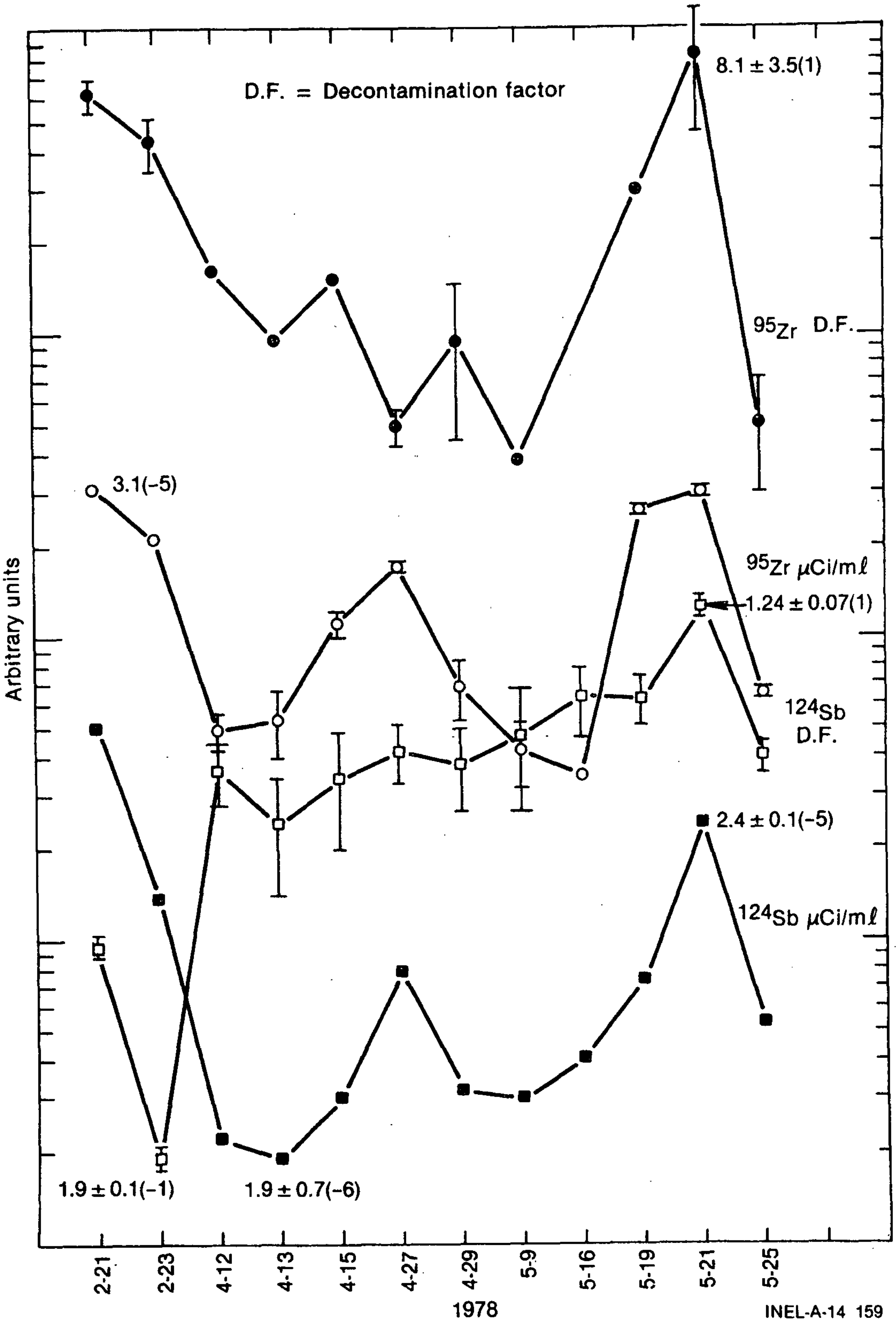


Figure 3.10

^{95}Zr and ^{125}Sb Inlet Concentrations and DF's for Unit #3 CVCS Mixed-Bed B Demineralizer



efficiency with bed usage. When the average inlet concentration of ^{131}I is divided by its average outlet concentration for each of the months, February, April, and May, the average DF's are respectively 2.89(3), 2.22(3), and 2.97(3). The average DF's for each of the above months are for ^{60}Co: 2.45(2), 3.82(1), and 1.02(2); and for ^{124}Sb: 5.06(-1), 3.60(0), and 7.62(0).

The measurements carried out on the demineralizers at Turkey Point indicate that DF's for many radionuclides tend to be correlated with inlet concentration. There is, therefore, no single DF value that exactly represents the DF for all values of inlet concentration for the radionuclide. It is of interest to have a single DF value that reflects the average performance of a demineralizer over the range of observed inlet concentrations for a radionuclide. We obtained these representative or "best value" DF's by first determining average inlet and outlet concentrations and then using the average concentrations to obtain DF's. Table 3.12 contains these "best value" DF's together with mean inlet and outlet concentrations and ranges for the inlet and outlet concentrations for demineralizer B. The "best value" DF's for ^{134}Cs and ^{137}Cs are equal to 1.0 which is the value of the average DF's of ^{134}Cs and ^{137}Cs during the period 4/12 to 5/19/78. In determining the "best value" DF's for cesium, the data taken during February while the resin in demineralizer B was very fresh were not included. While the resin was fresh, cesium DF's were much higher than normal, ranging up to approximately 13.

3.3.2 Unit #4

Table 3.13 lists dates and times of sampling of the Unit #4 CVCS mixed-bed demineralizer A inlet and outlet for the determination of decontamination factors (DF's). Also listed are the power level, letdown flow rate, number of bed volumes that passed through the demineralizer, and reactor coolant chemistry information for each sample date. Figure 3.11 presents these parameters graphically. The higher than normal reactor coolant conductivity observed on 4/12-15/78 was due to bypass of the CVCS demineralizer. The elevated conductivity on 12/6-8/78 has no apparent explanation.

The sampling period for the Unit #4 letdown started on 11/30/77 and ended 5/23/78. During this 175-day period, twenty sample sets were collected. The Unit #4 reactor experienced one trip (12/9/78 at 00:54) and also underwent three load reductions from 11/30/77 to 5/23/78. The percentage power level minimums on the following dates are: 12/1/77, 50%; 12/9/77, 44%; 2/14/78 to 3/9/78, 0%; and 4/24/78, 32%. The February-March power outage was for the purpose of steam generator tube inspection and repairs. Also of note is the fact that the Unit #4 CVCS mixed-bed demineralizer was bypassed on sample dates 4/12-13/78. The above-mentioned operational occurrences account for the significantly higher than average inlet concentrations measured on 12/9/77 and on 4/12-13/78, and 12/14/78.

TABLE 3.12

MEANS AND RANGES FOR ADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's FOR UNIT #3 CVCS MIXED BED B DEMINERALIZER

Nuclide	Inlet Concentration (μCi/ml) Mean	Inlet Concentration (μCi/ml) Range	Outlet Concentration (μCi/ml) Mean	Outlet Concentration (μCi/ml) Range	"Best Value" DF
^{84}Br	1.5(-2)	1.3-1.7(-2)	<8.9(-4)		>1.7(1)
^{131}I	8.4(-3)	0.337-1.88(-2)	3.3(-6)	0.11-1.2(-5)	2.6(3)
^{132}I	8.8(-2)	0.345-1.05(-1)	5.5(-5)	0.015-2.6(-4)	1.6(3)
^{133}I	4.7(-2)	0.72-6.0(-2)	2.4(-5)	0.023-1.0(-4)	1.9(3)
^{134}I	1.6(-1)	1.27-1.92(-1)	4.8(-5)	<0.012-<1.6(-4)	6(3)
^{135}I	8.9(-2)	0.0034-1.06(-1)	4.1(-5)	<0.009-<2.3(-4)	2.2(3)
^{88}Rb	2.1(-1)	0.59-4.8(-1)	1.3(-1)	0.00037-4.14(-1)	1.6(0)
^{89}Rb	4.9(-2)	2.41-6.3(-2)	3.3(-3)	<0.00057-<4.7(-2)	1.5(1)
^{134}Cs	4.7(-4)	0.050-1.38(-3)	3.7(-4)	0.143-8.5(-4)	1.3(0)
^{136}Cs	1.0(-4)	0.35-5.65(-4)	1.1(-5)	0.0096-2.7(-5)	9.4(0)
^{137}Cs	6.6(-4)	0.074-1.90(-3)	4.9(-4)	0.0188-1.13(-3)	1.3(0)
^{138}Cs	1.9(-1)	0.90-2.44(-1)	6.6(-2)	0.00007-4.3(-1)	2.9(0)
^{139}Cs	1.0(-1)	0.54-1.6(-1)	5.9(-3)	<0.046-9.9(-3)	1.8(1)
^{24}Na	6.8(-3)	0.032-1.12(-2)	2.7(-6)	<0.025-7.5(-6)	2.5(3)
^{51}Cr	6.6(-5)	<0.040-1.8(-4)	2.8(-6)	<0.017-1.7(-5)	2.3(1)
^{54}Mn	8.4(-5)	0.58-1.74(-4)	7.8(-7)	<0.052-3.2(-6)	1.1(2)
^{59}Fe	1.5(-5)	0.77-4.0(-5)	3.5(-7)	<1.9-<8.7(-7)	4.3(1)
^{57}Co	1.3(-6)	<0.6-4.5(-6)	3.2(-7)	0.99-9.9(-7)	3.9(0)
^{58}Co	3.4(-4)	0.112-1.45(-3)	5.0(-6)	0.05-2.65(-5)	6.9(1)
^{60}Co	2.2(-4)	0.88-8.7(-4)	2.3(-6)	0.10-9.0(-6)	9.5(1)
^{65}Zn	4.1(-6)	<0.13-1.3(-5)	<4.0(-7)		>1.0(1)
^{91}Sr	3.2(-3)	0.36-6.0(-3)	<4.7(-5)		>6.9(1)
^{91m}Y	2.2(-3)	0.82-5.6(-3)	<5.4(-5)		>4.1(1)
^{93}Y	1.5(-2)	0.11-6.2(-2)	<2.3(-4)		>6.4(1)
^{95}Zr	1.4(-5)	<0.35-3.1(-5)	7.5(-7)	<0.30-3.5(-6)	1.8(1)
^{95}Nb	2.3(-5)	0.0108-1.4(-4)	9.8(-7)	<0.31-2.6(-6)	2.3(1)
^{99}Mo	1.1(-3)	0.42-4.59(-3)	2.2(-6)	0.015-1.5(-5)	5.2(2)
^{103}Ru	9.2(-6)	0.24-3.12(-5)	4.7(-7)	<0.23-1.7(-6)	1.9(1)
^{106}Ru	1.1(-5)	0.29-4.1(-5)	1.3(-6)	<0.57-<6.8(-6)	8.4(0)
^{110m}Ag	3.7(-5)	<0.0095-3.3(-4)	2.7(-6)	<0.014-<5.4(-5)	1.3(1)
^{124}Sb*	6.2(-5)	0.30-5.0(-5)	1.1(-5)	0.61-1.9(-6)	5.6(0)
^{125}Sb*	2.8(-6)	0.18-<6.3(-5)	1.0(-6)	<0.17-2.1(-6)	2.8(0)
^{139}Ba	1.6(-2)	0.42-3.3(-2)	5.2(-3)	<0.049-8.2(-3)	3.0(0)
^{140}Ba	1.2(-3)	0.59-3.11(-3)	1.5(-5)	<0.0085-9.2(-5)	8.2(1)
^{140}La	9.9(-4)	0.028-6.38(-3)	5.9(-6)	<0.0084-1.37(-5)	1.7(2)
^{141}Ce	1.9(-6)	<0.32-3.2(-6)	5.1(-7)	<0.08-<2.4(-6)	3.8(0)
^{144}Ce	3.8(-5)	<0.003-1.7(-4)	1.2(-6)	<0.10-<5.9(-6)	3.0(1)
^{187}W	4.9(-4)	<0.17-1.1(-3)	<4.5(-5)		>1.1(1)
^{239}Np	3.4(-5)	<0.11-1.4(-4)	5.8(-6)	0.026-<6.0(-5)	5.9(0)

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* Data from 2/21/78 and 2/23/78 not included because of questionable inlet concentrations. Inlet concentrations were much higher than concentrations in reactor coolant.

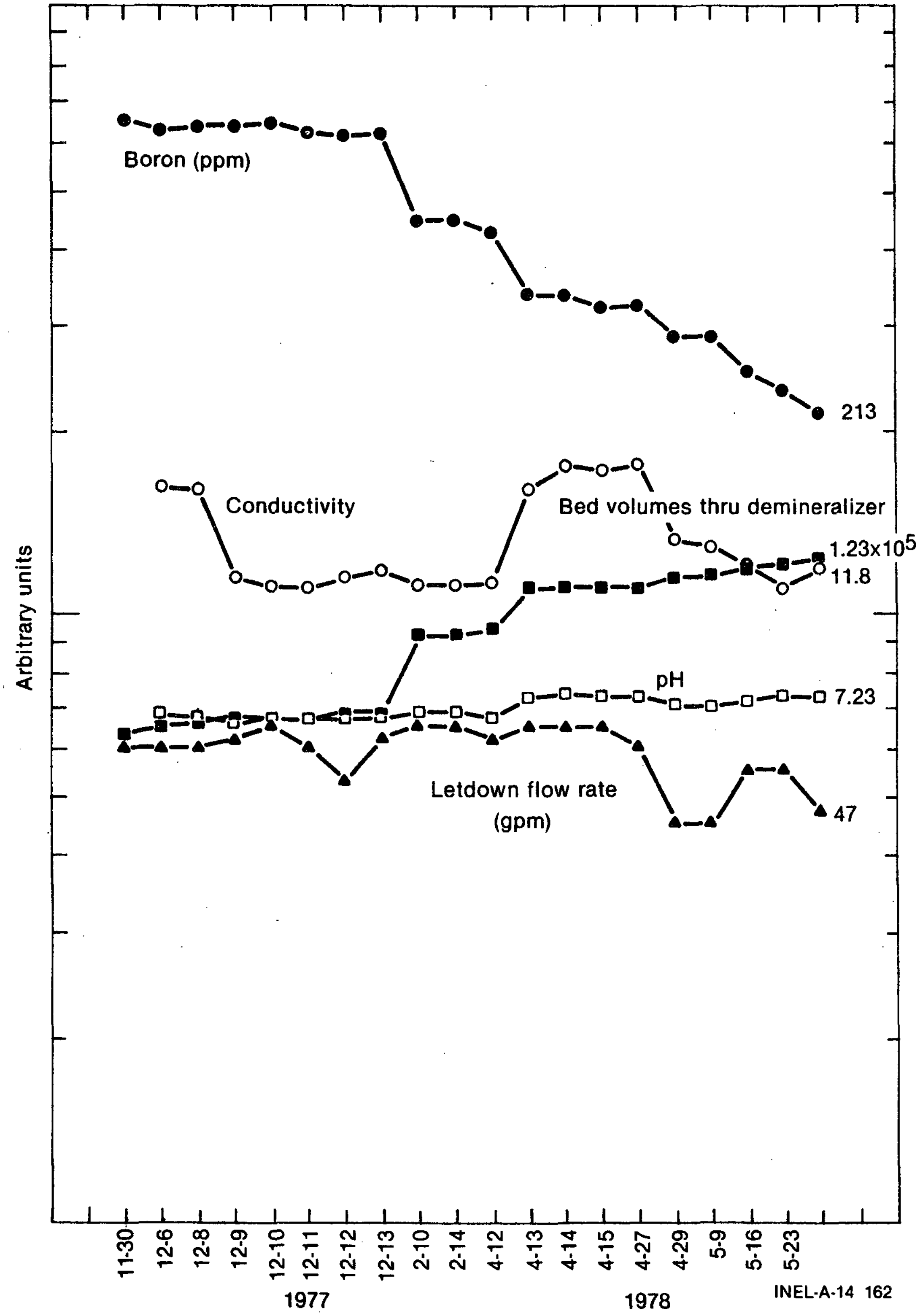
TABLE 3.13

UNIT #4 LETDOWN SAMPLE INFORMATION

Sample Date	Sample Time	Power Level (%)	Letdown Flow Rate (%)	Days Demin in Service	Bed Volumes Thru Demin (x 10^5)	Boron (ppm)	pH @ 25°C	Cond. (μmhos)
11/30/77	16:09	100	60	180	0.63	651	6.80	18.0
12/6/77	14:55	100	60	186	0.65	630	6.82	16.2
12/8/77	12:42	100	60	188	0.66	637	6.73	16.0
12/9/77	09:38	100	62	189	0.67	638	6.50	11.5
12/10/77	09:18	100	65	190	0.67	644	6.68	11.1
12/11/77	10:54	100	60	191	0.67	621	6.68	11.05
12/12/77	09:31	100	53	192	0.68	616	6.68	11.5
12/13/77	14:14	100	62	193	0.68	620	6.70	11.8
2/10/78	11:41	100	65	252	0.92	448	6.88	11.2
2/10/78	16:03	100	65	252	0.92	448	6.88	11.2
2/14/78	13:25	95	62	256	0.94	428	6.73	11.3
4/12/78	17:55	100	65	299	1.10	337	7.22	16.1
4/13/78	11:33	100	65	300	1.11	336	7.35	17.5
4/14/78	13:53	100	65	301	1.11	320	7.28	17.2
4/15/78	09:57	100	60	302	1.11	323	7.28	17.6
4/27/78	14:04	100	45	313	1.15	288	7.05	13.2
4/29/78	09:53	100	45	315	1.16	288	7.01	12.9
5/9/78	09:27	100	55	325	1.19	250	7.15	12.0
5/16/78	10:05	100	55	332	1.21	233	7.30	11.0
5/23/78	10:23	100	47	339	1.23	213	7.23	11.8

Figure 3.11

Unit #4 Letdown Operational Information



Appendix B Table B.13 presents inlet and outlet radionuclide concentrations and DF's for the Unit 4 CVCS mixed-bed demineralizer A. A summary of DF's for all measurements on Unit #4 CVCS mixed-bed A demineralizer (except while the demineralizer was being bypassed) is presented in Table 3.14 and Figures 3.12 to 3.15 show plots of inlet concentrations and decontamination factors for selected nuclides. When the data for any given radionuclide are examined as a whole there appears to be poor correlation between DF and inlet concentration. However, if we examine the data in the vicinity of 12/9/77 reactor coolant spike we see that the change in DF is roughly proportional to the change in inlet concentration for a number of nuclides, especially ^{134}Cs, ^{137}Cs, and ^{59}Fe.

In order to assess the change in DF with resin bed usage, average DF's were computed for selected nuclides for the following periods: 11/30-12/13/77, 2/10-14/78, 4/14-29/78, and 5/9-23/78. For the above periods the average DF's for ^{131}I are 3.94(3), 1.20(4), 2.26(3), and 4.30(3); for ^{60}Co they are 3.46(1), 2.40(1), 2.60(0), 1.10(1); and for ^{124}Sb they are 6.41(0), 3.29(0), 1.22(0), and 2.19(0). The dependence of DF on the number of bed volumes that passed through the demineralizer is not made clear using these average DF's possibly because that dependence is obscured by the effects due to the large variations in inlet concentrations. The demineralizer bypass of 4/12-13/78 caused an increase in reactor coolant radionuclide concentrations. The DF's of ^{54}Mn, ^{59}Fe, ^{58}Co, ^{60}Co, ^{124}Sb, exhibit minimums on 4/14/78 but show large increases on each of the next three sample dates and by 4/29/78 those DF's had increased to near their February values.

The "best value" DF's for CVCS #4 demineralizer A together with mean inlet and outlet radionuclide concentrations and ranges for the inlet and outlet concentrations are presented in Table 3.15.

3.3.3 Conclusions

The Unit #3 letdown data of 5/19,21,25/78 and the Unit #4 letdown data of 12/8-13/77 indicate that reactor coolant spikes of several radionuclides are effectively stopped by the mixed-bed demineralizers and that spikes of most radionuclides are diminished by the demineralizers. Demineralizer outlet concentrations of ^{134}Cs and ^{137}Cs decreased during spiking and no delayed outlet spike was measured either during the four days following the reactor coolant spike of Unit #4 or on the one sample date which followed by four days the spike of Unit #3 reactor coolant. Demineralizer outlet concentrations of ^{131}I did increase during both spikes but in each case the percentage increase in the outlet concentrations was much smaller than the percentage increase in the inlet concentration. Hence, percentage removal of ^{131}I improved dramatically with a large increase in ^{131}I inlet concentration. The spikes in inlet concentrations on 12/9/77 and 5/21/78 were accompanied by increases in decontamination factors for most of the other measured radionuclides.

TABLE 3.14

DF's FOR UNIT #4 CVCS MIXED-BED A DEMINERALIZER

Nuclide	16:09 11/30/77	14:55 12/6/77	12:42 12/8/77	09:38 12/9/77	09:18 12/10/77
^{131}I	>3.7(3)	>9.1(3)	6.2 ± 1.7(2)	4.2 ± 0.1(3)	1.27 ± 0.03(4)
^{132}I	>6.8(1)	>9.8(1)	>2.0(2)	>4.3(2)	>1.3(2)
^{133}I	>1.4(2)	>1.5(3)	8.9 ± 3.2(1)	5.02 ± 0.08(3)	2.2 ± 0.3(4)
^{134}I	>4.9(1)	>8.2(1)	>2.1(2)	>1.3(2)	*
^{135}I	>6.7(1)	>6.2(2)	>3.3(4)	6.9 ± 0.5(3)	>1.0(4)
^{88}Rb	1.8 ± 0.4(0)	3.9 ± 0.6(0)	4.5 ± 0.4(0)	3.6 ± 0.6(0)	*
^{89}Rb	>9.2(0)	>2.0(1)	3.8 ± 0.9(1)	9.8 ± 2.1(0)	*
^{134}Cs	1.96 ± 0.03(0)	9.0 ± 0.2(-1)	1.05 ± 0.02(0)	5.86 ± 0.09(0)	1.68 ± 0.03(0)
^{136}Cs	1.62 ± 0.10(0)	1.6 ± 0.2(0)	1.2 ± 0.1(0)	7.4 ± 0.4(1)	1.45 ± 0.05(1)
^{137}Cs	2.31 ± 0.03(0)	9.7 ± 0.2(-1)	1.05 ± 0.01(0)	5.07 ± 0.09(0)	1.61 ± 0.03(0)
^{138}Cs	1.00 ± 0.10(1)	1.25 ± 0.08(1)	1.57 ± 0.08(1)	1.6 ± 0.1(1)	*
^{139}Cs	*	*	>2.4(1)	*	*
^{3}H	9.8 ± 0.4(-1)	**	**	**	**
^{14}C	4.1 ± 0.6(-2)	**	**	**	**
^{24}Na	>2.7(2)	>3.0(3)	2.3 ± 0.1(3)	6.4 ± 0.6(2)	7.5 ± 1.9(2)
^{51}Cr	>1.1(2)	*	1.6 ± 0.3(1)	5.0 ± 1.7(1)	8.6 ± 1.9(0)
^{54}Mn	7.6 ± 0.4(1)	<5.4(0)	7.7 ± 1.4(1)	5.8 ± 0.9(1)	1.67 ± 0.08(1)
^{55}Fe	3.7 ± 0.4(0)	**	**	**	**
^{59}Fe	*	*	3.0 ± 1.6(1)	1.7 ± 0.1(2)	1.4 ± 0.2(1)
^{57}Co	>1.7(1)	*	>1.9(0)	*	>5.0(0)
^{58}Co	1.45 ± 0.02(2)	6.9 ± 0.7(0)	7.4 ± 0.4(0)	4.0 ± 0.1(1)	8.1 ± 0.2(0)
^{60}Co	1.24 ± 0.03(2)	1.0 ± 0.2(1)	7.5 ± 1.9(0)	1.3 ± 0.1(1)	5.0 ± 0.2(0)
^{63}Ni	5.3 ± 0.2(0)	**	**	**	**
^{65}Zn	*	*	*	2.2 ± 1.0(2)	>2.6(1)
^{89}Sr	2.3 ± 0.5(2)	**	**	**	**
^{90}Sr	9.0 ± 4.0(1)	**	**	**	**
^{91}Sr	*	*	>3.1(1)	>1.3(1)	>3.9(0)
^{91}Y	1.7 ± 0.8(0)	**	**	**	**
^{93}Y	*	>3.1(1)	>4.1(3)	>2.4(4)	>6.3(1)
^{95}Zr	>2.2(1)	>4.6(0)	8.7 ± 1.7(0)	1.3 ± 0.3(1)	2.9 ± 0.3(0)
^{95}Nb	2.6 ± 1.0(1)	<6.3(0)	1.7 ± 0.6(0)	1.4 ± 0.3(1)	1.9 ± 0.5(0)
^{99}Mo	>1.8(1)	>7.9(0)	1.3 ± 0.1(3)	5.7 ± 0.3(2)	6.8 ± 0.1(2)
^{103}Ru	<1.0(1)	*	1.3 ± 0.6(0)	*	>3.2(0)
^{110m}Ag	>4.4(-1)	>6.0(-1)	*	>1.3(0)	*
^{124}Sb	6.6 ± 0.5(1)	<1.1(0)	3.0 ± 1.1(0)	6.6 ± 1.5(0)	1.3 ± 0.2(0)
^{125}Sb	4.9 ± 2.2(0)	*	<3.3(0)	<1.4(1)	<1.4(0)
^{129m}Te	>2.1(2)	*	<3.0(1)	*	*
^{132}Te	*	*	*	*	8.3 ± 3.6(0)
^{139}Ba	1.30 ± 0.04(0)	1.39 ± 0.03(0)	1.8 ± 0.1(0)	1.3 ± 0.1(0)	<3.4(-1)
^{140}Ba	>2.5(1)	>1.1(1)	1.9 ± 0.7(0)	>1.2(2)	>7.2(1)
^{140}La	*	*	1.9 ± 0.5(2)	4.3 ± 0.6(2)	3.3 ± 0.6(1)
^{141}Ce	*	*	*	*	*
^{143}Ce	*	*	*	*	<1.5(0)
^{144}Ce	*	*	*	<1.5(2)	*
^{187}W	>4.5(1)	>1.2(2)	>7.7(1)	>5.5(1)	>1.6(1)
^{239}Np	*	*	2.8 ± 0.5(0)	1.0 ± 0.6(1)	9.3 ± 6.4(0)

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* Radionuclide not detected
** Radionuclide not measured

TABLE 3.14 (cont'd)

DF's FOR UNIT #4 CVCS MIXED-BED A DEMINERALIZER

Nuclide	10:54 12/11/77	09:31 12/12/77	14:14 12/13/77	11:41 2/10/78	16:03 2/10/78
^{131}I	8.9 ± 0.1(3)	2.0 ± 0.1(4)	7.1 ± 0.2(3)	>4.5(3)	>2.3(3)
^{132}I	>1.1(2)	>4.1(1)	>5.0(2)	>3.5(2)	>1.9(2)
^{133}I	>2.1(4)	>7.9(4)	3.3 ± 0.5(4)	2.6 ± 0.6(2)	>2.0(3)
^{134}I	>9.9(1)	>1.1(1)	>5.0(2)	>2.4(2)	>1.4(2)
^{135}I	>9.1(3)	>1.1(3)	>3.4(4)	>1.1(3)	>1.1(3)
^{88}Rb	3.7 ± 1.2(0)	3.3 ± 1.7(-1)	6.7 ± 0.5(0)	4.8 ± 0.8(0)	4.1 ± 0.8(0)
^{89}Rb	>9.8(0)	*	7.4 ± 1.6(1)	2.0 ± 0.4(1)	>4.0(1)
^{134}Cs	1.04 ± 0.03(0)	1.01 ± 0.02(0)	9.7 ± 0.3(-1)	9.7 ± 0.1(-1)	9.4 ± 0.1(-1)
^{136}Cs	2.9 ± 0.3(0)	2.4 ± 0.3(0)	1.4 ± 0.4(0)	2.2 ± 0.3(0)	2.1 ± 0.3(0)
^{137}Cs	1.09 ± 0.03(0)	1.08 ± 0.02(0)	1.03 ± 0.03(0)	9.87 ± 0.09(-1)	9.9 ± 0.1(-1)
^{138}Cs	2.1 ± 0.3(1)	9.9 ± 1.5(-1)	2.5 ± 0.1(1)	1.6 ± 0.2(1)	1.6 ± 0.2(1)
^{139}Cs	*	*	>8.7(1)	>3.1(1)	*
^{3}H	**	**	**	**	**
^{14}C	**	**	**	**	**
^{24}Na	1.5 ± 0.4(3)	1.4 ± 0.2(3)	1.6 ± 0.2(3)	>2.8(3)	3.3 ± 1.0(3)
^{51}Cr	2.0 ± 1.2(1)	1.8 ± 0.3(1)	2.3 ± 0.6(1)	>6.3(1)	>2.8(1)
^{54}Mn	6.8 ± 0.7(1)	4.9 ± 0.8(1)	6.2 ± 0.4(1)	8.5 ± 0.6(0)	4.3 ± 0.5(1)
^{55}Fe	**	**	**	**	**
^{59}Fe	2.4 ± 0.6(1)	7.3 ± 4.0(1)	2.2 ± 0.5(1)	*	>1.6(0)
^{57}Co	>2.3(0)	>3.1(0)	>2.3(0)	*	>1.6(0)
^{58}Co	3.2 ± 0.1(1)	9.8 ± 0.3(0)	2.8 ± 0.1(1)	1.11 ± 0.07(2)	1.17 ± 0.03(1)
^{60}Co	2.3 ± 0.1(1)	8.5 ± 0.3(0)	1.3 ± 0.1(1)	6.6 ± 1.9(1)	1.33 ± 0.09(1)
^{63}Ni	**	**	**	**	**
^{65}Zn	>3.1(0)	>8.3(0)	>6.9(0)	*	*
^{89}Sr	**	**	**	**	**
^{90}Sr	**	**	**	**	**
^{91}Sr	>1.2(1)	>1.5(1)	>1.4(1)	>2.9(1)	>2.1(1)
^{91}Y	**	**	**	**	**
^{93}Y	>3.1(2)	>2.6(3)	>3.5(3)	>2.6(1)	>1.3(1)
^{95}Zr	5.4 ± 0.6(0)	1.9 ± 0.3(0)	7.6 ± 0.7(0)	>7.5(0)	4.0 ± 1.1(0)
^{95}Nb	4.2 ± 0.5(0)	1.7 ± 0.3(0)	5.8 ± 0.6(0)	>9.1(0)	3.5 ± 0.6(0)
^{99}Mo	1.3 ± 0.1(3)	1.5 ± 0.4(2)	1.2 ± 0.2(3)	>2.1(1)	>1.0(1)
^{103}Ru	>1.7(0)	>1.2(0)	>1.9(0)	*	*
^{110m}Ag	*	*	*	*	>1.2(0)
^{124}Sb	3.6 ± 0.5(0)	2.6 ± 0.3(0)	3.4 ± 0.3(0)	3.1 ± 0.9(0)	3.4 ± 1.0(0)
^{125}Sb	*	>1.1(0)	>2.1(0)	>3.4(0)	*
^{129m}Te	<1.0(-1)	*	*	*	*
^{132}Te	>2.9(0)	>4.2(0)	>1.1(0)	*	*
^{139}Ba	1.13 ± 0.06(0)	5.9 ± 0.5(-1)	2.4 ± 0.1(0)	1.80 ± 0.04(0)	1.40 ± 0.04(-1)
^{140}Ba	>6.0(1)	>1.3(2)	>9.5(1)	>4.7(1)	>2.1(1)
^{140}La	>1.6(1)	1.0 ± 0.8(3)	2.5 ± 0.3(2)	*	>1.3(1)
^{141}Ce	>1.6(0)	*	*	*	*
^{143}Ce	>6.2(-1)	<5.0(-1)	*	*	*
^{144}Ce	*	*	*	*	*
^{187}W	>3.5(1)	>3.1(1)	>9.1(1)	>3.5(1)	>2.5(1)
^{239}Np	<1.5(0)	2.2 ± 1.7(0)	<8.7(1)	*	*

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* Radionuclide not detected
** Radionuclide not measured

TABLE 3.14 (cont'd)

DF's FOR UNIT #4 CVCS MIXED-BED A DEMINERALIZER

Nuclide	13:25 2/14/78	13:53 4/14/78	09:57 4/15/78	14:04 4/27/78
^{131}I	5.8 ± 4.1(4)	1.0 ± 0.2(4)	2.5 ± 0.8(3)	3.8 ± 0.1(2)
^{132}I	>4.7(3)	>1.9(2)	>3.3(2)	>1.1(3)
^{133}I	>4.5(4)	>3.3(3)	>9.4(2)	7.8 ± 3.4(2)
^{134}I	>3.6(2)	>2.3(2)	>2.6(2)	>4.4(2)
^{135}I	>1.4(4)	>4.5(2)	>8.6(1)	>2.9(2)
^{88}Rb	4.1 ± 0.4(0)	3.4 ± 1.0(2)	3.31 ± 0.06(0)	5.3 ± 0.2(0)
^{89}Rb	2.2 ± 0.5(1)	1.6 ± 0.4(1)	2.7 ± 0.7(1)	>4.4(1)
^{134}Cs	1.04 ± 0.02(0)	8.2 ± 0.2(-1)	9.2 ± 0.1(-1)	9.8 ± 0.1(-1)
^{136}Cs	2.1 ± 0.2(0)	1.7 ± 0.4(1)	2.9 ± 0.2(0)	4.4 ± 0.6(0)
^{137}Cs	9.8 ± 0.1(-1)	9.0 ± 0.2(-1)	9.5 ± 0.1(-1)	1.03 ± 0.02(0)
^{138}Cs	1.3 ± 0.1(1)	5.82 ± 0.09(0)	6.7 ± 0.1(0)	1.41 ± 0.03(1)
^{139}Cs	>1.2(1)	*	>3.5(0)	*
^{3}H	**	**	**	**
^{14}C	**	**	**	**
^{24}Na	1.9 ± 0.3(3)	7.1 ± 3.2(3)	1.7 ± 0.2(2)	4.9 ± 1.0(-2)
^{51}Cr	<2.2(0)	2.4 ± 1.2(0)	6.4 ± 2.3(0)	>1.2(2)
^{54}Mn	>5.8(1)	1.96 ± 0.07(0)	7.3 ± 0.4(0)	1.04 ± 0.05(1)
^{55}Fe	**	**	**	**
^{59}Fe	8.1 ± 2.0(1)	1.5 ± 0.2(0)	4.3 ± 1.0(0)	1.1 ± 0.2(1)
^{57}Co	*	<1.8(0)	*	>8.1(-1)
^{58}Co	2.43 ± 0.07(1)	1.10 ± 0.04(0)	2.46 ± 0.02(0)	6.8 ± 0.1(0)
^{60}Co	2.7 ± 0.4(1)	1.33 ± 0.04(0)	3.1 ± 0.1(0)	3.9 ± 0.2(0)
^{63}Ni	**	**	**	**
^{65}Zn	<4.0(1)	>1.9(0)	*	*
^{89}Sr	**	**	**	**
^{90}Sr	**	**	**	**
^{91}Sr	>5.0(2)	*	*	*
^{91}Y	**	**	**	**
^{93}Y	*	*	*	*
^{95}Zr	1.5 ± 0.3(1)	1.11 ± 0.08(0)	2.5 ± 0.4(0)	2.6 ± 1.0(0)
^{95}Nb	5.6 ± 1.2(0)	8.7 ± 0.6(-1)	2.1 ± 0.2(0)	4.8 ± 1.0(0)
^{99}Mo	1.5 ± 1.2(3)	>2.0(1)	>2.1(1)	>1.0(2)
^{103}Ru	*	>3.0(0)	>1.4(0)	>2.3(0)
^{110m}Ag	>1.6(0)	1.9 ± 0.7(0)	>1.4(0)	*
^{124}Sb	3.3 ± 1.0(0)	9.5 ± 0.7(-1)	1.1 ± 0.1(0)	1.8 ± 0.2(0)
^{125}Sb	<1.4(1)	*	*	*
^{129m}Te	*	*	*	>8.1(0)
^{132}Te	<4.3(1)	*	>1.7(0)	*
^{139}Ba	1.00 ± 0.05(0)	1.1 ± 0.1(0)	1.1 ± 0.1(0)	4.3 ± 2.7(0)
^{140}Ba	>3.4(2)	>3.5(0)	>3.0(0)	5.0 ± 1.6(0)
^{140}La	6.9 ± 2.4(1)	>1.3(2)	>1.1(1)	*
^{141}Ce	<3.8(1)	*	*	<1.5(-1)
^{143}Ce	*	*	*	*
^{144}Ce	<4.9(1)	*	*	*
^{187}W	>8.7(1)	>1.7(1)	>8.5(0)	*
^{239}Np	*	*	>3.0(0)	*

* Radionuclide not detected
** Radionuclide not measured

TABLE 3.14 (cont'd)

DF's FOR UNIT #4 CVCS MIXED-BED A DEMINERALIZER

Nuclide	09:53 4/29/78	09:27 5/9/78	10:05 5/16/78	10:23 5/23/78
^{131}I	6.2 ± 1.8(3)	>5.1(3)	>3.4(3)	>1.0(3)
^{132}I	>2.7(2)	*	>7.5(2)	>4.1(2)
^{133}I	>1.1(3)	7.9 ± 2.9(2)	>5.4(3)	>1.6(2)
^{134}I	>1.9(2)	>2.5(2)	>4.3(1)	>3.2(2)
^{135}I	>1.0(2)	>5.9(2)	>7.2(2)	>1.1(2)
^{88}Rb	1.18 ± 0.03(0)	9.8 ± 0.2(-1)	*	3.12 ± 0.09(0)
^{89}Rb	>1.7(1)	>2.2(1)	*	5.2 ± 1.7(1)
^{134}Cs	9.3 ± 0.1(-1)	9.4 ± 0.2(-1)	1.04 ± 0.02(0)	9.1 ± 0.2(-1)
^{136}Cs	4.8 ± 0.6(0)	4.4 ± 0.4(0)	5.4 ± 0.7(0)	5.4 ± 1.0(0)
^{137}Cs	9.8 ± 0.2(-1)	1.00 ± 0.02(0)	1.09 ± 0.02(0)	9.8 ± 0.1(-1)
^{138}Cs	5.2 ± 0.2(0)	6.4 ± 0.2(0)	>6.1(0)	7.3 ± 0.1(0)
^{139}Cs	*	*	*	*
^{3}H	**	**	**	**
^{14}C	**	**	**	**
^{24}Na	2.7 ± 0.5(2)	3.1 ± 0.2(2)	3.5 ± 0.2(2)	3.2 ± 1.0(2)
^{51}Cr	>1.4(2)	>2.8(1)	*	>4.5(0)
^{54}Mn	4.7 ± 0.6(1)	2.4 ± 0.3(1)	5.1 ± 0.9(1)	9.2 ± 1.1(0)
^{55}Fe	**	**	**	**
^{59}Fe	2.2 ± 0.5(1)	9.2 ± 2.9(0)	>1.2(1)	>4.8(0)
^{57}Co	*	*	*	>8.1(-1)
^{58}Co	1.91 ± 0.04(1)	3.9 ± 0.1(0)	1.82 ± 0.04(1)	5.0 ± 0.2(0)
^{60}Co	1.33 ± 0.03(1)	7.6 ± 0.3(0)	1.4 ± 0.2(1)	>7.4(0)
^{63}Ni	**	**	**	**
^{65}Zn	*	*	*	*
^{89}Sr	**	**	**	**
^{90}Sr	**	**	**	**
^{91}Sr	<2.5(0)	*	*	*
^{91}Y	**	**	**	**
^{93}Y	*	*	*	*
^{95}Zr	5.7 ± 1.2(0)	5.5 ± 1.2(-1)	>7.6(0)	6.7 ± 0.1(-1)
^{95}Nb	1.0 ± 0.4(1)	6.5 ± 0.6(-1)	>1.9(1)	9.6 ± 0.2(-2)
^{99}Mo	>2.9(2)	>7.9(1)	>6.4(1)	>1.7(1)
^{103}Ru	*	*	*	2.2 ± 0.8(-1)
^{110m}Ag	*	*	*	*
^{124}Sb	3.0 ± 0.3(0)	1.5 ± 0.2(0)	3.7 ± 0.6(0)	2.5 ± 0.3(0)
^{125}Sb	*	*	*	*
^{129m}Te	>1.1(1)	*	*	*
^{132}Te	*	>1.3(0)	*	*
^{139}Ba	1.4 ± 0.1(0)	2.0 ± 0.1(0)	8.3 ± 0.7(-1)	2.0 ± 0.1(0)
^{140}Ba	3.5 ± 0.6(0)	>1.4(1)	>1.7(1)	*
^{140}La	>7.9(1)	>3.5(2)	>6.1(2)	*
^{141}Ce	<1.6(-1)	*	*	<6.4(-2)
^{143}Ce	>1.2(1)	*	*	*
^{144}Ce	*	*	*	<7.5(-2)
^{187}W	>1.1(2)	>5.5(1)	>1.1(2)	>7.0(0)
^{239}Np	*	1.7 ± 1.4(-1)	*	>9.4(-1)

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* Radionuclide not detected
** Radionuclide not measured

Figure 3.12

^{131}I Inlet Concentrations and DF's for Unit #4 CVCS Mixed-Bed A Demineralizer

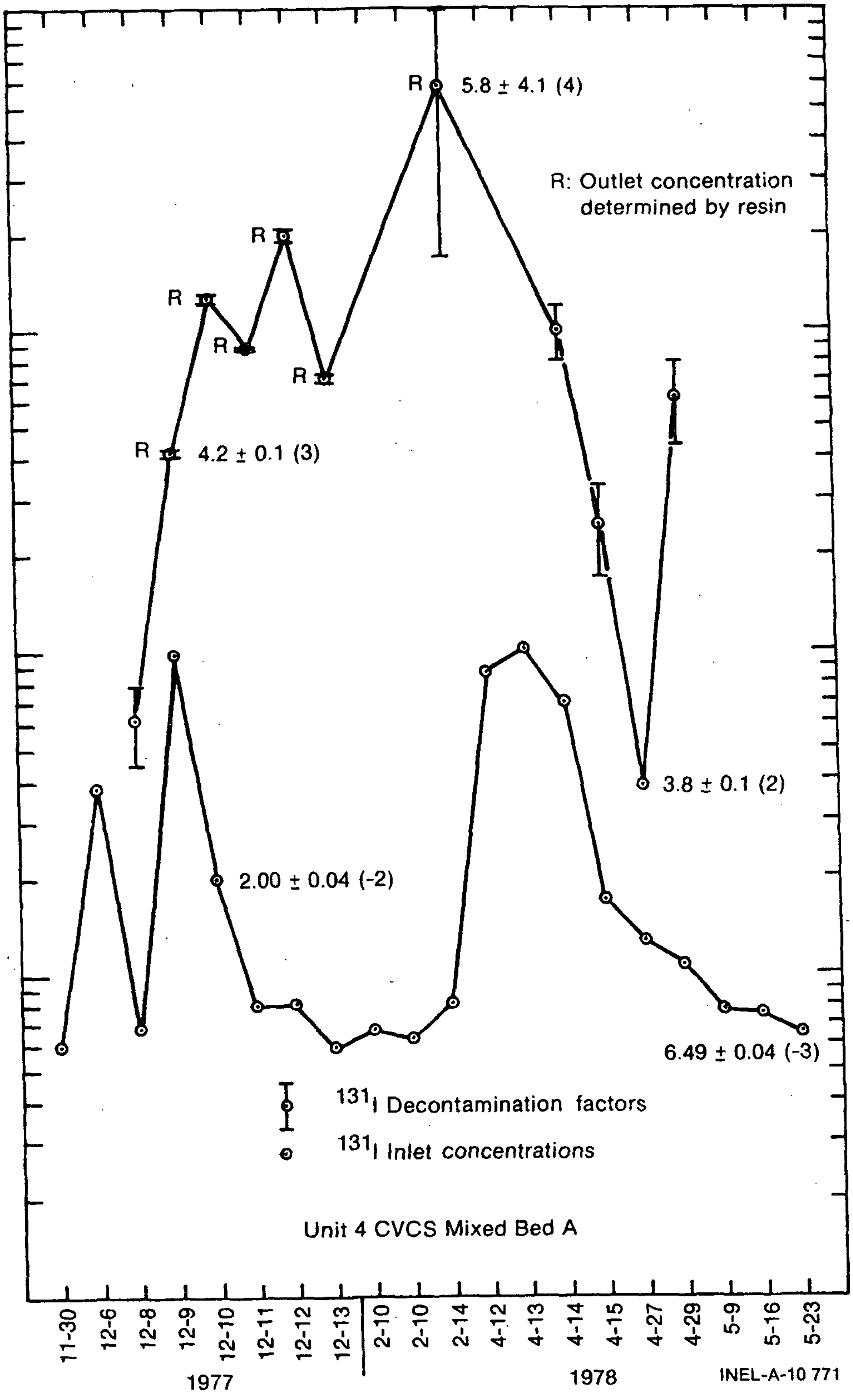

Figure 3.13

^{134}Cs and ^{137}Cs Inlet Concentrations and DF's for Unit #4 CVCS Mixed-Bed A Demineralizer

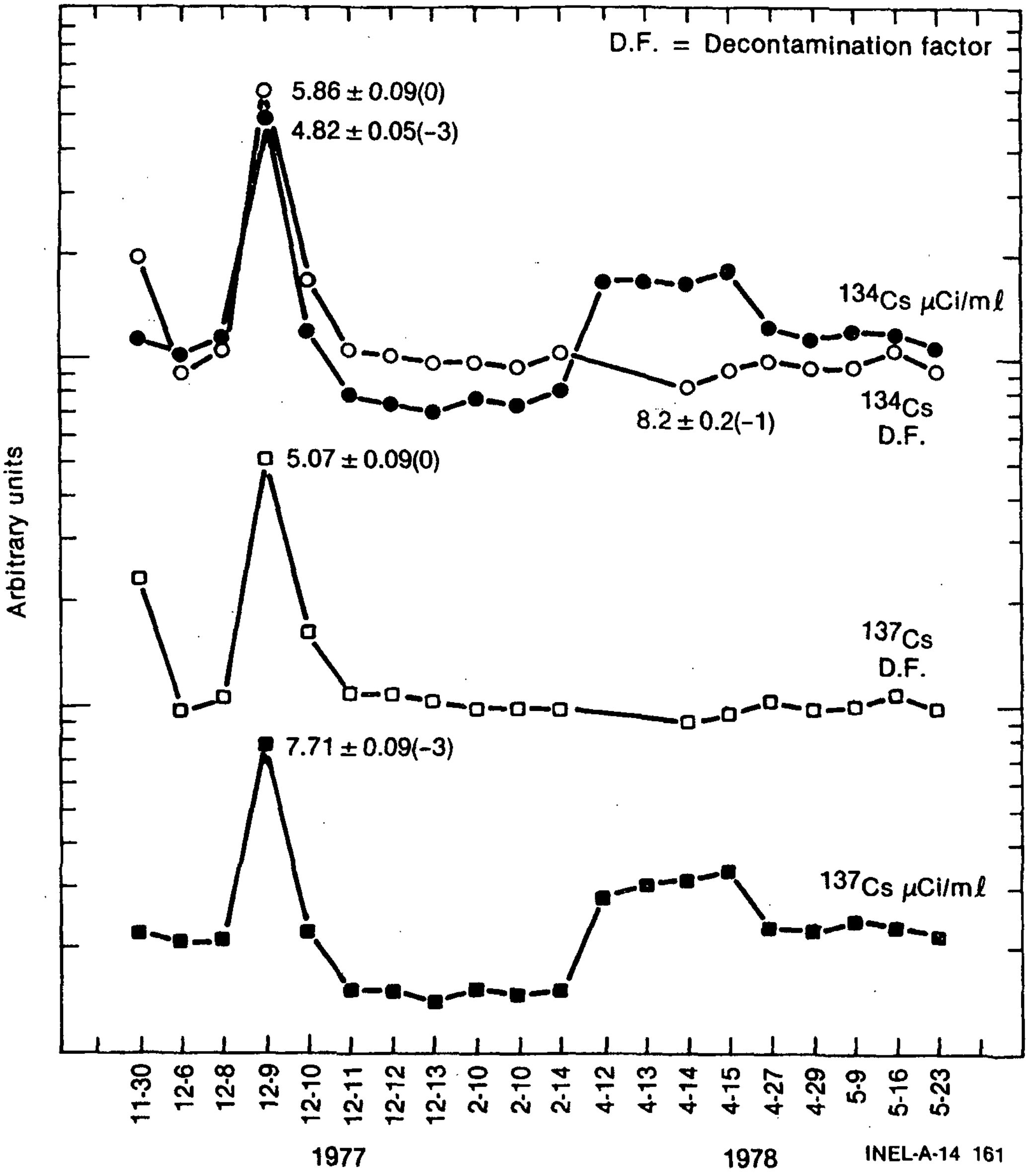

Figure 3.14

^{60}Co Inlet Concentrations and DF's for Unit #4 CVCS Mixed-Bed A Demineralizer

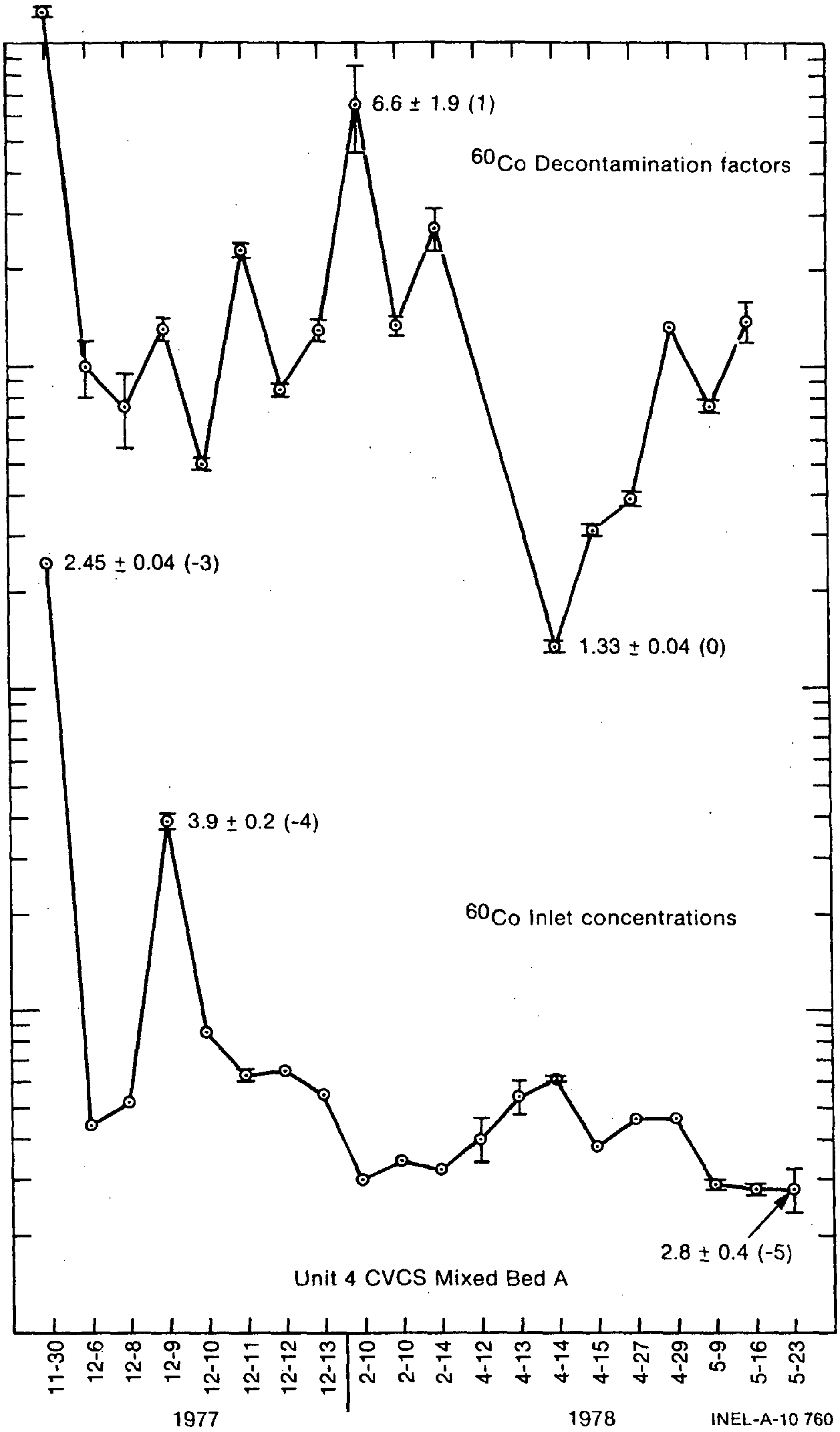

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Figure 3.15

^{54}Mn and ^{59}Fe Inlet Concentrations and DF's for Unit #4 CVCS Mixed-Bed A Demineralizer

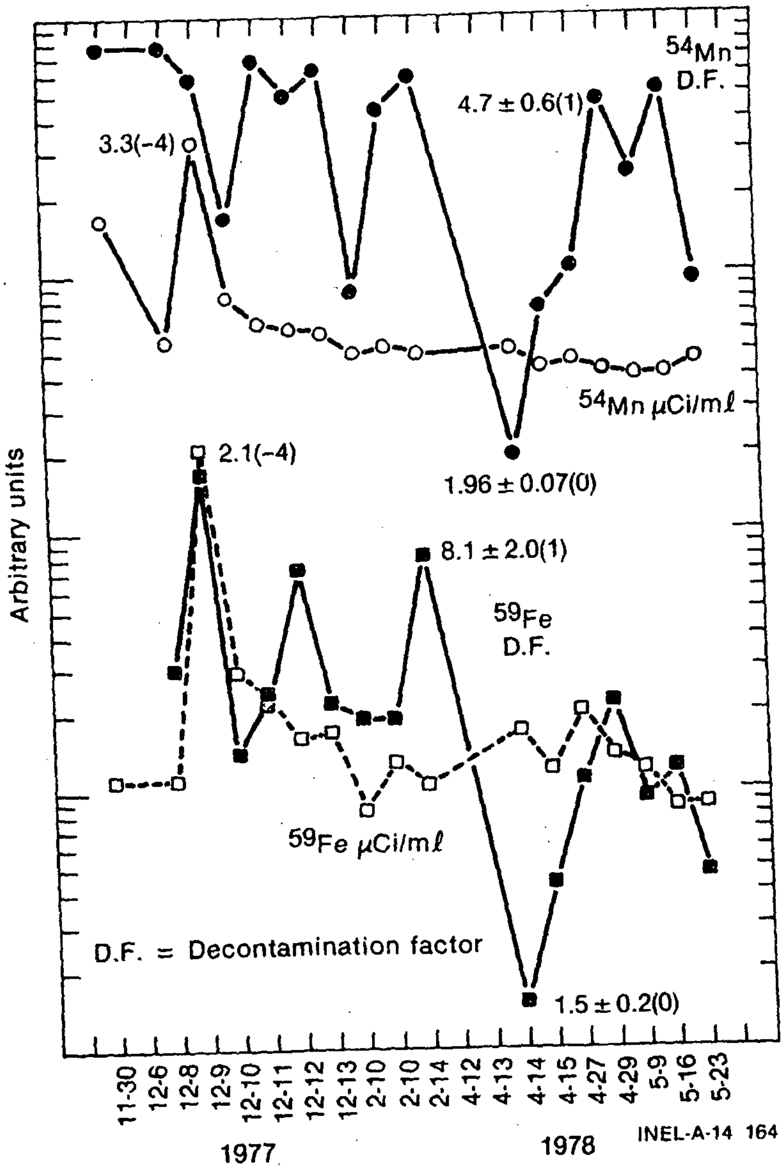

TABLE 3.15

MEANS AND RANGES FOR RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's FOR UNIT #4 CVCS MIXED-BED A DEMINERALIZER

Nuclide	Inlet Concentration (μCi/ml) Mean	Inlet Concentration (μCi/ml) Range	Outlet Concentration (μCi/ml) Mean	Outlet Concentration (μCi/ml) Range	"Best Value" DF
^{131}I	1.9(-2)	0.59-9.8(-2)	5.4(-6)	0.014-3.3(-5)	3.6(3)
^{132}I	1.5(-2)	0.348-8.5(-2)	<6.1(-5)		>2.5(2)
^{133}I	2.0(-2)	0.70-3.23(-2)	1.9(-5)	<0.001-1.1(-4)	1.1(3)
^{134}I	1.5(-2)	0.36-2.41(-2)	<1.2(-4)		>1.2(2)
^{135}I	1.6(-2)	0.48-5.2(-2)	2.5(-5)	<0.0029-<1.9(-4)	6.5(2)
^{88}Rb	1.0(-1)	0.44-3.34(-1)	5.5(-2)	0.0039-3.4(-1)	1.8(0)
^{89}Rb	8.3(-3)	0.42-1.5(-2)	9.6(-4)	0.0098-<2.2(-2)	8.7(0)
^{134}Cs	1.3(-3)	0.70-4.82(-3)	1.0(-3)	0.577-1.98(-3)	1.2(0)
^{136}Cs	2.0(-4)	0.016-2.65(-3)	1.8(-5)	0.37-4.7(-5)	1.1(1)
^{137}Cs	2.4(-3)	1.40-7.71(-3)	1.9(-3)	0.95-3.54(-3)	1.2(0)
^{138}Cs	4.9(-2)	1.3-7.9(-2)	5.7(-3)	0.147-1.34(-2)	8.6(0)
^{139}Cs	4.0(-2)	<0.0013-<5.6(-1)	<4.5(-3)		>8.9(0)
^{3}H	1.60 ± 0.05(-1)	***	1.63 ± 0.05(-1)	***	1.0(0)
^{14}C	3.2 ± 0.3(-6)	***	7.9 ± 0.8(-5)	***	4(-1)
^{24}Na	7.0(-3)	0.326-1.56(-2)	1.3(-5)	0.14-5.4(-5)	5.5(2)
^{51}Cr	2.4(-4)	<0.0059-2.1(-3)	1.8(-5)	<0.062-9.4(-5)	1.5(1)
^{54}Mn	7.3(-5)	0.40-3.3(-4)	4.4(-6)	0.071-2.6(-5)	1.6(1)
^{55}Fe	5.3 ± 0.5(-5)	***	1.45 ± 0.04(-5)	***	3.7(0)
^{59}Fe	2.5(-5)	0.085-2.1(-4)	1.5(-6)	0.013-1.1(-5)	1.7(1)
^{57}Co	2.6(-6)	0.062-2.2(-5)	5.9(-7)	<0.032-2.0(-6)	4.4(0)
^{58}Co	1.5(-3)	0.021-1.49(-2)	1.1(-4)	0.026-9.4(-4)	1.3(1)
^{60}Co	2.0(-4)	0.028-2.45(-3)	9.9(-6)	0.045-4.6(-5)	2.0(1)
^{63}Ni	1.49 ± 0.04(-5)	***	2.8 ± 0.1(-6)	***	5.3(0)
^{65}Zn	5.1(-6)	<0.068-5.6(-5)	2.9(-7)	0.042-<1.5(-6)	1.7(1)

TABLE 3.15 (cont'd)

MEANS AND RANGES FOR RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's FOR UNIT #4 CVCS MIXED-BED A DEMINERALIZER

Nuclide	Inlet Concentration (μCi/ml) Mean	Inlet Concentration (μCi/ml) Range	Outlet Concentration (μCi/ml) Mean	Outlet Concentration (μCi/ml) Range	"Best Value" DF
^{89}Sr	3.2 ± 0.1(-5)	***	1.4 ± 0.3(-7)	***	2.3(2)
^{90}Sr	6.3 ± 0.6(-7)	***	7 ± 3(-9)	***	9(1)
^{91}Sr	1.5(-4)	<0.52-7.9(-4)	1.9(-5)	<0.0024-<1.1(-4)	8.0(0)
^{91}Y	4 ± 2(-7)	***	2.4 ± 0.2(-7)	***	1.7(0)
^{93}Y	9.4(-4)	<0.015-5.1(-3)	<9.3(-5)		>1.0(1)
^{95}Zr	1.7(-5)	0.036-1.3(-4)	8.3(-6)	0.042-8.5(-5)	2.1(0)
^{95}Nb	1.9(-5)	0.049-1.3(-4)	9.5(-6)	<0.049-8.9(-5)	2.0(0)
^{99}Mo	3.1(-4)	0.046-2.43(-3)	1.6(-6)	0.052-<8.0(-6)	2.0(2)
^{103}Ru	2.8(-6)	0.083-<1.1(-5)	1.6(-6)	0.066-1.34(-5)	1.8(0)
^{110m}Ag	1.3(-4)	0.013-2.9(-4)	7.0(-5)	<0.0042-<3.1(-4)	1.6(1)
^{124}Sb	1.5(-5)	0.017-1.06(-4)	4.2(-6)	0.056-2.1(-5)	3.4(0)
^{125}Sb	3.8(-6)	<0.023-3.1(-5)	1.8(-6)	0.31-6.3(-6)	2.2(0)
^{139}Ba	6.0(-3)	0.057-1.07(-2)	4.6(-3)	0.217-1.2(-2)	1.3(0)
^{140}Ba	6.3(-5)	0.33-1.06(-4)	4.5(-6)	<0.016-2.6(-5)	1.4(1)
^{140}La	7.9(-5)	0.067-3.8(-4)	5.7(-7)	0.096-<7.4(-6)	1.4(2)
^{187}W	9.8(-4)	0.37-2.3(-3)	<3.6(-5)		>2.7(1)
^{239}Np	1.5(-5)	<0.18-5.9(-5)	7.3(-6)	<0.014-5.9(-5)	2.1(0)

*** One measurement, only, for this nuclide.

The behavior of the Cs decontamination factors, high instantaneous values during spiking and values which may sometimes be less than one during normal operation, suggests that a measured instantaneous DF is determined by the processes of ion exchange of Cs onto and off of the resin. Rapid increases in Cs inlet concentrations during spiking yield high instantaneous Cs DF's because the duration of the spike is short compared to the Cs ion residence time in the demineralizer. That is, the quantity of Cs loaded onto the bed during a spike is small compared to the total Cs (or competing ion) inventory of the bed and it is the latter that is the dominant determinant of the concentration of Cs in the outlet via Cs ion exchange onto the resin and ion exchange off of the resin and migration down through the bed.

The "best value" DF's listed in Tables 3.12 and 3.15 for mixed-bed demineralizers A and B when compared show that with the exceptions of ^{131}I, ^{138}Cs, ^{57}Co, ^{110m}Ag, and ^{125}Sb, the DF's of mixed bed B are larger than the corresponding DF's of mixed bed A. This may be due to the longer bed life of the mixed bed A as compared with that of mixed bed B.

4. BORIC ACID RECOVERY AND LIQUID RADWASTE SYSTEMS

4.1 System Description and Sample Points

4.1.1 Boric Acid Recovery System

The boric acid recovery system is used to recover boron from the plant letdown flow and from the fuel pool or other boron containing streams. In addition to the recovery of boron, it also reduces the radioactivity concentration of the stream prior to discharging it to the monitor tanks. The system is shown schematically in Figure 4.1 and systems components are listed in Table 4.1.

The boric acid recovery system functions in the following manner. One of three 97,000 gallon tanks, holdup tank (HUT) A, B, or C is processed through the system whenever it is filled. Normally one tank is filling while another is being processed with the third tank being full or empty as required. These tanks are filled from several sources which include:

1. The letdown flow from both Units #3 and #4. These streams can either be sent directly to a HUT or they can be processed through the letdown demineralizers.
2. Reactor Coolant Drain Tank. Water in this tank can come from any of several sumps or directly from the reactor coolant cold legs. During a cold shutdown the water from the reactor coolant loop would be processed through this tank if removal of the water is required for any reason. This tank also handles the excess letdown flow through the excess letdown coolers. The tank pumps automatically to a HUT whenever it is full.
3. The spent fuel pit. Any time a spent fuel pit is to be drained, the water will be processed through the boric acid recovery system by routing it through the holdup tanks.

Figure B.17 shows the HUT levels during the seven-month measurement period.

Feed to the boric acid evaporator (BAE) is passed through a base cation resin (30 ft^3 volume, 5.4 ft^2 cross sectional area) and a filter before being introduced into the evaporator itself. The base cation demineralizer is used to reduce the levels of soluble cationic species in the feed water. It also acts as a filter for some particulate species.

The evaporator is an AMF type (identical to the radwaste evaporator) which has an upper evaporator section and a lower concentrate (bottoms) holding section. The feed is introduced into the evaporator through a gas stripper and into the lower concentrate holding section. A pump moves the bottoms to the upper section where it flows down heated trays

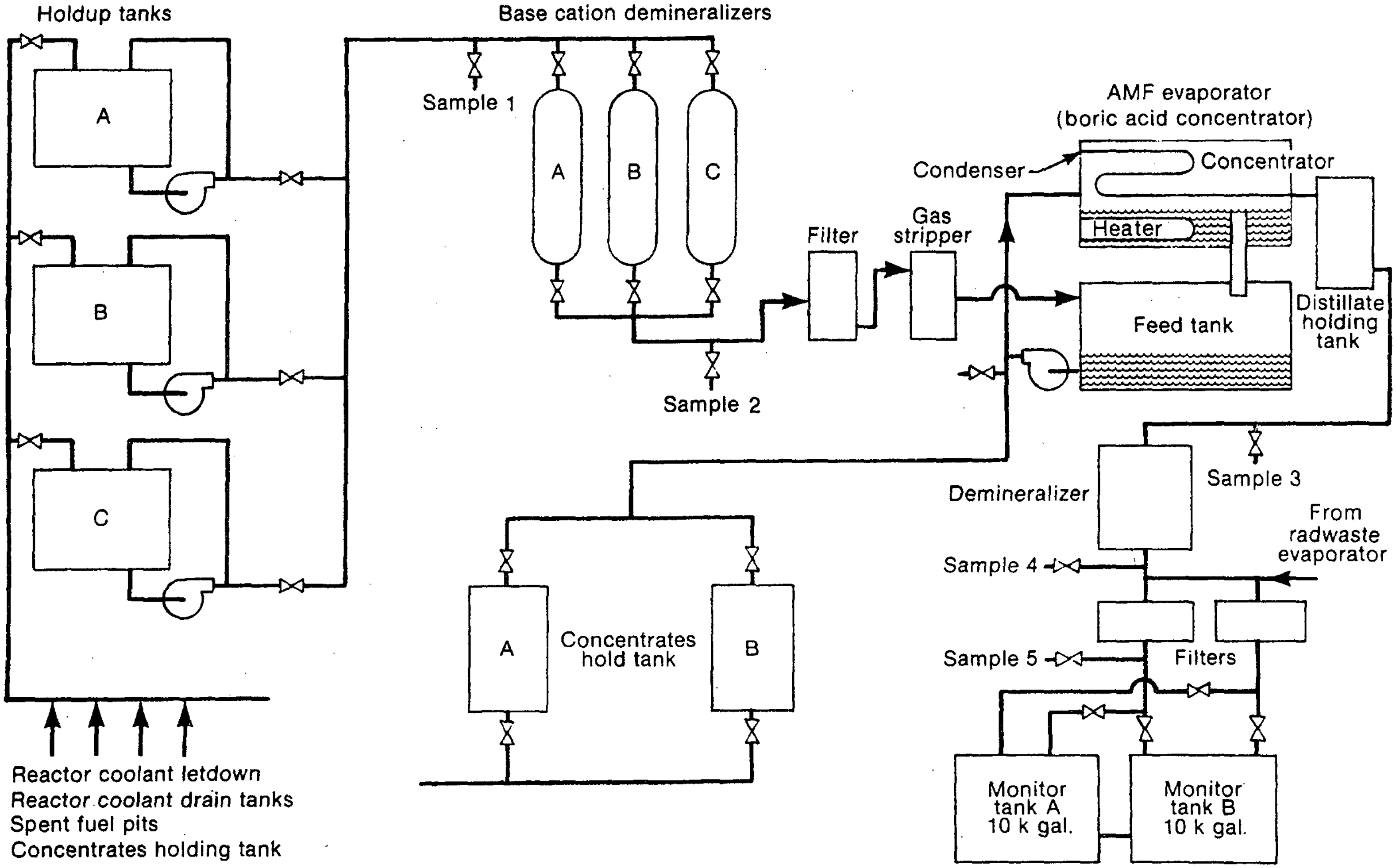

Figure 4.1

Diagram of Boric Acid Recovery System

TABLE 4.1

PRINCIPAL COMPONENTS IN RADWASTE AND BORIC ACID RECOVERY SYSTEMS

	Quantity[1]	Type	Capacity Each gpm	Head	Design Pressure psig	Design Temp °F
Pumps						
Boric acid transfer	4*	Canned	60	235 ft	150	250
Monitor tank	2*	Centrifugal	100	150 ft	150	200
Concentrates holding tank transfer	2*	Canned	20	150 ft	75	250
Reactor Coolant Drain (A)	1 per unit	Horiz cent, canned	150	175 ft	100	267
Reactor Coolant Drain (b)	1 per unit	Horiz cent, canned	50	175 ft	100	267
Chemical Drain	1*	Horiz cent	20	100 ft	150	180

	Quantity	Type	Volume each tank	Design Pressure	Design Temp °F
Tanks					
Reactor Coolant Drain	1 per unit	Horiz	350 gal	25 psig	267
Laundry & Hot Shower	2*	Vert	600 gal	Atm	180
Chemical Drain	1*	Vert	600 gal	Atm	180
Waste Holdup #1	1*	Horiz	3242 ft^3	Atm	150
Spent Resin Storage	1*	Vert	300 ft^3	100 psig	150
Waste Condensate	2*	Vert	1000 gal	Atm	180
Concentrates holding	1*	Vertical	925 gal	Atmos.	250
Monitor	2*	Diaphragm	10,000 gal	Atmos.	150
Monitor	3*		5000 gal	Atmos	
Waste Holdup#2	1*	Horizontal	24300 gal	Atmos	
Boric Acid	3*	Vert.	7500 gal	Atmos.	250
Holdup	3*	Horizontal	13,000 ft^3	15	200

	Quantity[1]	Type	Volume ft^3	Flow gpm	Design Pressure psig	Design Temp °F
Demineralizer Vessels						
Evaporator condensate	2*	Fixed	30	25	200	250
Base - cation ion exchangers	3*	Flushable	30	25	150	250

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[1] Quantity per unit unless otherwise specified.

*Shared or capable of being shared by Unit #3 and Unit #4 under a partial vacuum. The solution temperature is normally about 150°F with a vacuum of 15 to 25 inches of Hg. Boiling occurs in the upper section of the evaporator. The two sections are connected with a standpipe so that the upper section does not overfill. The bottoms, with fresh feed, are pumped to the upper section where boiling occurs and the overflow of concentrated solution can flow back to the lower tank. This operation continues until the feed is stopped. The evaporation continues to reduce the water content and then the bottoms are pumped to the concentrate holding tank (CHT).

The distillate is passed through a demisting screen and then allowed to condense into the condensate holding tank. From there it is pumped through a cooler, a demineralizer filled with a mixed-bed H^+-OH^- resin (30 ft^3 volume, 5.4 ft^2 cross sectional area), and a filter en route to one of two monitor tanks. Both of the filters in the stream behind the demineralizers are there to protect against resin fines and are not primarily designed for the collection of particulate radioactive material.

A set of samples for the boric acid recovery system consisted of the following:

1. Inlet to the base cation demineralizer. This sample is essentially a sample of the HUT.
2. Base cation demineralizer effluent. This sample was also used as the feed to the evaporator. It must be noted, however, that there is a filter between this sample point and the evaporator itself.
3. The evaporator distillate which is also the inlet to the condensate demineralizer.
4. The evaporator bottoms or concentrate.
5. The condensate demineralizer effluent.
6. The condensate demineralizer filter effluent. This filter was shared with the radwaste system and the effluent occasionally gave a mixed sample.

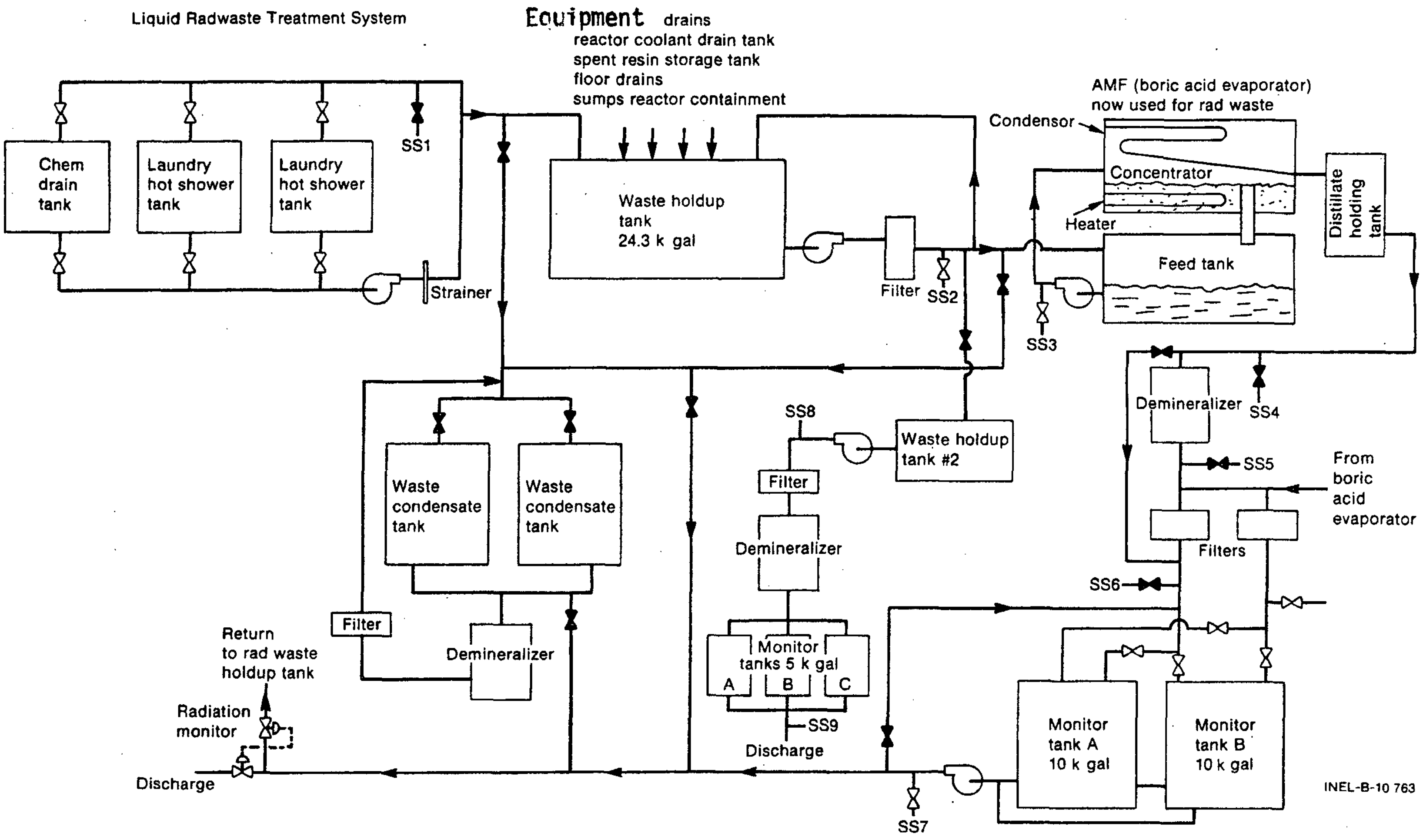
4.1.2 Radwaste System

An evaporator and a mixed-bed demineralizer are used to clean up waste water from drains, sumps, collecting tanks and, on occasion, water from the primary system through the reactor coolant drain tank. Figure 4.2 shows a diagram of this system and Table 4.1 lists system components.

All liquid wastes processed through the evaporator feed from one 23,000 gal waste holdup tank (WHT #1). A second waste holdup tank (10,000 gal WHT #2) is used as an overflow tank for WHT #1 but the water must be sent back to WHT #1 to be processed through the evaporator. Because the only feed path is from the WHT #1, water from any tanks to be processed will be mixed with the liquid previously pumped to the holdup tank.

Figure 4.2

Diagram of Liquid Radwaste System



The reactor coolant drain tank from both units can be drained to the containment sump which pumps to the WHT #1. All auxiliary building and reactor building drains and sumps feed to the WHT #1 but do not have sample locations. Most of these drains and sumps pump down automatically, making it difficult to determine where water to be processed originated. The two laundry and hot shower drain tanks and chemical drain tanks share one pump and can be pumped to the WHT #1 or to the two waste condensate tanks which can then be discharged or sent back to WHT #1 to be processed by the evaporator, depending on the activity level of the liquid. There is a demineralizer and filter through which the waste condensate tanks can be recirculated.

A recirculation line on the discharge of the pump for WHT #1 continuously circulates liquid in the tank through a 20 micron filter even if the flow is shut off to the evaporator. The sample point for the tank is between the filter and the recirculation line so that this is also a sample point for the feed to the evaporator. It is not possible to get a sample of the tank contents before it has passed through the filter.

The evaporator is an AMF vacuum distillation evaporator (identical to the boric acid evaporator) which consists of two 1000 gal. horizontal tanks, one above the other. The liquid in the lower tank (the feed tank) is pumped to the top tank (the concentrator) where the distillation occurs at a pressure below atmospheric pressure. There is a continual circulation of water from the concentrator to the feed tank so the concentrations in each tank are similar.

The feed and distillation continues until the liquid in the feed tank reaches a boron concentration of 22,000 ppm, at which time the liquid flow to the evaporator is shut off and the liquid in the evaporator (bottoms) is allowed to concentrate as distillation continues until the volume of liquid in the feed tank is reduced to 250 gal. At this time, the total bottoms volume is only reduced by 40% to 1250 gal. (i.e., the feed tank contains 250 gal. while the concentrator tank still contains 1000 gal.). The contents of the feed tank (20% of the total bottoms volume) are then dumped. For this reason the bottoms activity is never reduced by more than 20% when the bottoms are dumped. The bottoms that are dumped are drummed in concrete to be sent off site.

The liquid in the concentrator is boiled by a heating bundle and the vapor is condensed on cooling coils. The condensate liquid drains into a 60 gal. holding tank which is pumped to the condensate demineralizer and associated filter designed to collect resin fines. There are actually two filters in parallel (see Figure 2.4), and condensate from both the boric acid and waste evaporators pass through both filters. From the filters the condensate goes to one of two monitor tanks where it is sampled before being released to the environment. If the activity level is not low enough or if the high activity monitor alarm is tripped during release, the liquid is sent back to WHT #1 for reprocessing.

In an attempt to increase sensitivity, resin concentrations were taken on distillate and demineralizer outlet samples in a few cases, but little added information was gained even though the increase in volume was a factor of 9.

Auxiliary building and radwaste building monitor tanks were also sampled. Samples were obtained while the tanks were on recirculation. These tanks are representative of liquid which will be analyzed for radioactive content and released. The liquids in the auxiliary building monitor tanks are not indicative of the integrated radwaste evaporator distillate because boric acid evaporator distillate is also added to these tanks. The radwaste building monitor tanks, however, contain the integrated outlet from the test demineralizer system.

Levels of tanks in the radwaste system were obtained on a routine basis (every 4 hours) during the in-plant measurement period. Appendix B Figures B.18-21 show plots of these tank levels.

4.2 Discussion of Measurement Data - Boric Acid Recovery System

4.2.1 Measurements

Two intensive measurement periods for the boric acid recovery system occurred. They covered the time periods 2/16-22/78 and 5/2-17/78. During the first period Unit #3 was at power and Unit #4 had just been shut down (2/14/78) for steam generator repairs. During the second measurement period both units were at power, but the boric acid recovery system was also processing water from spent fuel pit #3. Radionuclide concentrations measured in samples from the boric acid recovery system during the two intensive measurement periods can be found in Appendix B, Tables B.14-B.20.

Table 4.2 shows the feeds to the holdup tanks during these measurement periods. These data were taken from the operations logs and represent the best estimate of the tank contents, although they may not include all of the sources of water in the holdup tanks.

4.2.2 Base Cation Demineralizers

The feed to the boron recovery system varied during the two time periods studied. Figure 4.3 shows the concentrations of ^{131}I, ^{137}Cs, and ^{58}Co that were fed to the base-cation demineralizer. The figure also shows the DF's of the demineralizer used to treat the feed to the evaporator. During the first two runs in February the contents of holdup tank A were being processed. Unit #4 was shut down on 2/14/78 and the resulting spiking increased the reactor coolant activity level. At this time the letdown flow was being directed to holdup tank C. The C HUT was lined up to the evaporator train and processing began on 2/20/78. The second two runs occurred while this water was being processed through the BAE train. During the February period and for the first two days of the May period, the base-cation demineralizer was loaded with a

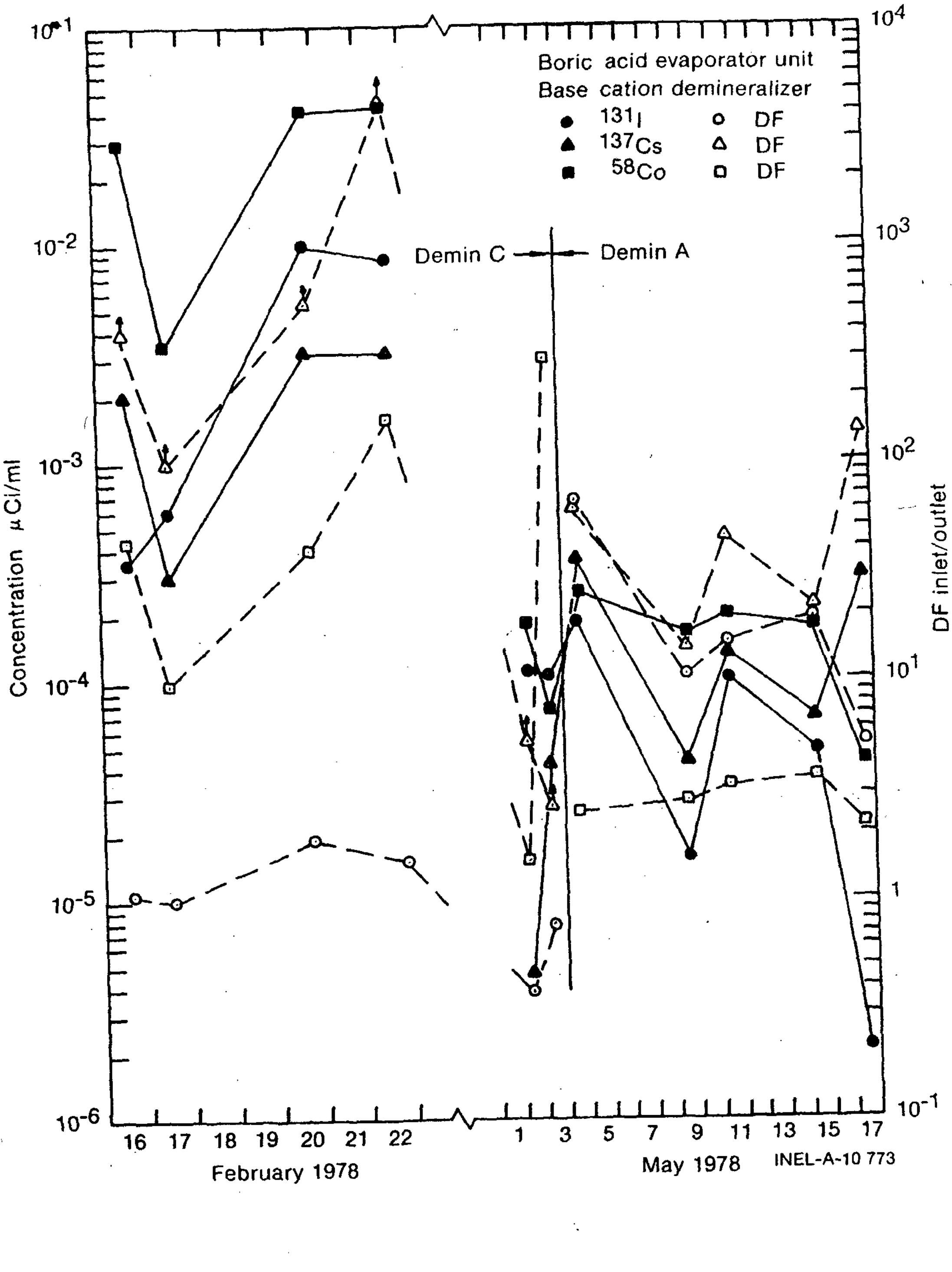
TABLE 4.2

BORIC ACID RECOVERY SYSTEM FEED CONTENTS AND SOURCES

Measurement Date	CVCS Holdup Tank	Feeds to Holdup Tank
2/16/78	A	#3 letdown 10:00, 2/7/78
2/17/78	A	#3 RCS through RCDT 08:30 on 1/31/78 to 15:00 on 8/31/78
2/20/78	C	#3 and #4 letdown from 10:30 on 2/14/78 to 02:05, 2/16/78
2/22/78	C	
5/2/78	A	#3 RWST from 07:45 on 4/29/78 to 12:55, 4/29/78 #3 SFP 19:10 on 5/1/78 to 06:30, 5/2/78 #3 letdown from 08:00, 4/26/78 to 06:30, 5/2/78
5/3/78	A	
5/4/78	C	#3 letdown 12:30 on 5/2/78 to 12:00 5/3/78; #3 SFP 12:30 to 13:11 on 5/2/78 and 06:10 to 12:00 on 5/3/78
5/9/78	A	#3 letdown 03:05 on 5/8/78 and #3 SFP 08:45 5/8/78; #3 letdown & #3 SFP 12:00 to 17:30 on 5/3/78
5/11/78	C	#4 letdown 03:05 on 5/8/78; #3 & #4 letdown 16:30 on 5/6/78; SFP #3 04:10 to 08:45 on 5/8/78; #3 SFP 19:40 on 5/6/78; #4 letdown 12:30 5/2/78 to 05:50 5/4/78
5/15/78	B	#3 letdown and #3 SFP 06:30 to 12:30 on 5/2/78 CHT on 5/6/78 @ 19:40 #3 letdown 05:50 5/4/78 to 16:30 5/6/78
5/17/78	A	#3 & #4 letdown 16:45 5/11/78 to 06:00 5/14/78 #3 letdown 06:00 5/14/78 to 07:45 on 5/17/78

Figure 4.3

Radionuclide Concentrations in Inlet to Boric Acid Recovery System and Demineralizer DF's



cation resin only. This is the normal resin used for this demineralizer, and its purpose is Cs removal. The cation resin had a reasonable DF for the crud-associated-radionuclides, removing over 90% of the ^{58}Co. During the May sampling period, demineralizer C was in service for the first two samples taken. The feed for these samples was a mixture of letdown water from the two units and water from the #3 spent fuel pit which was being drained for repairs. On 5/5/78 demineralizer C was taken out of service and demineralizer A was put into service. This new demineralizer contained a mixed-bed resin (H-OH form) for the removal of both cations and anions. The DF for ^{131}I increased as a result of this resin change and the DF for ^{137}Cs decreased. It is also interesting to note that the DF for ^{58}Co also changed with the mixed bed resin in service. It dropped from a value of about 10 to a value between 2 and 3.5.

4.2.3 Boric Acid Evaporator

The evaporator takes its feed from the outlet of the base cation demineralizer column. During the two sampling periods the evaporator saw a variety of feed activities. The spike activity from the 2/14/78 shutdown was fed to the evaporator on 2/20/78 and 2/22/78. Large quantities of fuel pit water, which had very low levels of the shorter-lived radionuclides including ^{131}I, was processed through the system during the May sampling period. Figures 4.4 and 4.5 show the concentrations of ^{131}I and ^{58}Co in the feed, bottoms and distillate along with the DF's* for both sampling periods. These two radionuclides have the highest activity levels of all of the radionuclides detected in the evaporator feed. The iodine is of interest because the evaporator is the source of iodine in the auxiliary building ventilation system (see Section 8). Data for ^{58}Co are plotted to show the behavior of the crud-associated radionuclides. Cesium is not shown since its concentrations were very low in the feed to the evaporator.

The plot of the iodine behavior shows how a DF of less than one can occur for a short period of time with a well functioning evaporator. In May the concentration of ^{131}I in the feed was dropping very rapidly due to the processing of fuel pit water by the evaporator (Figure 4.4), but the drop in activity in the bottoms tended to lag the drop in the feed. As a result, the DF was less than one for two runs until the bottoms concentration was sufficiently reduced to give a distillate with a lower concentration than the feed. Note that the concentration of the bottoms and the distillate follow a very similar pattern. Cobalt-58 did not exhibit this behavior.

One sample of BAE bottoms, taken on 5/17/78, was analyzed for alpha-emitting radionuclides. Resulting concentrations were 2 ± 1(-8) μCi/ml for ^{238}Pu and 2 ± 1(-8) for ^{239,240}Pu.

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*For an evaporator the DF is defined as the ratio of feed to distillate concentrations.

Figure 4.4

^{131}I Concentrations in BAE Feed, Distillate, and Bottoms and BAE DF's

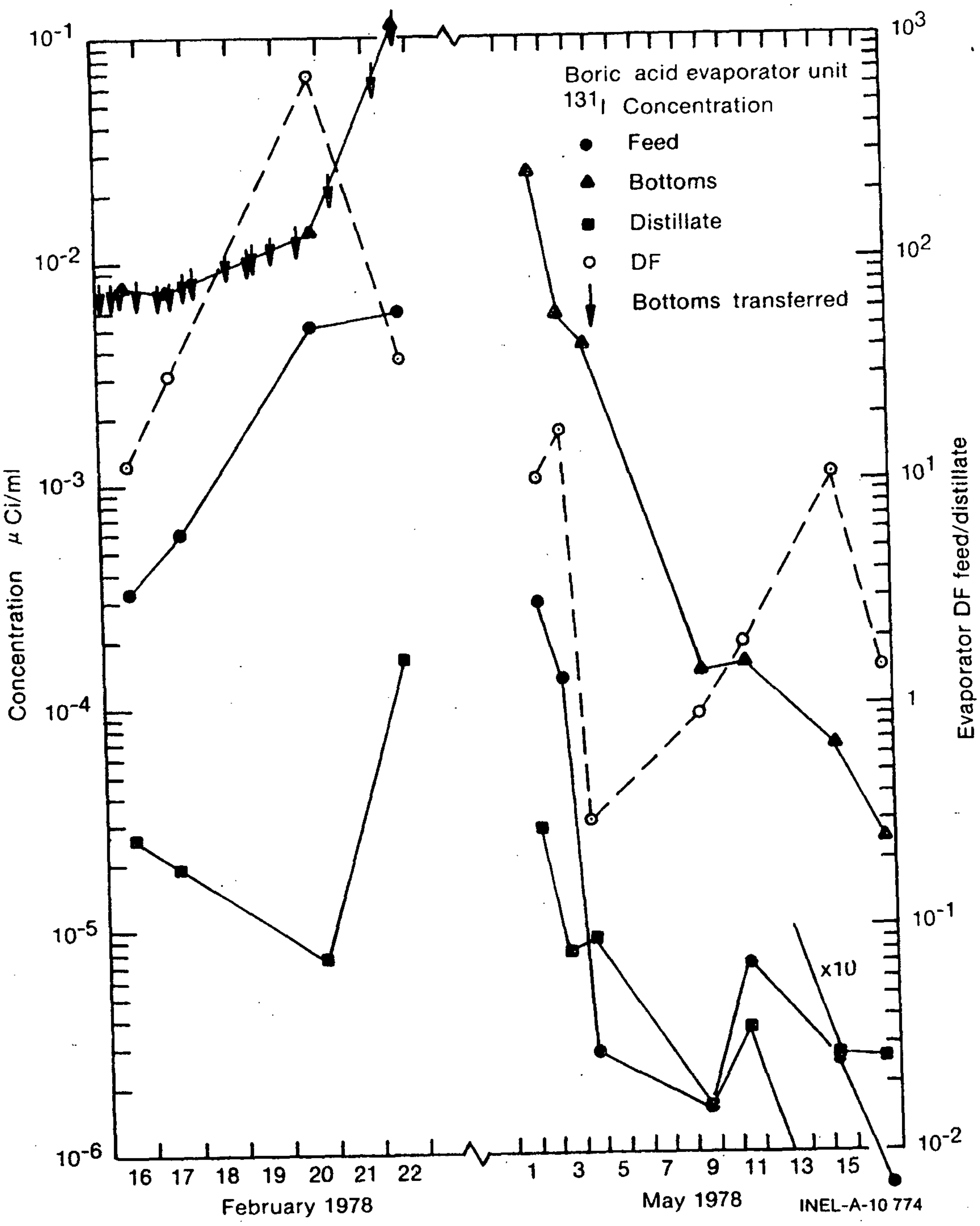
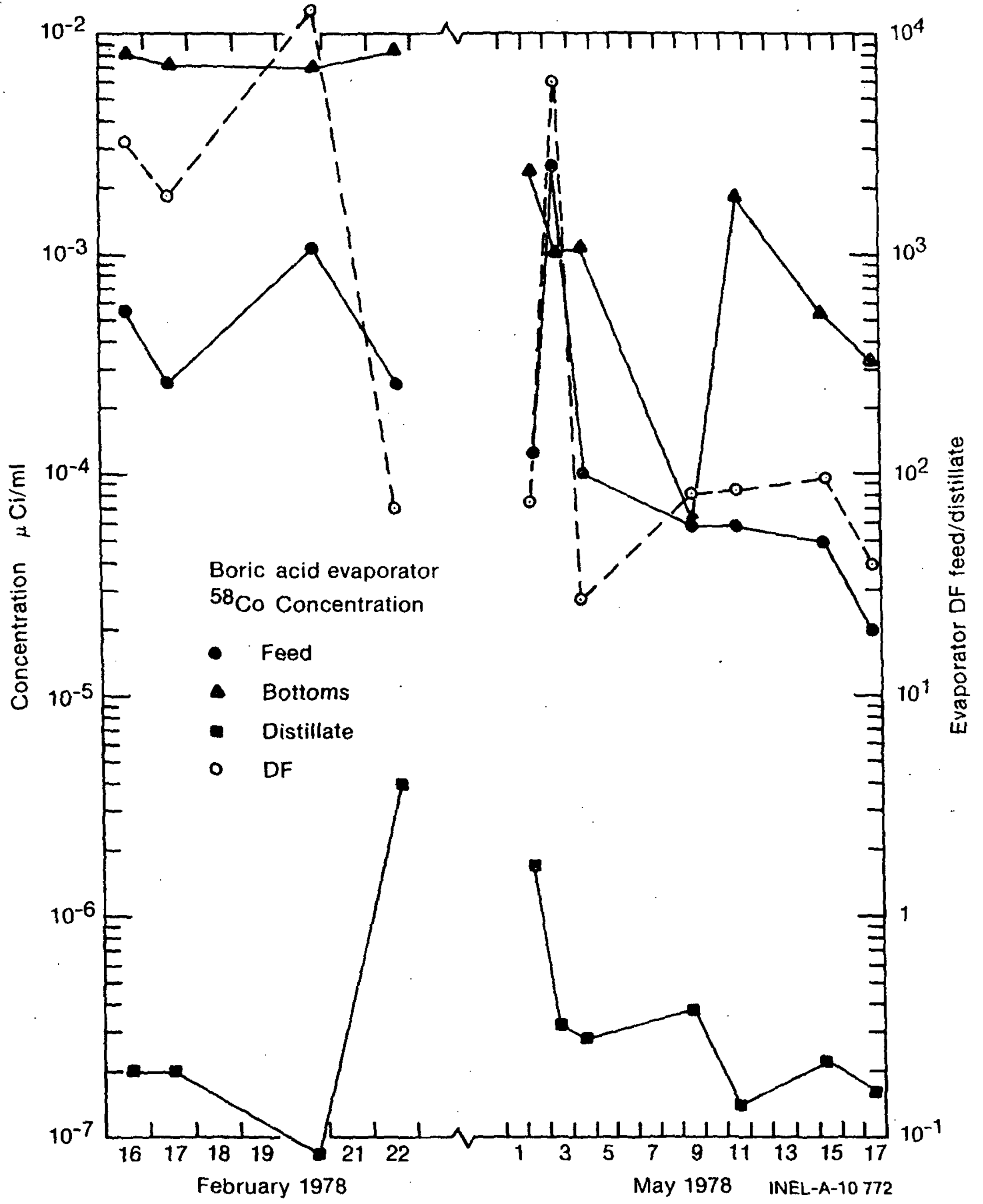


Figure 4.5

^{58}Co Concentrations in BAE Feed, Distillate, and Bottoms and BAE DF's



4.2.4 Condensate Demineralizer and Filter

After leaving the evaporator the distillate is condensed and then goes through the mixed-bed condensate demineralizer for further cleanup. Decontamination factors measured across the condensate demineralizer were, in general, much lower than those measured for the letdown demineralizers. The inlet radionuclide concentrations were also much lower than the corresponding input to the letdown demineralizers. Figure 4.6 shows a plot of ^{131}I concentrations in the inlet to the BAE condensate demineralizer and demineralizer DF's.

After leaving the condensate demineralizer the liquid passes through a filter then goes to one of the monitor tanks. During normal operation, the valve on the line connecting the inlets to the filters in the boric acid recovery system and the radwaste system is open. Hence, either stream sees two sets of filters hooked up in parallel (see Figure 2.4). In order to obtain DF's across the filter in the boric acid recovery system, this valve was closed temporarily. The measured DF's for this filter exhibited considerable variation for the crud-associated radionuclides, ranging from about 0.5 when crud-associated radionuclides were washed off the filter up to about 10.

4.2.5 Summary of Results

All of the individual DF's for each system component are presented in Tables 4.3 through 4.6.

To determine "best value" DF's for the boric acid recovery system, the analysis was split into two sections. The first was the time period when the base cation demineralizer C, which contained a cation resin, was in service. As expected, this demineralizer gave high DF's for the Cs isotopes and low DF's for ^{131}I. The second period was when the base cation demineralizer A was in service with a mixed-bed ion exchange resin. This demineralizer gave lower DF's for the Cs isotopes than the cation bed but higher DF's for ^{131}I. Next, average values of concentrations were used to calculate "best value" DF's for the two measurement periods. Tables 4.7 and 4.8 present means and ranges for radionuclide concentrations and "best value" DF's for system components during the periods when base cation demineralizer C and A were in service. Figures 4.7 and 4.8 present values for the radionuclides ^{131}I, $^{134-137}Cs$ and $^{57-60}Co$ for the periods when the two different types of resins were used in the base cation demineralizer column. Note that for decreasing feed, the values of the evaporator DF for ^{131}I (Figure 4.8) approaches 1.0. However, in the operation of an evaporator of this type, the distillate quality is dependent on the bottoms concentration and not directly on the feed. If we calculate the ratio of bottoms to distillate concentration, we arrive at the values shown in Figure 4.9.

Examination of the data obtained for iodine and cesium when the base cation demineralizer was loaded with a mixed-bed resin indicates that the DF's are a function of the inlet concentrations of the

Figure 4.6

^{131}I Concentration in Inlet to BAE Condensate Demineralizer and Demineralizer DF

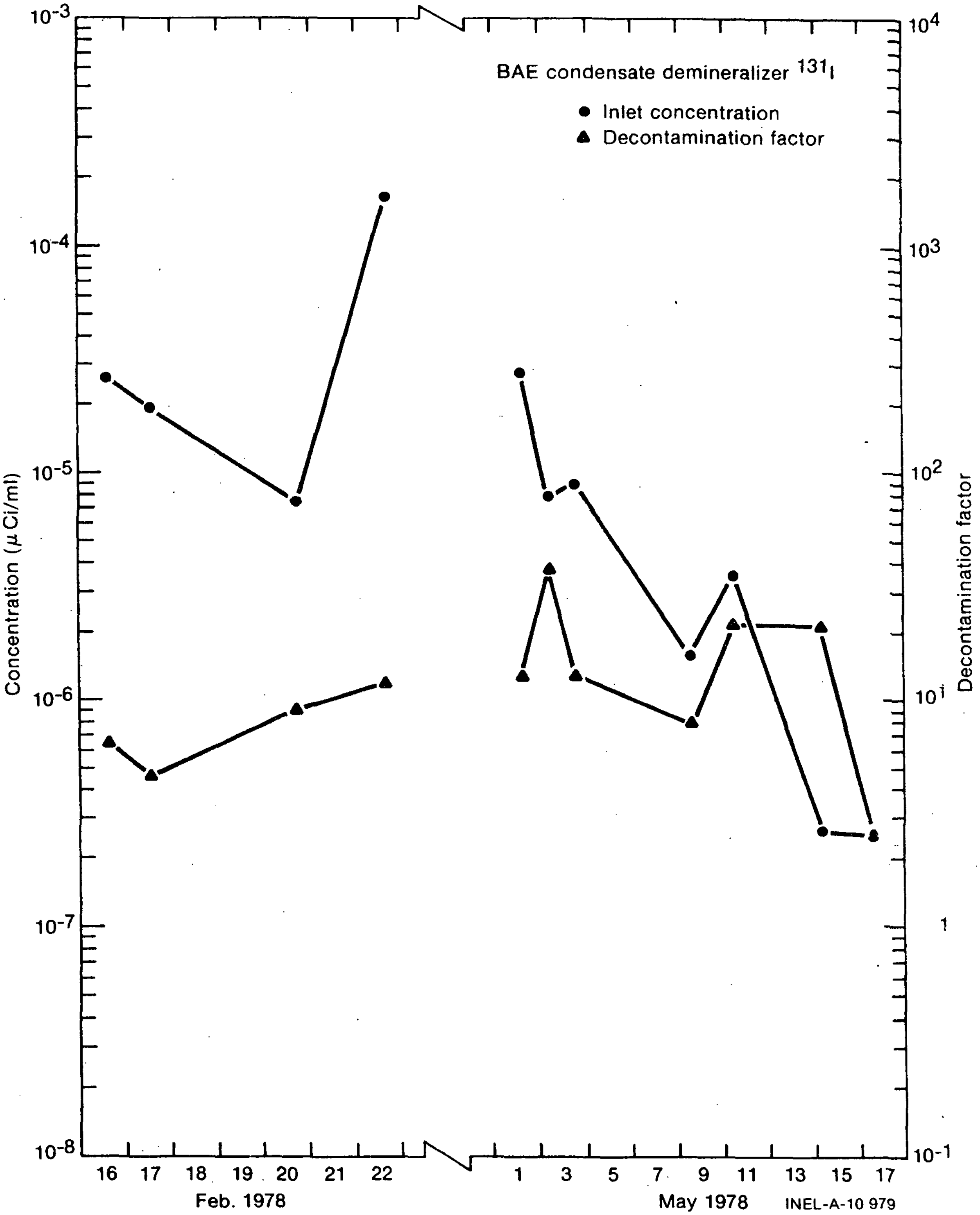


TABLE 4.3

DF's FOR BASE CATION DEMINERALIZERS

	Base Cation Demineralizer C (Cation Resin)					
Nuclide	15:10, 2/16/78	13:15, 2/17/78	18:15; 2/20/78	16:05, 2/22/78	09:05, 5/2/78	09:52, 5/3/78
^{131}I	1.07 ± 0.03(0)	1.00 ± 0.02(0)	1.92 ± 0.05(0)	1.45 ± 0.10(0)	3.8 ± 0.1(-1)	7.6 ± 0.3(-1)
^{134}Cs	>1.5(3)	>1.4(2)	>1.5(3)	>1.5(4)	5.8 ± 2.9(1)	>1.4(1)
^{137}Cs	>4.0(2)	>1.0(2)	>5.3(2)	>4.5(3)	>3.1(0)	>2.8(0)
^{51}Cr	2.0 ± 0.1(0)	1.4 ± 0.4(-2)	1.6 ± 0.1(0)	3.3 ± 0.2(0)	7.0 ± 1.5(-1)	1.4 ± 0.5(-2)
^{54}Mn	4.3 ± 0.1(1)	1.3 ± 0.1(1)	1.23 ± 0.04(2)	5.9 ± 0.2(2)	3.8 ± 0.4(0)	5.1 ± 0.3(-2)
^{59}Fe	1.7 ± 0.2(0)	1.3 ± 0.1(0)	1.7 ± 0.1(0)	2.22 ± 0.04(0)	8.8 ± 0.4(-1)	3.3 ± 1.3(-2)
^{57}Co	2.5 ± 0.2(1)	4.3 ± 1.6(0)	1.6 ± 0.3(1)	1.4 ± 0.8(2)	<2.3(0)	5.1 ± 1.3(-2)
^{58}Co	4.4 ± 0.1(1)	9.6 ± (0)	4.0 ± 0.1(1)	1.61 ± 0.05(2)	1.46 ± 0.03(0)	3.0 ± 0.1(-2)
^{60}Co	5.9 ± 0.1(1)	1.44 ± 0.01(1)	2.03 ± 0.04(1)	1.30 ± 0.02(2)	2.46 ± 0.09(0)	1.00 ± 0.01(-1)
^{65}Zn	6.4 ± 1.3(0)	2.8 ± 0.7(0)	4.5 ± 1.0(0)	3.7 ± 0.8(1)	*	<5.3(-2)
^{95}Zr	2.6 ± 0.1(0)	1.6 ± 0.1(0)	1.1 ± 0.1(0)	5.3 ± 0.2(0)	9.3 ± 2.2(-1)	4.6 ± 0.5(-2)
^{95}Nb	2.7 ± 0.1(0)	1.5 ± (0)	1.0 ± 0.1(0)	5.0 ± 0.3(0)	6.9 ± 0.4(-1)	3.9 ± 0.5(-2)
^{99}Mo	<1.4(1)	*	2.89 ± 0.06(0)	1.93 ± 0.05(0)	5.8 ± 1.0(0)	3.5 ± 0.6(-2)
^{103}Ru	5.0 ± 0.5(-2)	1.26 ± 0.04(0)	2.1 ± 0.9(-1)	2.7 ± 0.5(0)	<3.6(-1)	4.7 ± 1.2(-2)
^{106}Ru	<2.6(-1)	9.7 ± 0.8(-1)	<2.5(-1)	*	<1.2(0)	1.7 ± 0.6(-1)
^{110m}Ag	<5.3(1)	3.7 ± 1.0(0)	<3.6(1)	<9.2(1)	8.7 ± 1.8(-1)	4.0 ± 0.5(-2)
^{124}Sb	1.13 ± 0.04(0)	9.8 ± 0.2(-1)	9.7 ± 0.3(-1)	1.51 ± 0.03(-1)	9.4 ± 0.9(-1)	2.5 ± 0.2(-1)
^{125}Sb	1.43 ± 0.03(0)	9.8 ± 1.2(-1)	5.1 ± 0.5(-1)	1.39 ± 0.06(0)	9.7 ± 1.4(-1)	4.0 ± 0.3(-1)
^{140}La	5.8 ± 0.6(0)	2.5 ± 0.3(0)	2.8 ± 0.1(0)	9.1 ± 0.2(0)	2.4 ± 0.3(-1)	1.4 ± 0.1(0)
^{141}Ce	1.9 ± 0.9(1)	1.6 ± 0.5(0)	*	*	*	<3.6(-1)
^{144}Ce	<6(-1)	*	*	*	*	1.5 ± 1.0(-1)

* - Radionuclide not detected.

TABLE 4.3 (cont'd)

DF's FOR BASE CATION DEMINERALIZERS

	Base Cation Demineralizer A (Mixed-Bed Resin)				
Nuclide	14:34; 5/4/78	14:50; 5/9/78	11:58; 5/11/78	10:35; 5/15/78	14:46; 5/17/78
^{131}I	6.6 ± 0.5(1)	1.05 ± 0.07(1)	1.46 ± 0.03(1)	1.83 ± 0.05(1)	3.0 ± 1.3(0)
^{134}Cs	1.1 ± 0.3(2)	2.7 ± 0.2(1)	8.5 ± 0.2(1)	4.9 ± 0.5(1)	2.7 ± 0.3(2)
^{137}Cs	6.3 ± 0.3(1)	1.40 ± 0.06(1)	4.5 ± 0.3(1)	2.2 ± 0.1(1)	1.3 ± 0.1(2)
^{51}Cr	1.4 ± 0.3(0)	2.3 ± 0.2(0)	1.6 ± 0.1(0)	2.3 ± 0.2(0)	2.4 ± 0.9(0)
^{54}Mn	2.02 ± 0.09(0)	2.7 ± 0.1(0)	3.7 ± 0.4(0)	4.5 ± 0.3(0)	4.0 ± 0.7(0)
^{59}Fe	1.5 ± 0.4(0)	3.1 ± 0.6(0)	2.2 ± 0.3(0)	1.6 ± 0.4(0)	1.4 ± 0.7(0)
^{57}Co	<1.3(0)	1.8 ± 0.7(0)	2.0 ± 0.3(0)	3.3 ± 0.9(0)	1.8 ± 0.6(0)
^{58}Co	2.5 ± 0.3(0)	2.81 ± 0.05(0)	3.3 ± 0.1(0)	3.6 ± 0.1(0)	2.1 ± 0.1(0)
^{60}Co	2.2 ± 0.1(0)	2.6 ± 0.1(0)	3.4 ± 0.2(0)	3.4 ± 0.1(0)	3.3 ± 0.4(0)
^{65}Zn	<1.1(0)	<2.4(0)	<2.5(0)	<2.8(0)	1.1 ± 0.5(0)
^{95}Zr	2.0 ± 0.3(0)	2.6 ± 0.3(0)	2.0 ± 0.2(0)	2.7 ± 0.3(0)	2.7 ± 0.5(0)
^{95}Nb	1.7 ± 0.1(0)	2.7 ± 0.2(0)	2.2 ± 0.1(0)	2.0 ± 0.1(0)	2.1 ± 0.4(0)
^{99}Mo	5.5 ± 3.2(0)	*	*	*	*
^{103}Ru	2.3 ± 0.9(0)	2.8 ± 0.6(0)	1.6 ± 0.1(0)	2.4 ± 0.2(0)	1.0 ± 0.2(0)
^{106}Ru	*	1.5 ± 1.1(-1)	<1.7(0)	3.9 ± 0.6(0)	<9.4(-1)
^{110m}Ag	2.6 ± 0.7(0)	2.2 ± 0.4(0)	2.8 ± 0.3(0)	3.3 ± 0.2(0)	1.5 ± 0.3(0)
^{124}Sb	5.8 ± 0.9(0)	7.6 ± 1.1(0)	7.1 ± 0.8(0)	6.7 ± 0.4(0)	3.7 ± 1.1(0)
^{125}Sb	1.0 ± 0.5(1)	6.2 ± 0.7(0)	1.0 ± 0.2(1)	9.2 ± 0.5(0)	5.7 ± 1.6(0)
^{140}La	2.0 ± 0.5(0)	9.4 ± 0.7(-1)	2.7 ± 0.3(0)	4.1 ± 0.3(0)	2.3 ± 0.9(-1)
^{141}Ce	<8(-1)	>6.2(0)	<2.4(0)	*	<3.3(0)
^{144}Ce	*	1.1 ± 0.4(0)	<1.6(0)	<1.3(0)	1.4 ± 0.7(0)

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* - Radionuclide not detected

TABLE 4.4

DF's FOR BORIC ACID EVAPORATOR

Nuclide	2/16/78	2/17/78	2/20/78	2/22/78	5/2/78	5/3/78
^{131}I	1.24 ± 0.04(1)	3.1 ± 0.1(1)	6.9 ± 0.2(2)	3.7 ± 0.2(1)	1.05 ± 0.03(1)	1.72 ± 0.08(1)
^{134}Cs	*	<1.1(1)	<2.3(2)	*	3.0 ± 1.8(0)	*
^{137}Cs	*	<4.3(1)	<2.1(2)	*	*	*
^{51}Cr	>3.9(3)	1.4 ± 0.8(3)	<1.3(5)	8.5 ± 7.3(2)	>3.5(1)	>4.9(2)
^{54}Mn	>2.0(2)	9.8 ± 2.7(1)	1.8 ± 0.2(3)	>3.4(1)	6.6 ± 0.8(0)	4.3 ± 0.2(3)
^{59}Fe	>7.6(2)	>6.7(2)	5.8 ± 0.5(3)	8.7 ± 1.1(1)	>1.5(1)	6.5 ± 3.1(2)
^{57}Co	>6.5(1)	>6.8(1)	>1.0(3)	>1.6(0)	*	>9.9(1)
^{58}Co	3.2 ± 0.8(3)	1.8 ± 0.3(3)	1.29 ± 0.04(4)	6.9 ± 0.3(1)	7.3 ± 0.4(1)	7.8 ± 0.8(3)
^{60}Co	>1.6(3)	6.2 ± 4.2(2)	2.48 ± 0.09(3)	3.6 ± 0.6(1)	1.6 ± 0.1(1)	6.1 ± 2.4(3)
^{65}Zn	>1.2(2)	>6.6(1)	>4.3(3)	>5.3(0)	*	>9.4(1)
^{95}Zr	>7.5(2)	>4.8(2)	7.0 ± 1.4(3)	7.1 ± 4.9(1)	1.8 ± 0.6(1)	9.9 ± 2.8(2)
^{95}Nb	>1.1(3)	4.9 ± 3.3(2)	4.0 ± 1.5(3)	5.8 ± 2.5(1)	5.8 ± 1.5(1)	2.2 ± 1.4(3)
^{99}Mo	>9.3(0)	*	8.5 ± 3.1(4)	9.3 ± 1.3(1)	>3.2(1)	3.1 ± 1.4(3)
^{103}Ru	>1.0(3)	4.3 ± 1.4(2)	5.2 ± 1.0(3)	>2.3(1)	>2.1(1)	1.0 ± 0.4(3)
^{106}Ru	>6.3(2)	>7.9(2)	>2.3(4)	<1.7(-1)	>6(0)	>4.2(1)
^{110m}Ag	7.8 ± 3.9(1)	6.4 ± 1.8(1)	3.6 ± 0.2(2)	1.6 ± 0.2(1)	>1.7(1)	1.0 ± 0.2(2)
^{124}Sb	>9.6(3)	4.2 ± 1.3(3)	3.3 ± 0.2(3)	9.6 ± 1.5(1)	4.9 ± 2.5(1)	1.6 ± 0.8(3)
^{125}Sb	2.4 ± 0.6(3)	2.5 ± 0.5(3)	>3.9(1)	5.9 ± 0.4(1)	>3.9(1)	3.3 ± 0.6(2)
^{140}La	>7.1(1)	2.4 ± 1.1(1)	>1.1(5)	4.3 ± 0.3(2)	>1.8(2)	1.5 ± 0.5(2)
^{141}Ce	>6.5(0)	>4.6(1)	*	*	*	>1.2(1)
^{144}Ce	>2.2(2)	<5.3(1)	*	*	*	1.9 ± 1.1(1)

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* - Radionuclide not detected.

TABLE 4.4 (cont'd)

DF's FOR BORIC ACID EVAPORATOR

Nuclide	5/4/78	5/9/78	5/11/78	5/15/78	5/17/78
^{131}I	3.1 ± 0.3(-1)	9.2 ± 0.8(-1)	1.9 ± 0.1(0)	9.5 ± 2.8(0)	2.7 ± 1.3(0)
^{134}Cs	>9.0(0)	7.9 ± 0.9(0)	1.7 ± 0.8(2)	2.0 ± 1.5(2)	7.1 ± 2.4(0)
^{137}Cs	8.9 ± 1.2(1)	9.7 ± 0.4(0)	5.4 ± 2.5(1)	2.1 ± 1.5(1)	5.7 ± 4.1(2)
^{51}Cr	5.8 ± 3.1(1)	9.4 ± 1.6(1)	2.0 ± 0.4(2)	1.2 ± 0.5(2)	7.8 ± 2.0(1)
^{54}Mn	2.1 ± 0.6(1)	6.0 ± 0.5(1)	2.1 ± 0.8(1)	6.8 ± 0.6(1)	1.7 ± 0.7(1)
^{59}Fe	>2.6(1)	>5.5(0)	9.4 ± 2.8(1)	>1.4(1)	>4.7(0)
^{57}Co	>1.2(1)	>3.1(0)	1.3 ± 0.8(2)	>3.4(0)	3.3 ± 1.5(1)
^{58}Co	3.6 ± 0.6(2)	1.5 ± 0.3(2)	4.2 ± 1.8(2)	2.3 ± 0.5(2)	1.2 ± 0.3(2)
^{60}Co	1.9 ± 0.3(2)	9.4 ± 0.3(1)	8.3 ± 0.4(1)	9.7 ± 0.6(1)	7.6 ± 1.0(1)
^{65}Zn	>1.0(1)	>3.2(0)	>1.4(0)	>2.3(0)	>2.9(0)
^{95}Zr	4.1 ± 0.5(1)	8.5 ± 1.2(1)	6.7 ± 0.9(1)	8.0 ± 2.9(1)	7.6 ± 2.3(1)
^{95}Nb	5.1 ± 4.6(1)	9.0 ± 1.1(1)	7.8 ± 0.8(1)	1.4 ± 0.2(2)	8.6 ± 1.9(1)
^{99}Mo	9.4 ± 6.4(0)	*	*	*	>6.7(0)
^{103}Ru	>7.4(0)	>5.9(0)	3.6 ± 0.6(1)	1.6 ± 0.5(2)	8.1 ± 2.5(1)
^{106}Ru	<1.1(1)	7.7 ± 4.2(1)	>3.1(0)	>5.4(0)	>4.8(0)
^{110m}Ag	4.3 ± 0.7(0)	5.1 ± 0.9(1)	2.8 ± 0.2(1)	2.6 ± 0.3(1)	2.8 ± 0.5(1)
^{124}Sb	5.1 ± 1.1(1)	>8.1(0)	5.8 ± 1.6(1)	1.5 ± 0.5(2)	2.3 ± 0.7(1)
^{125}Sb	2.0 ± 1.0(1)	2.6 ± 0.4(1)	1.4 ± 0.3(1)	8.0 ± 1.0(1)	1.5 ± 0.4(1)
^{140}La	>1.1(1)	>7.4(0)	>5.6(0)	6.1 ± 3.6(2)	>1.2(1)
^{141}Ce	>1.7(1)	*	2.7 ± 0.9(1)	*	>9.2(-1)
^{144}Ce	*	>3.3(1)	1.3 ± 0.4(1)	>3.8(0)	>2.8(0)

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* - Radionuclide not detected.

TABLE 4.5

DF's FOR BAE CONDENSATE DEMINERALIZER

Nuclide	2/16/78	2/17/78	2/20/78	2/22/78	5/2/78	5/3/78
^{131}I	6.5 ± 0.2(0)	4.7 ± 0.2(0)	9.1 ± 0.3(0)	1.17 ± 0.03(1)	1.32 ± 0.07(1)	3.8 ± 1.3(1)
^{134}Cs	3.8 ± 2.2(-1)	1.0 ± 0.7(0)	1.9 ± 0.6(-1)	<2.5(0)	>1.7(0)	<1.2(0)
^{137}Cs	<2.3(-1)	3.5 ± 2.3(-1)	3.6 ± 1.3(-1)	<2.8(0)	<5.9(-1)	3.1 ± 0.8(-2)
^{51}Cr	*	1.8 ± 1.7(0)	<9.2(-2)	4.8 ± 4.2(-1)	<1.4(0)	*
^{54}Mn	<5.5(-1)	4.7 ± 1.6(-1)	5.2 ± 0.6(-1)	<1.9(0)	>6.9(0)	>2.2(0)
^{59}Fe	*	*	2.3 ± 0.8(0)	1.2 ± 0.6(1)	*	>2.6(0)
^{57}Co	*	*	*	*	*	*
^{58}Co	2.4 ± 0.6(-1)	4.0 ± 0.7(-1)	1.06 ± 0.04(-1)	8.0 ± 0.5(-1)	4.9 ± 0.9(0)	4.6 ± 0.5(0)
^{60}Co	*	6.3 ± 5.0(-1)	5.5 ± 0.3(-1)	1.3 ± 0.3(0)	>2.2(1)	1.4 ± 0.3(0)
^{95}Zr	*	*	1.1 ± 0.4(0)	2.4 ± 2.7(0)	>1.3(0)	1.4 ± 0.7(1)
^{95}Nb	*	>8.2(-1)	>1.4(0)	2.2 ± 1.3(1)	>2.2(0)	>5.0(0)
^{99}Mo	*	<1.1(0)	6.4 ± 2.7(-1)	9.1 ± 2.1(1)	*	>1.4(0)
^{103}Ru	*	7.1 ± 3.2(-1)	2.0 ± 1.6(0)	<4.4(0)	*	>1.9(0)
^{106}Ru	*	<1.3(-1)	*	0.6 ± 1.5(2)	*	<1.0(1)
^{110m}Ag	2.9 ± 1.5(-1)	2.0 ± 0.6(-1)	2.8 ± 0.2(-1)	1.8 ± 0.4(0)	*	2.9 ± 0.5(1)
^{124}Sb	*	1.2 ± 0.5(0)	3.4 ± 0.4(0)	5.2 ± 8.1(1)	>1.3(0)	*
^{125}Sb	>4.9(0)	3.9 ± 0.9(1)	2.9 ± 0.4(0)	2.0 ± 1.4(1)	*	>2.6(0)
^{140}La	*	>1.8(0)	<4.8(-1)	>4.2(0)	*	7.7 ± 3.7(0)
^{141}Ce	*	*	*	*	*	*
^{144}Ce	*	>1.6(0)	*	*	*	>1.2(1)

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* - Radionuclide not detected.

TABLE 4.5 (cont'd)

DF's FOR BAE CONDENSATE DEMINERALIZER

Nuclide	5/4/78	5/9/78	5/11/78	5/15/78	5/17/78
$^{131}\mathrm{I}$	1.3 ± 0.1(1)	8.0 ± 1.7(0)	2.2 ± 0.4(1)	3.2 ± 1.2(1)	2.6 ± 0.8(0)
$^{134}\mathrm{Cs}$	<2.1(0)	2.4 ± 0.6(1)	7.5 ± 3.5(-2)	1.5 ± 1.2(-1)	1.1 ± 0.5(0)
$^{137}\mathrm{Cs}$	2.9 ± 0.4(-1)	9.7 ± 0.7(0)	1.0 ± 0.9(0)	2.2 ± 2.2(0)	3.3 ± 3.1(-2)
$^{51}\mathrm{Cr}$	>1.1(2)	6.3 ± 1.3(-1)	2.1 ± 0.7(0)	>1.7(-1)	>7.8(-2)
$^{54}\mathrm{Mn}$	4.1 ± 1.2(1)	>9.2(-1)	7.8 ± 2.9(0)	5.5 ± 3.2(-1)	3.3 ± 2.9(1)
$^{59}\mathrm{Fe}$	*	<1.2(1)	>1.4(-1)	*	*
$^{57}\mathrm{Co}$	*	*	>4.3(-2)	*	>5.4(-2)
$^{58}\mathrm{Co}$	4.5 ± 0.7(0)	4.5 ± 0.9(-1)	5.6 ± 2.7(-1)	3.6 ± 0.9(0)	1.9 ± 1.0(0)
$^{60}\mathrm{Co}$	1.3 ± 0.2(0)	1.71 ± 0.04(0)	5.0 ± 4.2(0)	6.5 ± 1.2(0)	4.8 ± 0.8(0)
$^{95}\mathrm{Zr}$	8.2 ± 3.4(0)	8.5 ± 1.4(-1)	>3.0(-1)	5.8 ± 4.3(0)	>1.5(-1)
$^{95}\mathrm{Nb}$	1.3 ± 1.5(1)	8.4 ± 0.5(-1)	5.5 ± 1.7(-1)	>5.5(-1)	7.1 ± 3.1(-1)
$^{99}\mathrm{Mo}$	2.4 ± 1.4(1)	*	1.0 ± 0.6(0)	*	1.6 ± 1.1(0)
$^{103}\mathrm{Ru}$	*	<9.2(0)	>4.0(-1)	>1.9(-1)	>1.4(-1)
$^{106}\mathrm{Ru}$	>9.8(0)	>7.9(-1)	*	*	*
$^{110m}\mathrm{Ag}$	1.0 ± 0.2(1)	1.9 ± 0.2(-1)	3.1 ± 0.5(0)	5.9 ± 1.7(-1)	2.4 ± 0.7(0)
$^{124}\mathrm{Sb}$	1.5 ± 0.3(0)	<2.3(0)	2.6 ± 1.4(0)	1.9 ± 1.2(0)	2.6 ± 1.6(0)
$^{125}\mathrm{Sb}$	1.2 ± 0.1(0)	9.4 ± 1.2(-1)	4.3 ± 1.5(-1)	3.2 ± 1.2(-1)	2.0 ± 0.4(0)
$^{140}\mathrm{La}$	*	*	*	>7.2(-2)	*
$^{141}\mathrm{Ce}$	*	*	>1.1(-1)	*	*
$^{144}\mathrm{Ce}$	*	*	4.4 ± 3.6(0)	*	*

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* - Radionuclide not detected.

TABLE 4.6

DF's FOR BAE CONDENSATE DEMINERALIZER FILTER

Nuclide	2/16/78	2/17/78	2/20/78	2/22/78	5/2/78	5/3/78
^{131}I	9.6 ± 0.3(-1)	1.07 ± 0.03(0)	1.00 ± 0.02(0)	1.09 ± 0.03(0)	9.3 ± 0.5(-1)	9.7 ± 0.3(-1)
^{134}Cs	2.7 ± 1.3(0)	1.1 ± 0.9(0)	9.4 ± 1.3(-1)	>3.0(-1)	*	8.2 ± 3.0(0)
^{136}Cs	9.2 ± 6.8(-1)	*	1.0 ± 0.2(0)	*	*	*
^{137}Cs	1.2 ± 0.3(0)	6.5 ± 1.6(-1)	9.1 ± 0.3(-1)	5.6 ± 3.3(-1)	1.0 ± 0.3(0)	8.0 ± 1.1(0)
^{51}Cr	*	9.3 ± 8.6(0)	4.0 ± 1.4(0)	>4.1(0)	*	<1.7(0)
^{54}Mn	>3.2(0)	2.6 ± 1.8(0)	4.7 ± 1.0(0)	>5.4(-1)	<1.7(0)	<1.7(0)
^{59}Fe	*	<9.3(-1)	4.1 ± 2.3(0)	5.9 ± 3.6(-1)	*	*
^{57}Co	*	*	<6.2(0)	<2.2(0)	*	<2.7(0)
^{58}Co	4.9 ± 0.5(-1)	1.1 ± 0.1(0)	4.3 ± 0.2(0)	8.8 ± 0.4(-1)	2.5 ± 0.7(0)	7.1 ± 1.0(-1)
^{60}Co	<4.6(-1)	1.6 ± 1.2(0)	3.5 ± 0.3(0)	1.1 ± 0.1(0)	<7.2(-2)	8.6 ± 0.9(-1)
^{65}Zn	*	*	*	*	*	*
^{95}Zr	*	<6.2(0)	>2.6(0)	>5.6(-1)	*	>9.3(-1)
^{95}Nb	*	<7.7(0)	<3.7(0)	>1.4(-1)	*	<4.6(-1)
^{99}Mo	*	<9.8(0)	>2.6(0)	>2.1(-1)	*	*
^{103}Ru	*	1.1 ± 0.7(1)	1.1 ± 1.4(0)	3.1 ± 3.9(-1)	*	*
^{106}Ru	*	>7.9(0)	*	>2.8(-1)	*	>1.2(0)
^{110m}Ag	1.0 ± 0.2(0)	1.0 ± 0.2(0)	8.3 ± 0.5(-1)	8.0 ± 3.0(-1)	*	4.7 ± 0.8(-1)
^{124}Sb	*	>2.0(0)	5.5 ± 1.9(0)	>3.6(-1)	*	<8.5(-1)
^{125}Sb	*	>1.4(-1)	2.8 ± 0.8(0)	>5.3(-1)	*	<1.0(0)
^{140}La	*	*	>1.1(0)	*	*	>3.7(-1)
^{141}Ce	*	*	*	*	*	*
^{144}Ce	<1.4(0)	*	*	*	*	*

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* - Radionuclide not detected.

TABLE 4.6 (cont'd)

DF's FOR BAE CONDENSATE DEMINERALIZER FILTER

Nuclide	5/4/78	5/9/78	5/11/78	5/15/78	5/17/78
^{131}I	9.4 ± 1.1(-1)	1.3 ± 0.5(0)	1.2 ± 0.3(0)	1.2 ± 0.5(-1)	5.4 ± 1.3(0)
^{134}Cs	2.1 ± 0.1(0)	7.8 ± 1.9(-2)	6.9 ± 3.5(-1)	4.4 ± 1.9(-1)	1.5 ± 0.8(0)
^{136}Cs	*	*	*	*	*
^{137}Cs	2.4 ± 0.2(0)	9.7 ± 8.2(0)	6.7 ± 5.7(-1)	4.3 ± 3.1(0)	1.1 ± 1.1(1)
^{51}Cr	*	>3.4(0)	>2.6(0)	*	*
^{54}Mn	>1.3(0)	<1.7(0)	1.8 ± 0.4(0)	1.1 ± 0.6(0)	5.0 ± 4.2(-1)
^{59}Fe	*	>1.5(-1)	*	*	*
^{57}Co	*	*	*	*	*
^{58}Co	7.8 ± 0.5(-1)	1.8 ± 0.2(1)	1.8 ± 0.7(0)	9.0 ± 0.8(-1)	6.6 ± 3.5(-1)
^{60}Co	1.42 ± 0.05(0)	2.1 ± 0.9(1)	6.1 ± 5.1(-1)	2.0 ± 0.7(0)	2.3 ± 1.0(0)
^{65}Zn	*	*	*	*	*
^{95}Zr	>1.5(0)	>8.7(-1)	<1.7(1)	>3.6(-2)	*
^{95}Nb	8.9 ± 7.3(-1)	8.1 ± 6.5(-1)	6.4 ± 2.1(0)	<1.4(1)	7.4 ± 3.0(0)
^{99}Mo	>7.6(-1)	*	>3.7(-2)	*	>1.7(-1)
^{103}Ru	*	>2.3(-1)	<1.5(1)	*	<2.4(1)
^{106}Ru	<1.6(-1)	*	*	*	*
^{110m}Ag	7.1 ± 1.7(-1)	6.9 ± 1.7(0)	8.1 ± 2.0(-1)	4.8 ± 1.5(0)	1.2 ± 0.3(0)
^{124}Sb	>3.7(0)	>9.3(-1)	6.0 ± 2.5(-1)	1.1 ± 1.0(0)	6.5 ± 4.5(-1)
^{125}Sb	1.0 ± 0.1(0)	2.4 ± 0.3(0)	5.3 ± 1.9(0)	3.5 ± 1.3(0)	1.1 ± 0.3(0)
^{140}La	*	*	<4.8(0)	*	*
^{141}Ce	*	*	*	*	*
^{144}Ce	*	*	>6.2(-2)	*	*

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* - Radionuclide not detected.

TABLE 4.7

BORIC ACID RECOVERY SYSTEM WITH BASE CATION DEMIN. C
MEAN RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's

	Base Cation Demin. C (Cation Resin)				
	Inlet Concentration (μCi/ml)		Outlet Concentration (μCi/ml)		"Best Value"
Nuclide	Mean	Range	Mean	Range	DF
^{131}I	3.3(-3)	0.010-1.00(-2)	2.1(-3)	0.136-5.2(-3)	1.6(0)
^{134}Cs	9.0(-4)	0.031-2.16(-3)	<1(-6)		>9(2)
^{137}Cs	1.5(-3)	0.0046-3.24(-3)	<5.2(-6)		>2.8(2)
^{51}Cr	3.5(-4)	0.019-8.2(-4)	2.7(-4)	0.30-5.0(-4)	1.3(0)
^{54}Mn	9.7(-4)	0.0058-2.57(-3)	2.7(-5)	0.039-1.13(-4)	3.6(1)
^{59}Fe	1.05(-4)	0.0010-2.5(-4)	6.2(-5)	0.025-1.44(-4)	1.7(0)
^{57}Co	3.5(-5)	0.04-9.1(-5)	3.1(-6)	0.39-7.8(-6)	1.2(1)
^{58}Co	2.0(-2)	0.0074-4.29(-2)	8.3(-4)	0.125-2.5(-3)	2.4(1)
^{60}Co	4.6(-3)	0.0073-1.35(-2)	2.4(-4)	0.476-7.3(-4)	1.9(1)
^{65}Zn	2.2(-5)	<9(-7)-5.1(-5)	6.2(-6)	0.09-1.7(-5)	3.5(0)
^{95}Zr	4.3(-5)	0.032-1.15(-4)	3.3(-5)	0.54-6.9(-5)	1.3(0)
^{95}Nb	7.3(-5)	0.048-2.02(-4)	5.8(-5)	0.14-1.23(-4)	1.2(0)
^{99}Mo	1.7(-4)	0.012-6.13(-4)	7.4(-5)	0.0067-2.12(-4)	2.3(0)
^{103}Ru	9.2(-6)	0.09-3.45(-5)	2.2(-5)	0.21-4.18(-5)	4(-1)
^{106}Ru	1.1(-5)	0.7-3.7(-5)	3.0(-5)	<0.02-5.7(-5)	4(-1)
^{110m}Ag	1.5(-4)	0.024-<5.8(-4)	1.7(-5)	0.46-6.0(-5)	9(0)
^{124}Sb	2.4(-4)	0.081-6.2(-4)	2.2(-4)	0.099-5.5(-4)	1.1(0)
^{125}Sb	3.1(-4)	0.014-1.06(-3)	2.7(-4)	0.154-7.39(-4)	1.1(0)
^{140}La	1.2(-4)	0.026-3.77(-4)	2.9(-5)	0.035-1.10(-4)	4.2(0)
^{141}Ce	2.9(-6)	<0.62-7.4(-6)	1.4(-6)	0.39-1.7(-6)	2.1(0)
^{144}Ce	2(-6)	***	4.9(-6)	<0.024-1.3(-5)	4(-1)

*** Radionuclide detected in one measurement only.

TABLE 4.7 (cont'd)

BORIC ACID RECOVERY SYSTEM WITH BASE CATION DEMIN. C
MEAN RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's

Boric Acid Evaporator

Nuclide	Feed Concentration (μCi/ml) Mean	Range	Distillate Concentration (μCi/ml) Mean	Range	"Best Value" DF
^{131}I	2.1(-3)	0.136-5.2(-3)	4.2(-5)	0.075-1.64(-4)	5.0(1)
^{134}Cs	<1(-6)		9.6(-8)	0.057-2.0(-7)	<1(1)
^{137}Cs	<5.2(-6)		4.7(-8)	1.5-6.7(-8)	<1.1(2)
^{51}Cr	2.7(-4)	0.30-5.0(-4)	2.2(-7)	<0.037-2.8(-7)	1.2(3)
^{54}Mn	2.7(-5)	0.039-1.13(-4)	1.3(-7)	0.114-5.9(-7)	2.0(2)
^{59}Fe	6.2(-5)	0.025-1.44(-4)	2.5(-7)	0.046-1.26(-6)	2.5(2)
^{57}Co	3.1(-6)	0.39-7.8(-6)	<8.4(-8)		>3.6(1)
^{58}Co	8.3(-4)	0.125-2.5(-3)	1.1(-6)	0.083-3.86(-6)	7.8(2)
^{60}Co	2.4(-4)	0.476-7.3(-4)	7.9(-7)	0.12-2.9(-6)	3.1(2)
^{65}Zn	6.2(-6)	0.09-1.7(-5)	<1.1(-7)		>5.5(1)
^{95}Zr	3.3(-5)	0.54-6.9(-5)	9.4(-8)	0.07-3(-7)	3.5(2)
^{95}Nb	5.8(-5)	0.14-1.23(-4)	1.15(-7)	0.21-2.6(-7)	5.1(2)
^{99}Mo	7.4(-5)	0.0067-2.12(-4)	3.7(-7)	0.0025-2.1(-6)	2.0(2)
^{103}Ru	2.2(-5)	0.21-4.18(-5)	3.9(-8)	0.76-6.4(-8)	5.6(2)
^{106}Ru	3.0(-5)	<0.02-5.7(-5)	3.8(-7)	<0.0017-1.2(-6)	8.1(1)
^{110m}Ag	1.7(-5)	0.46-6.0(-5)	2.4(-7)	0.42-6(-7)	7.2(1)
^{124}Sb	2.2(-4)	0.099-5.5(-4)	2.8(-7)	0.02-1.3(-6)	7.8(2)
^{125}Sb	2.7(-4)	0.154-7.39(-4)	3.9(-7)	0.069-1.4(-6)	6.9(2)
^{140}La	2.9(-5)	0.035-1.10(-4)	4.3(-8)	<0.10-9.6(-8)	6.7(2)
^{141}Ce	1.3(-6)	0.39-1.7(-6)	<1.1(-7)		>1.2(1)
^{144}Ce	4.9(-6)	<0.024-1.3(-5)	2.0(-7)	<0.064-7(-7)	2.4(1)

TABLE 4.7 (cont'd)

BORIC ACID RECOVERY SYSTEM WITH BASE CATION DEMIN. C
MEAN RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's

Condensate Demineralizer

	Inlet Concentration (μCi/ml)		Outlet Concentration (μCi/ml)		"Best Value"
Nuclide	Mean	Range	Mean	Range	DF
^{131}I	4.2(-5)	0.075-1.64(-4)	4.2(-6)	0.021-1.40(-5)	1.0(1)
^{134}Cs	9.3(-8)	0.057-2.0(-7)	1.0(-7)	0.30-2.1(-7)	9(-1)
^{137}Cs	4.7(-8)	1.5-6.7(-8)	2.2(-7)	0.50-4.9(-7)	2(-1)
^{51}Cr	2.2(-7)	<0.037-2.8(-7)	2.2(-7)	0.40-6(-7)	1.0(0)
^{54}Mn	1.3(-7)	0.114-5.9(-7)	6.8(-8)	<0.12-1.38(-7)	1.9(0)
^{59}Fe	2.5(-7)	0.046-1.26(-6)	4.3(-8)	0.11-1.0(-7)	5.7(0)
^{57}Co	<8.4(-8)		<5.8(-8)		
^{58}Co	1.1(-6)	0.083-3.86(-6)	1.2(-6)	0.35-4.8(-6)	9(-1)
^{60}Co	7.9(-7)	0.12-2.9(-6)	2.9(-7)	0.88-9.9(-7)	2.7(0)
^{95}Zr	9.4(-8)	0.07-3(-7)	4.1(-8)	0.5-5.5(-8)	2.3(0)
^{95}Nb	1.1(-7)	0.21-2.6(-7)	2.9(-8)	<0.11-<1.1(-7)	4.0(0)
^{99}Mo	3.7(-7)	0.0025-2.1(-6)	2.8(-8)	0.39-4.8(-8)	1.3(1)
^{103}Ru	3.9(-8)	0.76-6.4(-8)	3.6(-8)	0.38-9.0(-8)	1.1(0)
^{106}Ru	3.8(-7)	<0.0017-1.2(-6)	1.4(-7)	0.19-3.8(-7)	2.7(0)
^{110m}Ag	2.4(-7)	0.42-6(-7)	2.5(-7)	0.21-5.4(-7)	1.0(0)
^{124}Sb	2.8(-7)	0.02-1.3(-6)	4.1(-8)	1.7-8.6(-8)	7.0(0)
^{125}Sb	3.9(-7)	0.069-1.4(-6)	4.3(-8)	0.59-6.9(-8)	9.1(0)
^{140}La	4.3(-8)	<0.10-9.6(-8)	5.7(-8)	0.021-<5.2(-7)	7.5(-1)
^{141}Ce	<1.1(-7)		<4.9(-8)		
^{144}Ce	2.0(-7)	<0.064-7(-7)	<4.2(-8)		>4.9(0)

TABLE 4.7 (cont'd)

BORIC ACID RECOVERY SYSTEM WITH BASE CATION DEMIN. C
MEAN RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's

Condensate Demineralizer Filter

Nuclide	Inlet Concentration (μCi/ml) Mean	Inlet Concentration (μCi/ml) Range	Outlet Concentration (μCi/ml) Mean	Outlet Concentration (μCi/ml) Range	"Best Value" DF
^{131}I	4.2(-6)	0.021-1.40(-5)	4.0(-6)	0.0216-1.28(-5)	1.0(0)
^{134}Cs	1.0(-7)	0.30-2.1(-7)	5.8(-8)	2.2-8.7(-8)	1.8(0)
^{137}Cs	2.2(-7)	0.50-4.9(-7)	1.6(-7)	0.61-2.9(-7)	1.4(0)
^{51}Cr	2.2(-7)	0.40-6(-7)	5.7(-8)	0.059-<3.9(-7)	3.9(0)
^{54}Mn	6.8(-8)	<0.12-1.38(-7)	3.3(-8)	0.47-5.3(-8)	2.0(0)
^{59}Fe	4.3(-8)	0.11-1.0(-7)	5.5(-8)	0.027-1.7(-7)	8(-1)
^{57}Co	<5.8(-8)		2.2(-8)	0.088-3(-8)	<2.6(0)
^{58}Co	1.2(-6)	0.35-4.8(-6)	1.3(-6)	0.099-5.44(-6)	9(-1)
^{60}Co	2.9(-7)	0.88-9.9(-7)	5.8(-7)	0.063-1.8(-6)	5(-1)
^{65}Zr	4.1(-8)	0.5-5.5(-8)	2.5(-8)	<0.25-<9.8(-8)	1.6(0)
^{95}Nb	2.9(-8)	<0.11-<1.1(-7)	2.7(-8)	0.041-<1.1(-7)	1.1(0)
^{99}Mo	2.8(-8)	0.39-4.8(-8)	<4.1(-8)		>7(-1)
^{103}Ru	3.6(-8)	0.38-9.0(-8)	2.9(-8)	0.033-1.11(-7)	1.2(0)
^{106}Ru	1.4(-7)	0.19-3.8(-7)	<7.6(-7)		>2(-1)
^{110m}Ag	2.5(-7)	0.21-5.4(-7)	2.6(-7)	0.45-5.2(-7)	1.0(0)
^{124}Sb	4.1(-8)	1.7-8.6(-8)	2.3(-8)	0.31-<8.2(-8)	1.8(0)
^{125}Sb	4.3(-8)	0.59-6.9(-8)	3.6(-8)	0.085-<1.2(-7)	1.2(0)
^{140}La	5.7(-8)	0.021-<5.2(-7)	<4.0(-8)		>1.4(0)
^{141}Ce	<4.9(-8)		<4.7(-8)		
^{144}Ce	<4.2(-8)		5.5(-8)	***	<7(-1)

*** Radionuclide detected in one measurement only.

TABLE 4.8

BORIC ACID RECOVERY SYSTEM WITH BASE CATION DEMIN. A
MEAN RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's

	Base Cation Demin. A (Mixed-Bed Resin)				
	Inlet Concentration (μCi/ml)		Outlet Concentration (μCi/ml)		"Best Value"
Nuclide	Mean	Range	Mean	Range	DF
^{131}I	7.0(-5)	0.21-1.85(-4)	2.9(-6)	0.70-6.9(-6)	2.4(1)
^{134}Cs	1.2(-4)	0.297-2.26(-4)	1.1(-6)	0.85-1.8(-6)	1.0(2)
^{137}Cs	1.8(-4)	0.42-3.59(-4)	3.4(-6)	2.3-5.7(-6)	5.4(1)
^{51}Cr	2.2(-5)	1.0-3.4(-5)	1.3(-5)	0.42-2.5(-5)	1.7(0)
^{54}Mn	1.2(-5)	0.68-1.95(-5)	3.8(-6)	1.7-7.2(-6)	3.0(0)
^{59}Fe	2.8(-6)	0.77-3.7(-6)	1.5(-6)	0.56-2.5(-6)	1.9(0)
^{57}Co	6.2(-7)	0.25-1.0(-6)	3.4(-7)	1.4-6.2(-7)	1.8(0)
^{58}Co	1.7(-4)	0.427-2.51(-4)	5.8(-5)	0.20-1.0(-4)	2.9(0)
^{60}Co	1.1(-4)	0.50-2.03(-4)	3.7(-5)	2.28-7.7(-5)	2.9(0)
^{65}Zn	6(-7)	***	5.3(-7)	3.7-8.1(-7)	1.0(0)
^{95}Zr	5.8(-6)	4.1-8.6(-6)	2.4(-6)	1.6-3.3(-6)	2.4(0)
^{95}Nb	9.8(-6)	0.66-1.63(-5)	4.5(-6)	3.1-6.1(-6)	2.2(0)
^{99}Mo	7.6(-7)	<0.33-2.7(-6)	1.6(-7)	<0.63-4.9(-7)	4.7(0)
^{103}Ru	1.6(-6)	0.8-2.6(-6)	7.8(-7)	0.65-1.09(-6)	2.0(0)
^{106}Ru	3.9(-6)	0.092-1.4(-5)	3.2(-6)	<0.61-6.1(-6)	1.2(0)
^{110m}Ag	4.3(-6)	1.8-6.4(-6)	1.7(-6)	1.2-2.27(-6)	2.6(0)
^{124}Sb	7.6(-6)	0.15-1.2(-5)	1.2(-6)	0.4-1.9(-6)	6.4(0)
^{125}Sb	1.5(-5)	0.46-3.3(-5)	1.7(-6)	0.8-3.6(-6)	8.5(0)
^{140}La	2.8(-6)	0.18-9.2(-6)	1.1(-6)	0.73-2.26(-6)	2.5(0)
^{141}Ce	4.4(-7)	<0.36-1.0(-6)	3.3(-7)	0.11-1.2(-6)	1.3(0)
^{144}Ce	2.0(-6)	<0.83-4.6(-6)	2.0(-6)	<0.37-4.3(-6)	1.0(0)

*** Radionuclide detected in one measurement only.

TABLE 4.8 (cont'd)

BORIC ACID RECOVERY SYSTEM WITH BASE CATION DEMIN. A
MEAN RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's

Boric Acid Evaporator

Nuclide	Feed Concentration (μCi/ml) Mean	Feed Concentration (μCi/ml) Range	Distillate Concentration (μCi/ml) Mean	Distillate Concentration (μCi/ml) Range	"Best Value" DF
^{131}I	2.9(-6)	0.70-6.9(-6)	2.9(-6)	0.26-9.0(-6)	1.0(0)
^{134}Cs	1.1(-6)	0.85-1.8(-6)	7.4(-8)	0.047-1.4(-7)	1.5(1)
^{137}Cs	3.4(-6)	2.3-5.7(-6)	1.1(-7)	0.040-3.1(-7)	3.0(1)
^{51}Cr	1.3(-5)	0.42-2.5(-5)	1.5(-7)	0.54-4.3(-7)	8.7(1)
^{54}Mn	3.8(-6)	1.7-7.2(-6)	1.2(-7)	0.37-2.2(-7)	3.1(1)
^{59}Fe	1.5(-6)	0.56-2.5(-6)	5.6(-8)	0.17-<1.7(-7)	2.7(1)
^{57}Co	3.4(-7)	1.4-6.2(-7)	2.8(-8)	0.019-<1.3(-7)	1.2(1)
^{58}Co	5.8(-5)	0.20-1.0(-4)	2.4(-7)	1.4-3.8(-7)	2.4(2)
^{60}Co	3.7(-5)	2.28-7.7(-5)	3.9(-7)	1.2-8.2(-7)	9.6(1)
^{65}Zn	5.3(-7)	3.7-8.1(-7)	<1.8(-7)		>2.9(0)
^{95}Zr	2.4(-6)	1.6-3.3(-6)	3.8(-8)	2.1-7.5(-8)	6.3(1)
^{95}Nb	4.5(-6)	3.1-6.1(-6)	5.7(-8)	0.33-1.0(-7)	7.9(1)
^{99}Mo	1.6(-7)	<0.63-4.9(-7)	3.8(-8)	0.29-5.2(-8)	4.2(0)
^{103}Ru	7.8(-7)	0.65-1.09(-6)	2.8(-8)	0.069-<1.1(-7)	2.8(1)
^{106}Ru	3.2(-6)	<0.61-6.1(-6)	2.5(-7)	0.57-<8.3(-7)	1.3(1)
^{110m}Ag	1.7(-6)	1.2-2.27(-6)	2.4(-7)	0.39-3.0(-7)	7.0(0)
^{124}Sb	1.2(-6)	0.4-1.9(-6)	2.6(-8)	1.2-3.7(-8)	4.5(1)
^{125}Sb	1.7(-6)	0.8-3.6(-6)	6.3(-8)	4.5-7.7(-8)	2.8(1)
^{140}La	1.1(-6)	0.73-2.26(-6)	4.2(-8)	0.037-<1.3(-7)	2.7(1)
^{141}Ce	3.3(-7)	0.11-1.2(-6)	4.8(-8)	0.079-<1.4(-7)	6.9(0)
^{144}Ce	2.0(-6)	<0.37-4.3(-6)	1.6(-7)	1.1-<6.3(-7)	1.2(1)

TABLE 4.8 (cont'd)

BORIC ACID RECOVERY SYSTEM WITH BASE CATION DEMIN. A
MEAN RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's

Condensate Demineralizer

Nuclide	Inlet Concentration (μCi/ml) Mean	Inlet Concentration (μCi/ml) Range	Outlet Concentration (μCi/ml) Mean	Outlet Concentration (μCi/ml) Range	"Best Value" DF
^{131}I	2.9(-6)	0.26-9.0(-6)	2.3(-7)	0.085-6.7(-7)	1.3(1)
^{134}Cs	7.4(-8)	0.047-1.4(-7)	6.2(-8)	0.059-1.1(-7)	1.2(0)
^{137}Cs	1.1(-7)	0.040-3.1(-7)	9.8(-8)	0.32-2.2(-7)	1.2(0)
^{51}Cr	1.5(-7)	0.54-4.3(-7)	1.4(-7)	<0.39-<6.9(-7)	1.0(0)
^{54}Mn	1.2(-7)	0.37-2.2(-7)	3.2(-8)	0.54-6.7(-8)	3.9(0)
^{59}Fe	5.6(-8)	0.17-<1.7(-7)	5.0(-8)	0.14-<2.6(-7)	1.1(0)
^{57}Co	2.8(-8)	0.019-<1.3(-7)	<5.2(-8)		>5(-1)
^{58}Co	2.4(-7)	1.4-3.8(-7)	2.6(-7)	0.61-8.5(-7)	9(-1)
^{60}Co	3.9(-7)	1.2-8.2(-7)	1.5(-7)	0.58-4.8(-7)	2.6(0)
^{95}Zr	3.8(-8)	2.1-7.5(-8)	3.6(-8)	0.43-4.6(-8)	1.1(0)
^{95}Nb	5.7(-8)	0.33-1.0(-7)	5.0(-8)	0.76-8.3(-8)	1.1(0)
^{99}Mo	3.8(-8)	0.29-5.2(-8)	1.7(-8)	0.022-<1(-7)	2.2(0)
^{103}Ru	2.8(-8)	0.069-<1.1(-7)	1.8(-8)	<0.49-<6.9(-8)	1.5(0)
^{106}Ru	2.5(-7)	0.57-<8.3(-7)	<3.3(-7)		>8(-1)
^{110m}Ag	2.4(-7)	0.39-3.0(-7)	7.7(-8)	0.18-2.0(-7)	3.2(0)
^{124}Sb	2.6(-8)	1.2-3.7(-8)	1.7(-8)	0.64-4.0(-8)	1.6(0)
^{125}Sb	6.3(-8)	4.5-7.7(-8)	9.6(-8)	0.27-1.8(-7)	7(-1)
^{140}La	4.2(-8)	0.037-<1.3(-7)	<5.3(-8)		>8(-1)
^{141}Ce	4.8(-8)	0.079-<1.4(-7)	<9.0(-8)		>5.3(-1)
^{144}Ce	1.6(-7)	1.1-<6.3(-7)	1.1(-7)	<0.031-<5.9(-7)	1.4(0)

TABLE 4.8 (cont'd)

BORIC ACID RECOVERY SYSTEM WITH BASE CATION DEMIN. A
MEAN RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's

	Condensate Demineralizer Filter				
	Inlet Concentration (μCi/ml)		Outlet Concentration (μCi/ml)		"Best Value"
Nuclide	Mean	Range	Mean	Range	DF
^{131}I	2.3(-7)	0.085-6.7(-7)	2.1(-7)	0.18-7.1(-7)	1.1(0)
^{134}Cs	6.2(-8)	0.059-1.1(-7)	7.3(-8)	0.46-1.0(-7)	9(-1)
^{137}Cs	9.8(-8)	0.32-2.2(-7)	4.1(-8)	0.33-9.3(-8)	2.4(0)
^{51}Cr	1.4(-7)	<0.039-<6.9(-7)	8.7(-8)	<0.043-<4.2(-7)	1.6(0)
^{54}Mn	3.2(-8)	0.54-6.7(-8)	3.1(-8)	<0.4-7.8(-8)	1.0(0)
^{59}Fe	5.0(-8)	0.14-<2.6(-7)	<8.2(-8)		>6(-1)
^{57}Co	<5.2(-8)		<4.9(-8)		
^{58}Co	2.6(-7)	0.61-8.5(-7)	9.3(-8)	0.48-1.4(-7)	2.8(0)
^{60}Co	1.5(-7)	0.58-4.8(-7)	4.9(-8)	2.3-9.8(-8)	3.1(0)
^{95}Zr	3.6(-8)	0.43-4.6(-8)	3.0(-8)	0.057-<1.2(-7)	1.2(0)
^{95}Nb	5.0(-8)	0.76-8.3(-8)	2.7(-8)	0.044-1.0(-7)	1.9(0)
^{99}Mo	1.7(-8)	0.022-<1(-7)	<5.7(-8)		>3(-1)
^{103}Ru	1.8(-8)	<0.49-<6.9(-8)	1.1(-8)	0.29-<5.3(-8)	1.6(0)
^{106}Ru	<3.3(-7)		1.6(-7)	0.37-<6.7(-7)	<2.1(0)
^{110m}Ag	7.7(-8)	0.18-2.0(-7)	2.8(-8)	1.5-4.1(-8)	2.7(0)
^{124}Sb	1.7(-8)	0.64-4.0(-8)	1.0(-8)	0.57-1.2(-8)	1.6(0)
^{125}Sb	9.6(-8)	0.27-1.8(-7)	3.8(-8)	2.5-6.1(-8)	2.5(0)
^{140}La	<5.3(-8)		1.8(-8)	<0.56-<7.6(-8)	<2.9(0)
^{141}Ce	<9.0(-8)		<6.8(-8)		
^{144}Ce	1.1(-7)	<0.031-<5.9(-7)	<3.0(-7)		>4(-1)

AVERAGE CONCENTRATION µCi/ml

^{131}I	^{134}Cs	^{137}Cs	^{58}Co	^{60}Co
3.3×10^{-3}	9.0×10^{-4}	1.5×10^{-3}	2.0×10^{-2}	4.6×10^{-3}
DF = 1.6	>900	>280	24	19
2.1×10^{-3}	$<1 \times 10^{-6}$	$<5.2 \times 10^{-6}$	8.3×10^{-4}	2.4×10^{-4}
DF = 50	---	---	780	310
4.2×10^{-5}	9.6×10^{-8}	4.7×10^{-8}	1.1×10^{-6}	7.9×10^{-7}
DF = 10	0.9	0.2	0.9	2.7
4.2×10^{-6}	1.0×10^{-7}	2.2×10^{-7}	1.2×10^{-6}	2.9×10^{-7}
DF = 1.0	1.8	1.4	0.9	0.5
4.0×10^{-6}	5.8×10^{-8}	1.6×10^{-7}	1.3×10^{-6}	5.8×10^{-7}

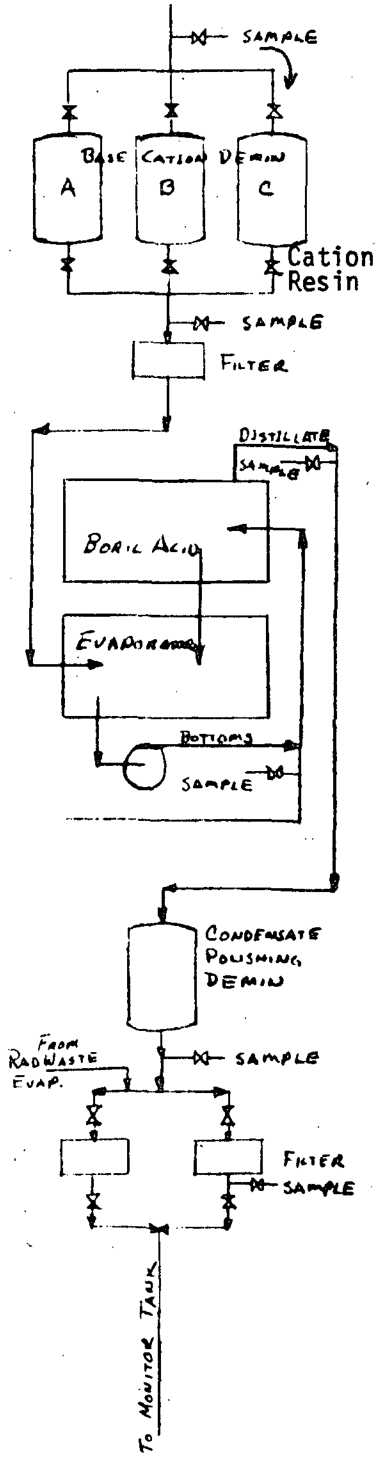
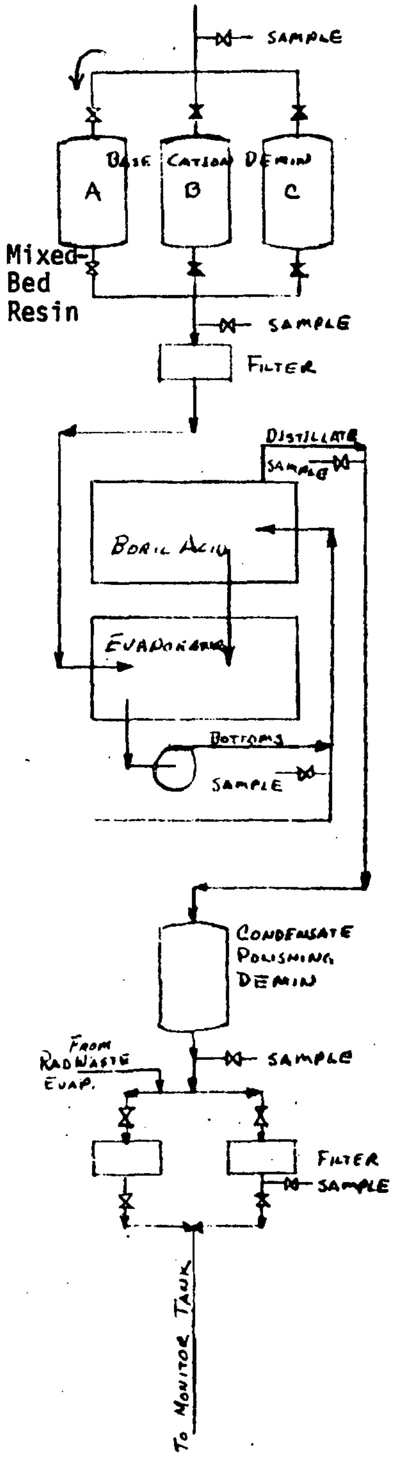


FIGURE 4.7

BORIC ACID RECOVERY SYSTEM
AVERAGE CONCENTRATIONS AND "BEST VALUE" DF's
FOR OPERATION WITH BASE CATION DEMINERALIZER C IN SERVICE

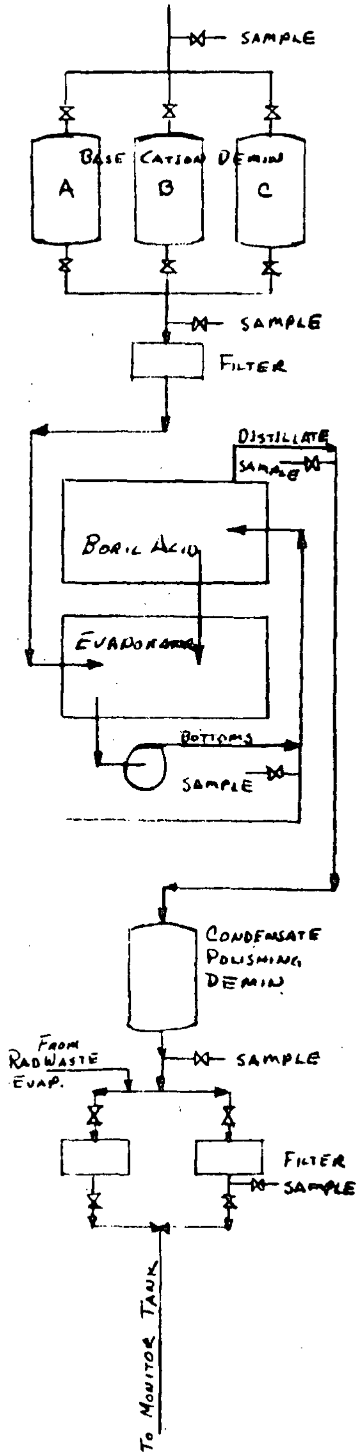


AVERAGE CONCENTRATION µCi/ml

^{131}I	^{134}Cs	^{137}Cs	^{58}Co	^{60}Co
7.0×10^{-5}	1.2×10^{-4}	1.8×10^{-4}	1.7×10^{-4}	1.1×10^{-4}
DF = 24	100	54	2.9	2.9
2.9×10^{-6}	1.1×10^{-6}	3.4×10^{-6}	5.8×10^{-5}	3.7×10^{-5}
DF = 1.0	15	30	240	96
2.9×10^{-6}	7.4×10^{-8}	1.1×10^{-7}	2.4×10^{-7}	3.9×10^{-7}
DF = 13	1.2	1.2	0.9	2.6
2.3×10^{-7}	6.2×10^{-8}	9.8×10^{-8}	2.6×10^{-7}	1.5×10^{-7}
DF = 1.1	0.9	2.4	2.8	3.1
2.1×10^{-7}	7.3×10^{-8}	4.1×10^{-8}	9.3×10^{-8}	4.9×10^{-8}

FIGURE 4.8

BORIC ACID RECOVERY SYSTEM
AVERAGE CONCENTRATIONS AND "BEST VALUE" DF's
FOR OPERATION WITH BASE CATION DEMINERALIZER A IN SERVICE



AVERAGE CONCENTRATION µCi/ml

^{131}I	^{134}Cs	^{137}Cs	^{58}Co	^{60}Co
2.4×10^{-5}	1.0×10^{-7}	9×10^{-8}	6.9×10^{-7}	6.1×10^{-7}
DF = 670	260	990	5070	2790
1.6×10^{-2}	2.6×10^{-5}	8.9×10^{-5}	3.5×10^{-3}	1.7×10^{-3}

FIGURE 4.9

BORIC ACID EVAPORATOR
AVERAGE CONCENTRATIONS AND RATIOS OF
BOTTOMS TO DISTILLATE ACTIVITIES

radionuclides. Figure 4.10 shows plots of the DF's for ^{131}I and ^{137}Cs vs. inlet concentration on log-log graph paper. The functional form of the expression can be approximated by

$$DF = a\ C^b$$

where

DF = decontamination factor

a = constant

C = inlet activity concentration ($\mu Ci/ml$)

b = slope of line

For this case the value of b is near 1 (one). Because of this apparent dependence of DF on inlet concentration, the "best value" DF's represent average DF's obtained within the observed range of inlet concentrations. They, therefore, are valid only in this range of inlet concentrations.

The base cation demineralizer C when charged with a cation resin did not show this correlation, for two reasons. (1) Iodine was not taken out at all, and (2) Cs was taken out so well that almost all of the DF's measured were lower limit values.

The evaporator data were examined in detail to see if the same type of correlation with feed and DF could be found. There were essentially two effects observed. The first was a correlation between the DF for the crud-associated radionuclides $^{57-60}Co$ and the feed concentration to the evaporator. This correlation is shown in Figure 4.11. Data for the radwaste evaporator (see Section 4.3) and three other evaporator types at two other nuclear power plants (2,3) are included. The functional form of the expression is essentially the same as that found for the mixed-bed demineralizer with essentially the same slope (i.e., about 1). Since DF is defined as feed concentration divided by distillate concentration, a slope of 1 implies that the distillate concentration is constant (i.e., independent of the feed concentration). Therefore, the DF of the evaporator for particulate type activity will depend upon the feed concentration.

The second effect was a correlation between the bottoms concentration and the distillate concentration of ^{131}I. This correlation is shown in Figure 4.12 and includes data from the radwaste evaporator (see Section 4.3). This correlation is important since it shows how iodine spiking in the coolant can be transmitted through the processing stream and radwaste system and affect the discharge to the environment. That is, the iodine concentration in the distillate will not increase until the bottoms concentration increases. Since feed concentrations are normally orders of magnitude lower than bottoms concentrations, an iodine spike will be attenuated and delayed in time by the evaporator. The non-volatile radionuclides, i.e., the cesiums and the cobalts, did not show this correlation in the BAE. In the radwaste evaporator (see section

Figure 4.10

Correlation Between ^{131}I DF and Inlet Concentration for Base Cation Demineralizer A (Mixed-Bed Resin)

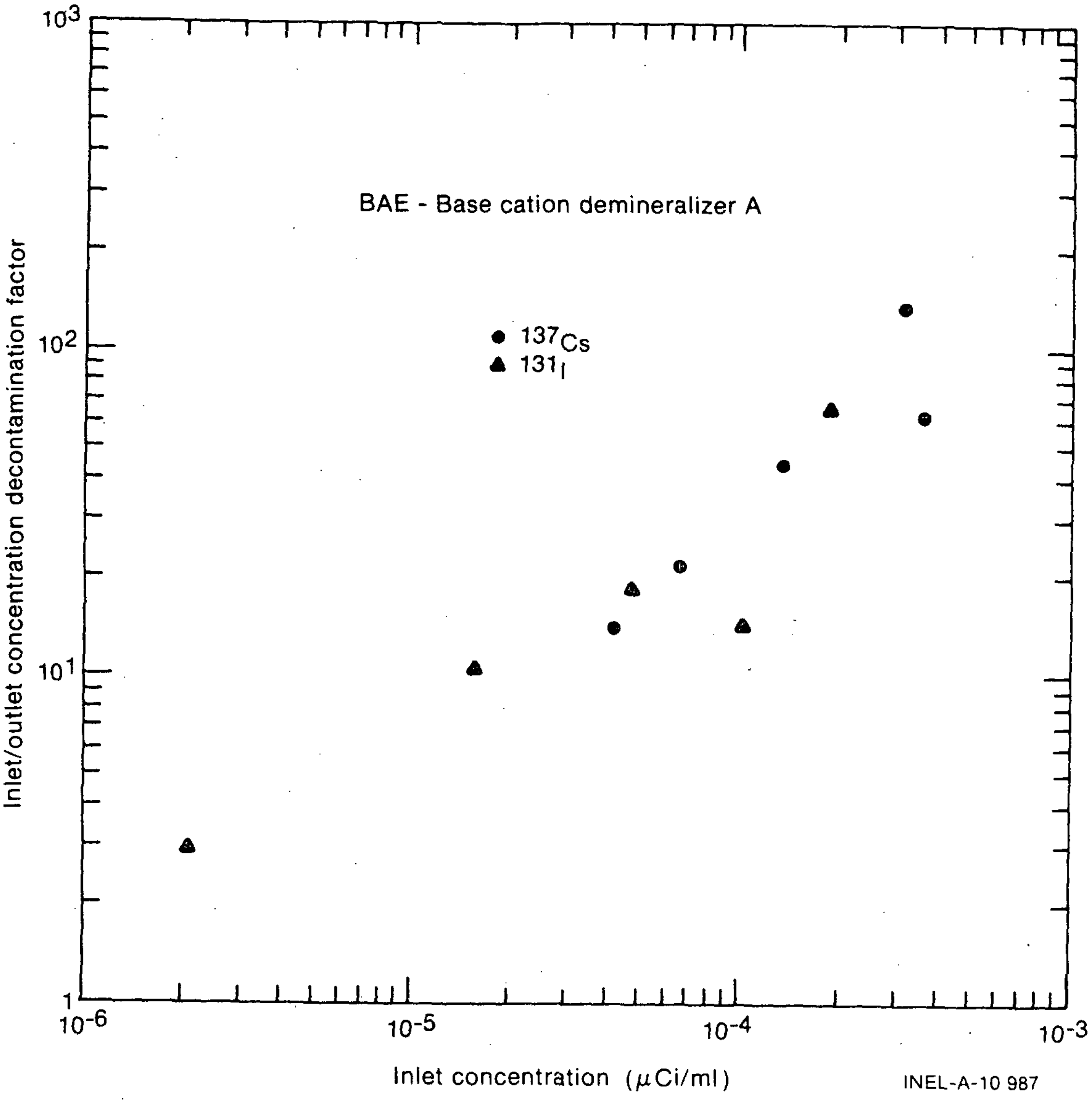


Figure 4.11

Correlation Between ^{58}Co and ^{60}Co DF and Feed Concentration for Boric Acid Evaporator

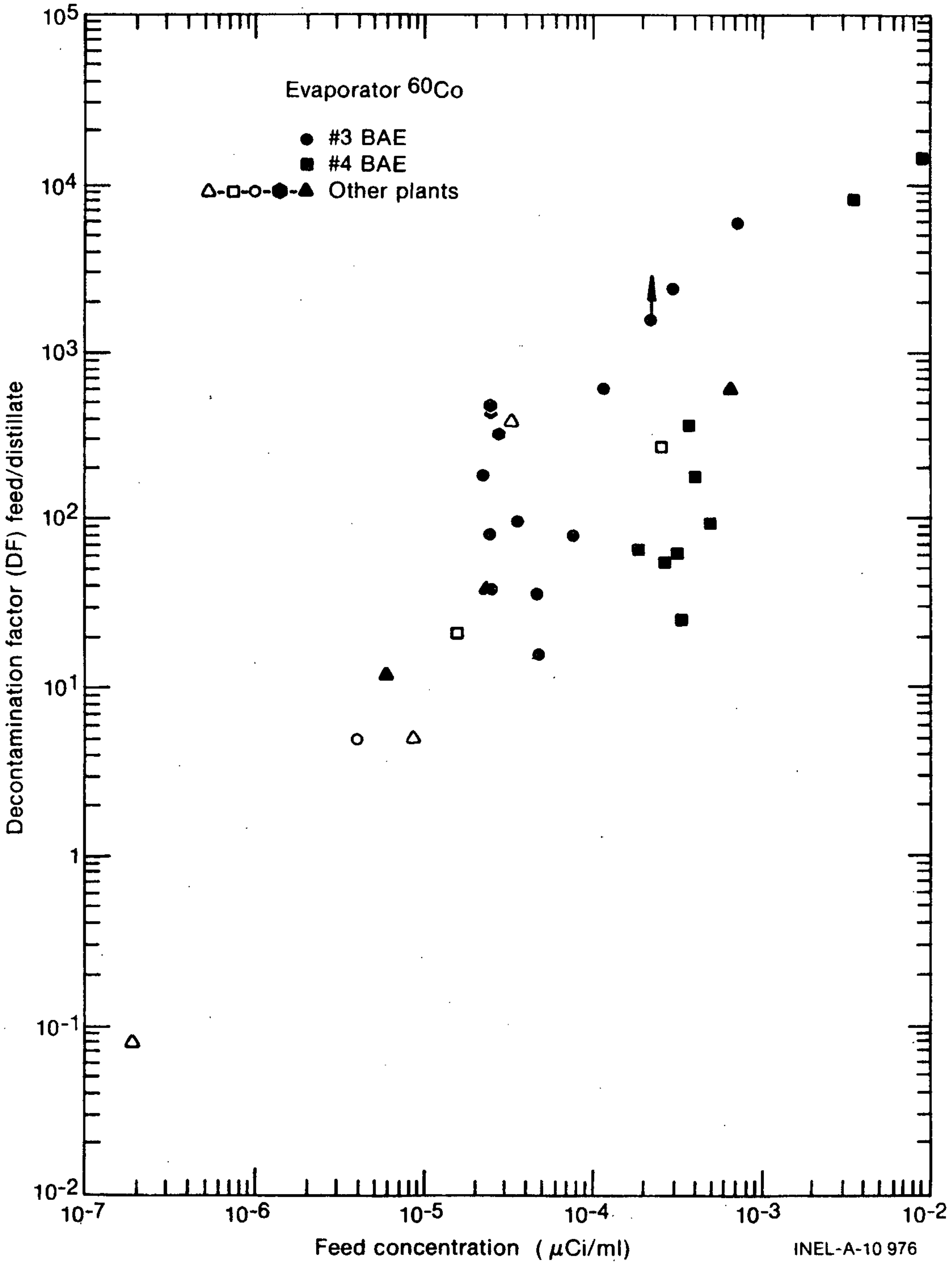
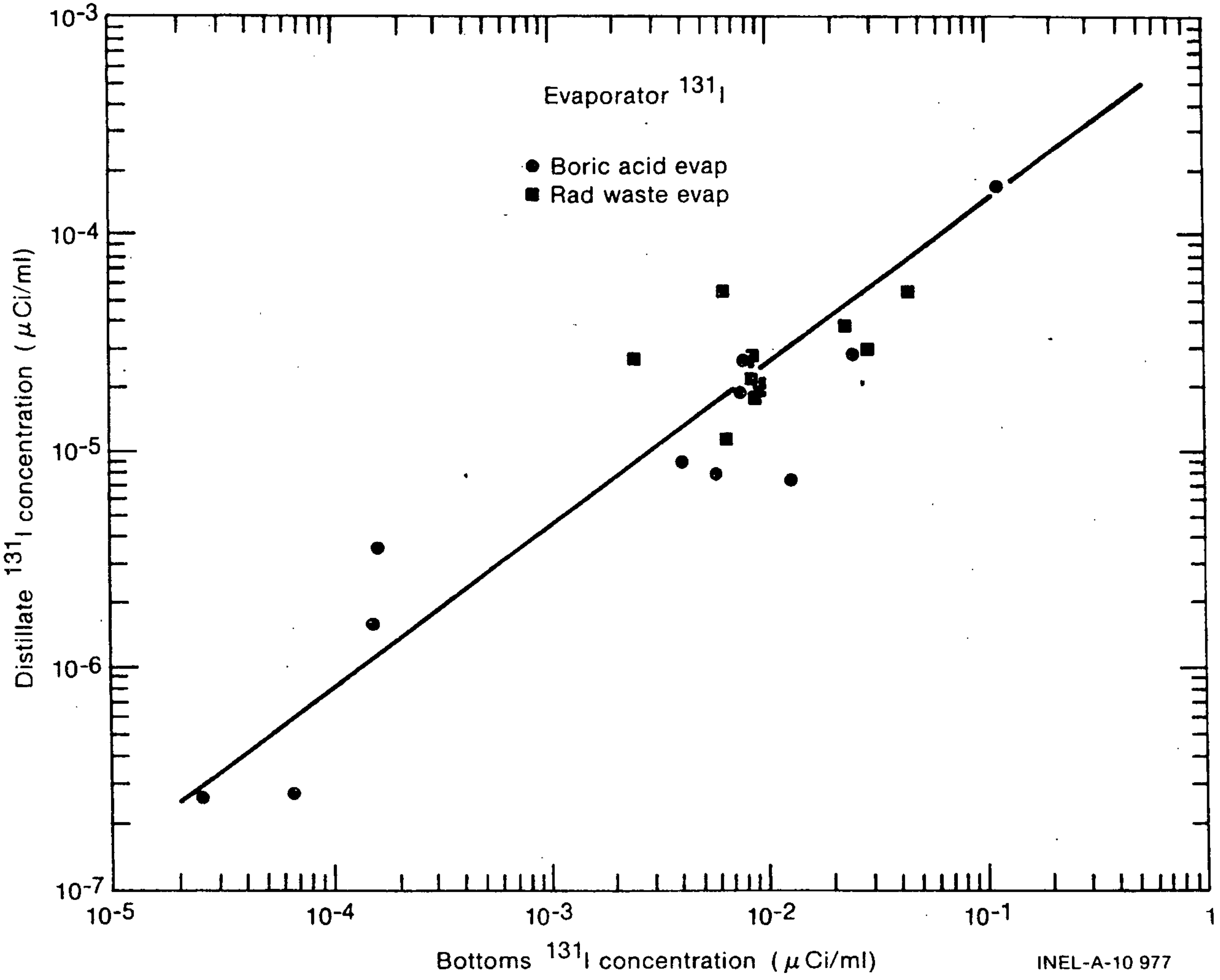


Figure 4.12

Correlation Between ^{131}I Concentration in BAE Distillate and Bottoms



4.3.2) the reverse trend (i.e., concentrations of cesiums and cobalts in the distillate decreased as concentrations in the feed increased) was observed.

4.3 Discussion of Measurement Data - Liquid Radwaste System

4.3.1 Introduction

During the measurement period at Turkey Point, two different systems were used to process liquid radwaste. Prior to April 1978 the radwaste evaporator was used exclusively. Beginning in April the new filter-demineralizer system underwent testing and the evaporator was used infrequently. Both radwaste systems were studied. Prime emphasis, however, was placed on the radwaste evaporator system (including the condensate demineralizer) and 15 sample sets were obtained. Attempts were made to study the filter-demineralizer system being tested, but samples were obtainable only from the tank feeding this system and the monitor tanks at the outlet of the system. Therefore, only average DF's for batches could be obtained.

4.3.2 Radwaste Evaporator

Studies of the radwaste evaporator system spanned the period January-April, 1978, with intensive measurements occurring in January and February. A summary of pertinent chemistry and operating parameters for the sample sets is listed in Table 4.9 and is presented graphically in Figure 4.13. The operational parameters (i.e., temperature, vacuum) remained relatively constant for the measurements. Feed rate ranged from 8 to 14 gpm, the average being approximately 10 gpm.

In general, the conductivity was in the range of 3 to 4 mho except during the period when the feed was shut off prior to dumping of the bottoms. Boron concentration in the bottoms ranged from about 7,000 to 22,000 ppm, but was normally about 15,000 ppm. Boron concentration was high on 2/1/78 and 2/5/78 because the samples were taken shortly before the bottoms were dumped. For the 4/28/78 sample set, the boron concentration was low because the evaporator had been in service a short time (less than 1/2 day) and was processing laundry wastes which would be expected to contain low amounts of boron.

Samples of the radwaste evaporator feed, distillate, and bottoms were obtained during both normal operation and during one period when the feed had been shut off and the bottoms volume was being reduced in preparation for dumping. Measured radionuclide concentration in these samples can be found in Appendix B, Tables B.21-B.24. The means and ranges for these data are given in Table 4.10. Examination of the ranges indicates that for all radionuclides detected, except ^{110m}Ag, the range in distillate activities is much smaller (factors of 1.7 to 38) than the range in feed activities. Similarly in most cases the range in bottoms activities is also smaller (factors of 1.9 to 11) than the range in feed activities. The feed-to-distillate DF's (see Table 4.11) show these range differences, i.e., the DF's are not constant but exhibit variations of up to several orders of magnitude for some radionuclides.

TABLE 4.9

RADWASTE EVAPORATOR OPERATING PARAMETERS

Date; Time	Feed Tank Temp °F	Feed Tank Level inches	Concentrator Temp °F	Vacuum in Evap " Hg	Waste Holdup Tank %	Distillate Level inches	Boron Conc. In Bottoms PPM	Distillate Conductivity µmhos	gal/min
1/5/78; 13:15	160	20	180	25	45	60	10,600	3.7	10
1/6/78; 16:30	160	45	180	25	48	60	14,000	3.9	11
1/8/78; 09:46	160	45	180	24	48.5	60	11,300	2.3	11
1/8/78; 12:35	160	33	180	24	48.5	60	14,400	2.9	9
1/8/78; 13:20	160	32	180	24	49.5	60	14,400	3.1	9
1/8/78; 17:22	160	33	180	24	40	63	14,400	4.0	9
1/10/78; 09:13	180	33	180	25	32	62	14,700	4.0	10
FEED SHUT OFF									
1/10/78; 10:05	160	30	180	25	NA	60		10.1	9
1/10/78; 10:10	160	15	180	24	NA	60		12.8	9
1/10/78; 10:15	160	10	180	24	NA	60		14.0	9
1/11/78; 12:45	160	35	180	25	35	60	14,461	8.0	9
2/1/78; 16:00	160	30	179	24		64	18,600	3.4	10
2/5/78; 10:00		32					22,400	4.8	8
2/18/78; 13:30	167	32	178	23.4	25	58			14
4/28/78; 10:44	155	33	190		20	60	7,110	3.5	12

Figure 4.13

Radwaste Evaporator Operating Parameters

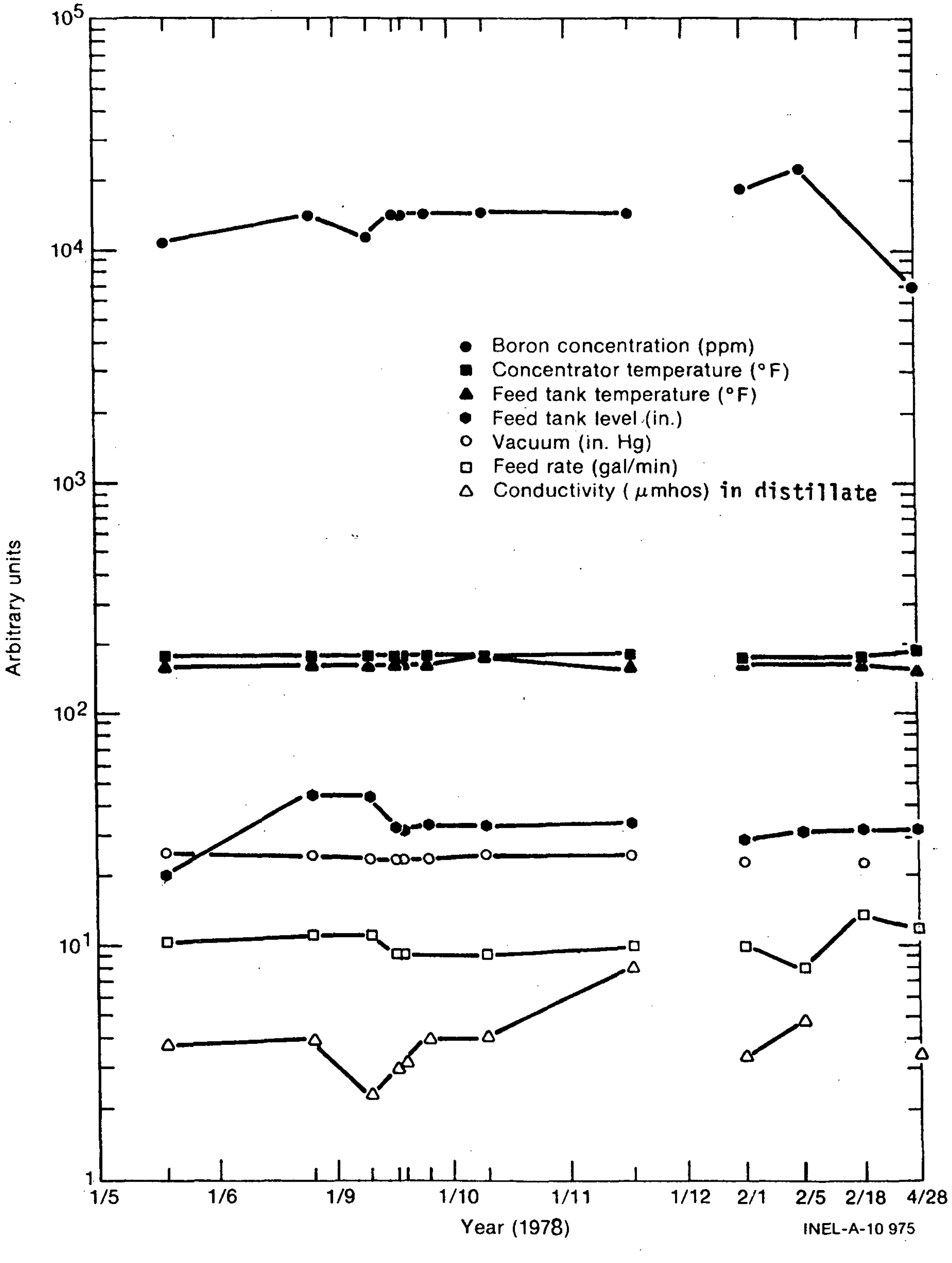


TABLE 4.10

MEANS AND RANGES FOR RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR FEED, DISTILLATE, AND BOTTOMS

	Feed		Bottoms		Distillate	
Nuclide	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{131}I	7.45(-4)	8.0-270(-5)	1.5(-2)	2.5-44(-3)	3.1(-5)	1.1-5.5(-5)
^{132}I	1.0(-5)	4.8-14(-6)	*	*	*	*
^{133}I	4.9(-5)	2.5-264(-6)	3.9(-4)	4.9-190(-5)	1.2(-7)	8.6-240(-8)
^{134}I	1.8(-4)	5.6-550(-6)	4.4(-3)	4.9-2200(-5)	1.4(-6)	4.9-29(-7)
^{135}I	7.8(-5)	5.0-320(-6)	3.3(-4)	5.3-110(-5)	2.3(-7)**	**
^{134}Cs	2.1(-4)	1.1-75(-5)	4.0(-3)	1.9-12(-3)	2.3(-7)	9.6-61(-8)
^{136}Cs	5.5(-6)	1.0-23(-6)	2.1(-4)	1.0-5.4(-4)	1.5(-7)	1.1-1.7(-7)
^{137}Cs	4.0(-4)	2.4-160(-5)	7.5(-3)	3.8-24(-3)	3.5(-7)	6.2-97(-8)
^{138}Cs	1.7(-4)	5.3-820(-6)	1.2(-3)	3.7-530(-5)	*	*
^{24}Na	5.1(-6)	1.7-8.6(-6)	3.2(-5)	1.2-4.9(-5)	*	*
^{51}Cr	1.8(-4)	2.3-71(-5)	9.9(-4)	3.4-33(-4)	2.0(-6)	**
^{54}Mn	9.6(-5)	1.1-47(-5)	1.3(-3)	4.8-38(-4)	4.2(-7)	5.3-92(-8)
^{59}Fe	2.5(-5)	2.8-79(-6)	1.6(-4)	6-36(-5)	2.7(-7)**	**
^{57}Co	1.7(-5)	1.4-96(-6)	1.7(-4)	4.8-36(-5)	1.2(-7)	4.3-17(-8)
^{58}Co	6.7(-3)	4.1-400(-4)	6.9(-2)	9.2-250(-3)	1.3(-5)	1.0-32(-6)
^{60}Co	1.7(-3)	1.8-93(-4)	1.8(-2)	5.9-66(-3)	3.9(-6)	4.2-130(-7)
^{65}Zn	3.0(-5)	3.4-62(-6)	4.0(-4)	7.3-110(-3)	*	*
^{95}Zr	2.9(-5)	2.9-110(-6)	2.2(-4)	9.4-43(-5)	2.4(-7)	4.2-49(-8)
^{95}Nb	4.7(-5)	2.2-150(-6)	1.9(-4)	3.5-62(-5)	4.2(-7)	1.1-9.5(-7)
^{99}Mo	1.5(-5)	3.5-26(-6)	2.3(-4)	4.7-4.2(-5)	*	*
^{103}Ru	2.7(-5)	1.7-120(-6)	1.4(-4)	2.2-50(-5)	1.4(-7)	6.1-21(-8)
^{106}RuD	5.1(-5)	6.2-170(-6)	2.4(-4)**	**	*	*
^{110m}Ag	8.7(-6)	2.9-12(-6)	*	*	3.2(-7)	7.2-75(-8)
^{124}Sb	1.7(-4)	1.0-92(-5)	1.9(-3)	2.3-77(-4)	1.7(-7)	4.0-26(-8)
^{125}Sb	1.8(-4)	1.0-100(-5)	1.7(-3)	3.9-77(-4)	2.4(-7)	1.4-3.6(-7)
^{129m}Te	1.6(-5)	<0.11-4.8(-5)	1.5(-3)	**	3.6(-6)**	**
^{140}La	3.5(-6)	5.6-77(-7)	2.1(-5)	1.0-51(-6)	1.1(-7)**	**

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* Radionuclide not detected.

** Radionuclide detected in one sample only.

TABLE 4.11

DECONTAMINATION FACTORS FOR RADWASTE EVAPORATOR

Nuclide	1/5/78; 13:15	1/6/78; 16:31	1/9/78; 09:46	1/9/78; 12:30	1/9/78; 13:20	1/9/78; 17:15
^{131}I	1.6 ± 0.3	3.1 ± 0.1	25 ± 1	23 ± 1	24 ± 1	15 ± 1
^{132}I	*	*	*	*	>24	*
^{133}I	*	>44	2.4 ± 1.2(2)	1.5 ± 0.6(3)	>2.1(2)	>1(2)
^{134}I	*	4 ± 1	*	*	>19	*
^{135}I	*	>1.2(2)	>65	>150	>50	>83
^{134}Cs	77 ± 3	2.7 ± 1.0(2)	*	>350	>3.3(2)	*
^{136}Cs	14 ± 3	>25	>15	>20	*	*
^{137}Cs	25 ± 79	>445	1.5 ± 0.9(3)	2.0 ± 1.6(3)	1.1 ± 0.6(3)	1.1 ± 0.7(3)
^{138}Cs	*	*	>38	*	*	*
^{24}Na	>16	>23	>21	*	>86	*
^{51}Cr	>4.5(2)	>3.7(2)	*	*	>28	*
^{54}Mn	3.6 ± 3.1(1)	4.5 ± 0.1(1)	50 ± 12	40 ± 6	36 ± 8	39 ± 9
^{59}Fe	>14	>13	*	*	*	*
^{57}Co	>27	5.9 ± 2.8(1)	*	>34	>30	*
^{58}Co	5.0 ± 0.3(1)	5.3 ± 0.3(1)	48 ± 2	59 ± 3	48 ± 1	59 ± 2
^{60}Co	6.4 ± 0.3(1)	56 ± 4	74 ± 6	74 ± 6	58 ± 3	61 ± 6
^{65}Zn	>2.5(2)	>2.8(2)	>1.3(2)	>1.2(2)	>1.1(2)	>1.1(3)
^{95}Zr	3.1 ± 1.0(1)	>30	*	*	>1.8	*
^{95}Nb	5.1 ± 1.1(1)	>47	>16	>11	>34	*
^{103}Ru	*	55 ± 24	>12	>13	*	*
^{103m}Rh	*	55 ± 24	>12	>13	*	*
^{106}Ru	*	*	*	*	*	*
^{106}Rh	*	*	*	*	*	*
^{110m}Ag	*	*	*	*	*	*
^{124}Sb	93 ± 19	>3.4(2)	>3.0(2)	>2.5(2)	>2.8(2)	>250
^{125}Sb	46 ± 17	*	>1.0(2)	>260	>53	*
^{129m}Te	*	*	*	>160	*	*
^{140}La	*	>7	>11	>10	>20	*

TABLE 4.11 (cont'd)

DECONTAMINATION FACTORS FOR RADWASTE EVAPORATOR

Nuclide	1/10/78; 09:13	1/11/78; 12:43	2/1/78; 16:10	2/5/78; 10:40	2/18/78; 13:30	4/28/78; 10:44
^{131}I	13 ± 1	9.7 ± 0.2	90 ± 4	36 ± 2	21.9 ± 0.5	7.0 ± 0.5
^{132}I	*	*	*	*	*	>4.8(2)
^{133}I	>43	1.4 ± 1.1(2)	>1.7(2)	>8.7(2)	1.2 ± 0.1(2)	21 ± 2
^{134}I	>3	>50	*	1.5 ± 0.6(2)	*	*
^{135}I	>17	*	*	*	*	1.5 ± 0.1(2)
^{134}Cs	>4.4(2)	5.6 ± 2.0(2)	>3(3)	>2.0(3)	1.1 ± 0.2(3)	1.1 ± 0.1(2)
^{136}Cs	>15	>10	*	*	2.1 ± 0.6(2)	>11
^{137}Cs	<1(5)	>700	>2.7(3)	*	5.9 ± 0.4(2)	2.1 ± 1.8(3)
^{138}Cs	*	>8	*	*	**	>18
^{3}H	**	0.90 ± 0.04	**	**	**	**
^{14}C	**	1.3 ± 0.2(1)	**	**	**	**
^{24}Na	>12	*	>4	*	*	>78
^{51}Cr	>2.6(2)	>200	>2.4(2)	>1.8(3)	33 ± 6	>40
^{54}Mn	74 ± 17	5.5 ± 3.7(2)	>2.3(3)	2.0 ± 0.7(3)	72 ± 5	61 ± 28
^{55}Fe	**	4.0 ± 0.2(1)	**	**	**	**
^{59}Fe	*	*	>1.3(2)	*	31 ± 9	>14
^{57}Co	30 ± 9	*	>3.2(2)	*	17 ± 1	>28
^{58}Co	71 ± 3	2.3 ± 0.3(2)	4.0 ± 2.4(4)	6.8 ± 0.9(3)	27 ± 1	3.7 ± 0.4(2)
^{60}Co	97 ± 6	3.9 ± 0.5(2)	1.5 ± 1.1(4)	8.6 ± 1.1(2)	26 ± 2	1.8 ± 0.2(2)
^{63}Ni	**	3.3 ± 0.7(2)	**	**	**	**
^{65}Zn	>123	>1.7(2)	>1.0(2)	>1.3(2)	*	*
^{89}Sr	**	>2.8(2)	**	**	**	**
^{90}Sr	**	5.6 ± 1.0(1)	**	**	**	**
^{91}Sr	*	*	*	*	>15	>6
^{91}Y	**	8.0 ± 0.5(1)	**	**	**	**

TABLE 4.11 (cont'd)

DECONTAMINATION FACTORS FOR RADWASTE EVAPORATOR

Nuclide	1/10/78; 09:13	1/11/78; 12:43	2/1/78; 16:10	2/5/78; 10:40	2/18/78; 13:30	4/28/78; 10:44
^{95}Zr	>80	>55	>2.7(2)	>4.1(2)	31 ± 5	2.2 ± 0.5(2)
^{95}Nb	>1.8(2)	>105	>7.5(2)	>6.9(2)	27 ± 4	1.4 ± 0.4(2)
^{103}Ru	>50	>28	>600	*	38 ± 8	>19
^{103m}Rh	>50	>28	>600	*	38 ± 8	>19
^{106}Ru	*	*	*	*	>31	>13
^{106}Rh	*	*	*	*	>31	>13
^{110m}Ag	*	>120	*	*	*	1.5 ± 0.3(2)
^{124}Sb	>3.1(2)	>170	>1.0(3)	*	1.6 ± 0.3(2)	2.5 ± 0.7(2)
^{125}Sb	>2.2(2)	*	>2.0(3)	*	1.6 ± 0.5(2)	1.2 ± 0.2(2)
^{129m}Te	*	*	*	*	*	*
^{140}Ba	*	*	*	*	*	>25
^{140}La	*	*	>15	*	>53	>41
^{141}Ce	*	*	*	*	7.6 ± 4.1	*

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* Radionuclide not detected in feed and/or distillate.

** Radionuclide not measured.

The variations in DF's show no correlation with either operating or chemistry parameters. There is, however, a correlation between DF and feed concentration. Figures 4.14 to 4.16 show plots of DF and feed, distillate, and bottoms activities for ^{131}I, ^{54}Mn, and ^{60}Co, respectively. These plots show a definite correlation between DF and feed activity (i.e., the DF tends to increase as the feed concentration increases and to decrease as the feed concentration decreases), although there is insufficient data to uniquely define the correlation function. Cesium-137 also exhibits a correlation between DF and feed activity.

Because the bottoms is the liquid being evaporated in this type of evaporator, the feed activity will not immediately affect the bottoms concentrations. The feed concentration levels for ^{131}I and ^{137}Cs generally are 10 to 100 times lower than the bottoms, and if a spike in the feed occurs, the effect on the bottoms does not show up immediately, so that the distillate does not change. This tends to attenuate or stop the propagation of a spike through the evaporator to the distillate. On 1/9/78 and 2/1/78 spikes occurred in the feed concentrations but did not show up in the distillate. For example, from 1/6/78 to 1/9/78 ^{131}I and ^{137}Cs feed concentrations rose by factors of 7 and 1.5, but the bottoms showed no change for ^{131}I and a decrease in Cs concentrations. The distillate showed essentially no change. From 1/11/78 to 2/1/78 the ^{131}I concentrations in the feed rose by a factor of 25, the bottoms by 4 and the distillate 2.5.

A comparison of distillate to bottoms activities indicates that the distillate actually can become better as the bottoms concentration increases. Figure 4.17 shows plots of the distillate activity as a function of the bottoms concentration and of the feed concentration for ^{60}Co. The data indicate that the distillate concentration tends to decrease as the bottoms or feed concentration increases. An explanation for this behavior is not readily apparent.

Figures 4.18 to 4.20 show plots of the ratio of the bottoms-to-distillate activity vs. bottoms activity for ^{131}I, ^{54}Mn, and ^{60}Co. These plots indicate that the bottoms-to-distillate ratio increases with bottoms activity, i.e., the distillate activity remains the same or even may decrease with increasing bottoms activity. A similar plot for ^{137}Cs provided inconclusive results due to the small range in bottoms activities and large uncertainties in the measured distillate activities.

Table 4.12 lists "best value" DF's for the radwaste evaporator. These DF's compare favorably with the corresponding "best value" DF's for the boric acid evaporator (see Tables 4.7 and 4.8). For most radionuclides, the radwaste evaporator DF falls between the two values measured for the boric acid evaporator. This occurs because the feed concentrations fall between those for the boric acid evaporator.

One sample of radwaste evaporator bottoms, obtained on 1/11/78, was analyzed for alpha-emitting radionuclides. Resulting concentrations were $3.2 \pm 0.2(-7)$ µCi/ml for ^{238}Pu and $1.9 \pm 0.2(-7)$ µCi/ml for ^{239,240}Pu.

Figure 4.14

^{131}I Concentrations and DF's for Radwaste Evaporator

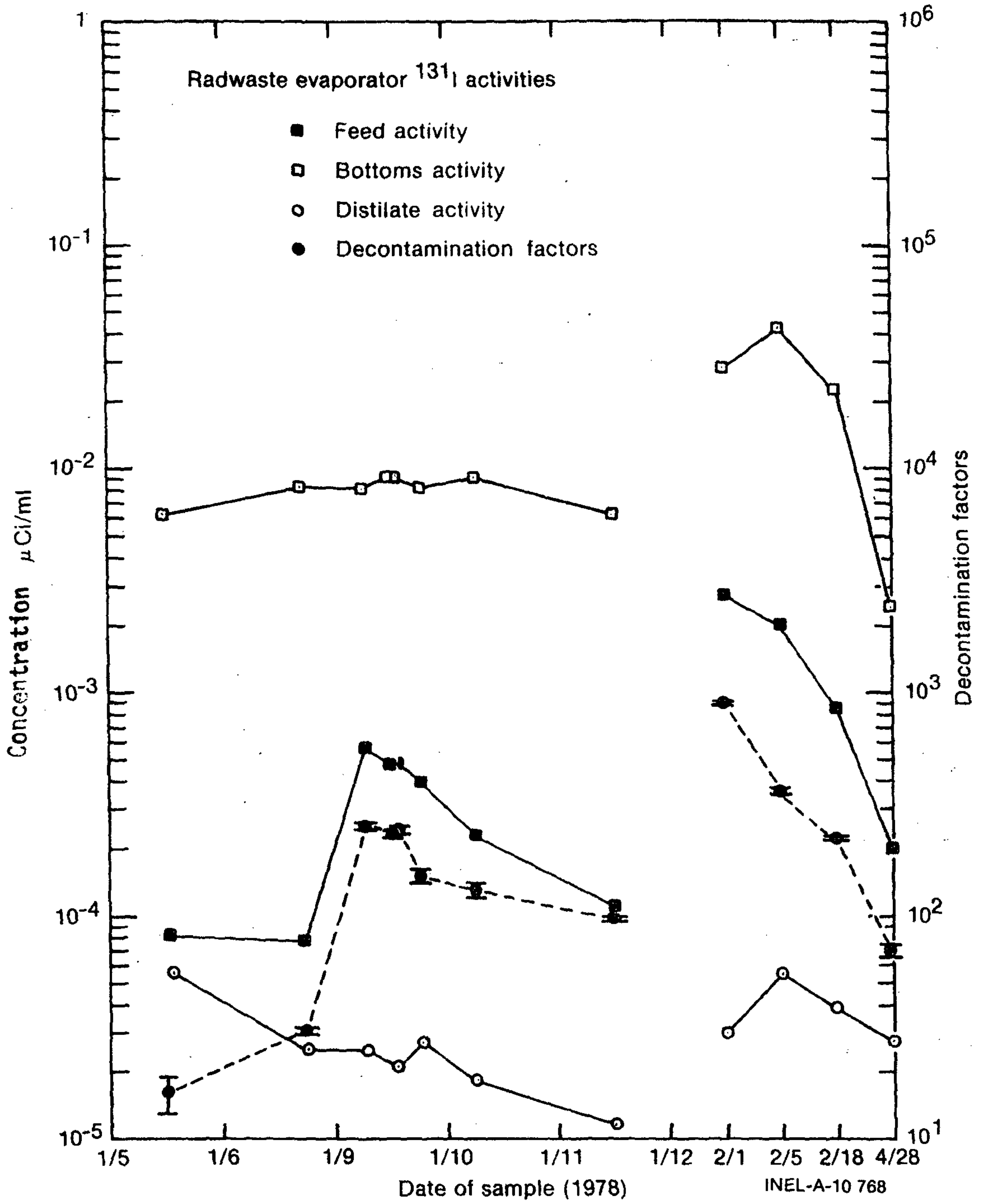

Figure 4.15

^{54}Mn Concentrations and DF's for Radwaste Evaporator

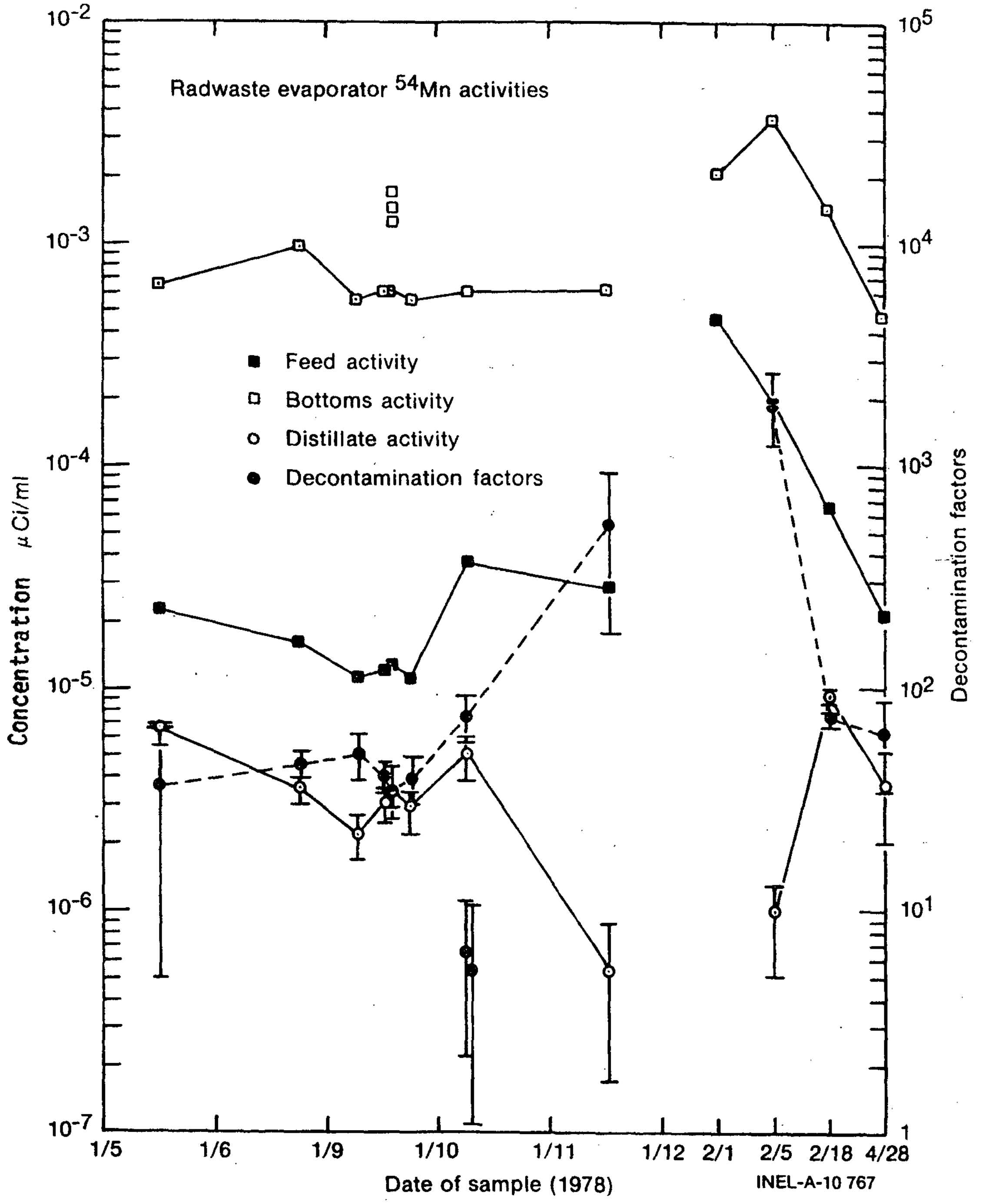

Figure 4.16

^{60}Co Concentrations and DF's for Radwaste Evaporator

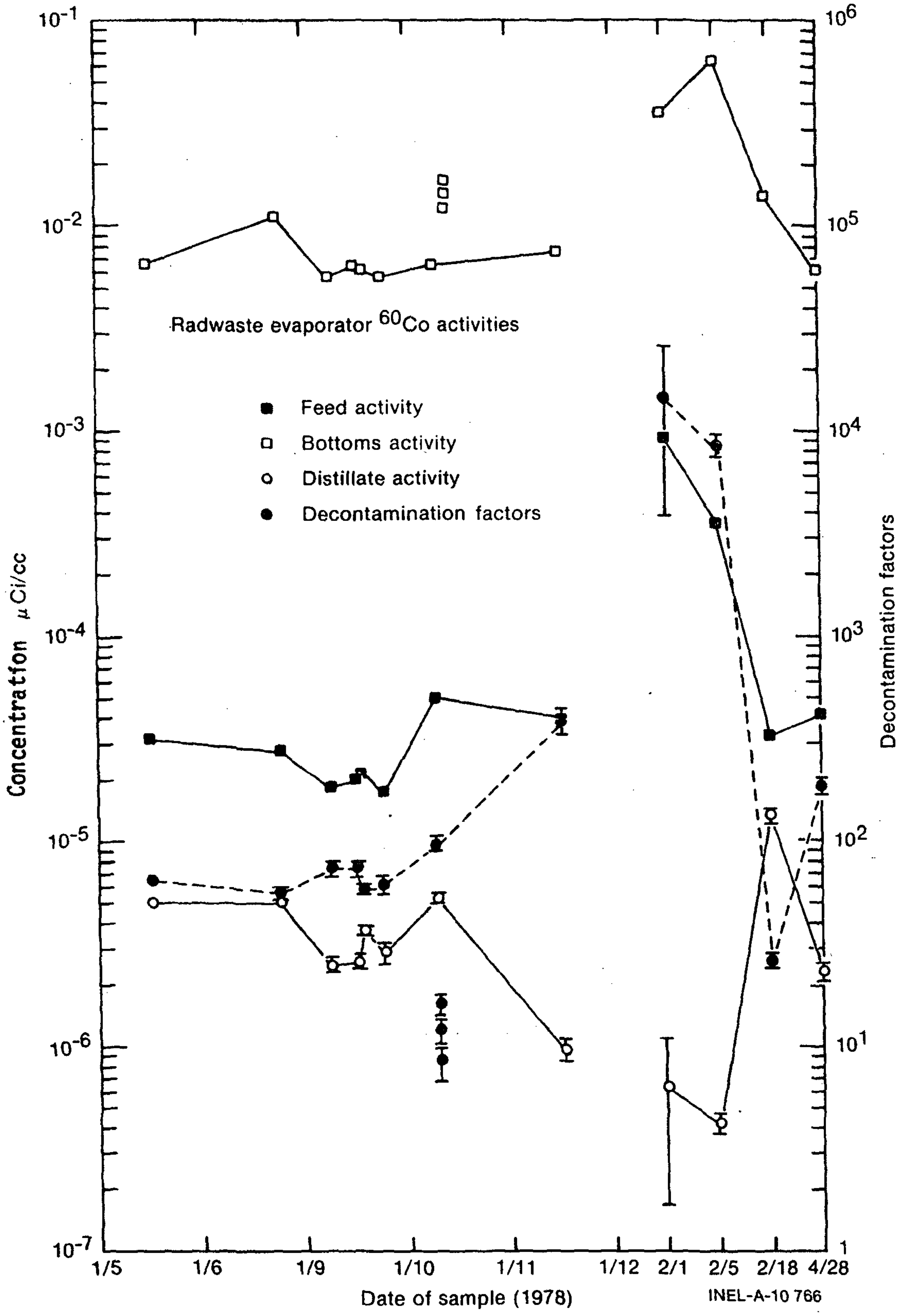

Figure 4.17

Correlation Between ^{60}Co Concentration in Distillate and Bottoms, Radwaste Evaporator

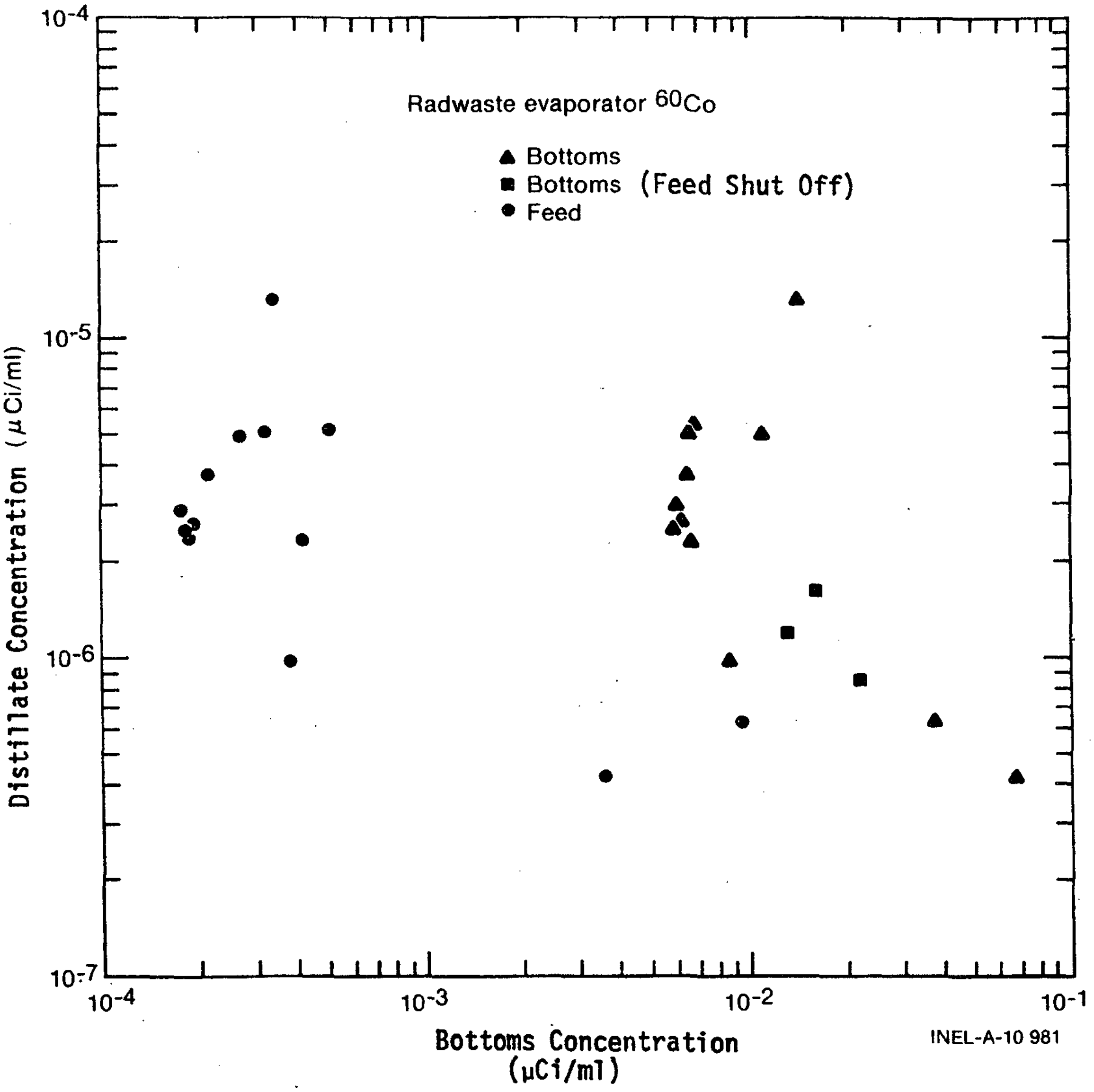

Figure 4.18

Correlation Between ^{131}I Concentration in Distillate and Bottoms, Radwaste Evaporator

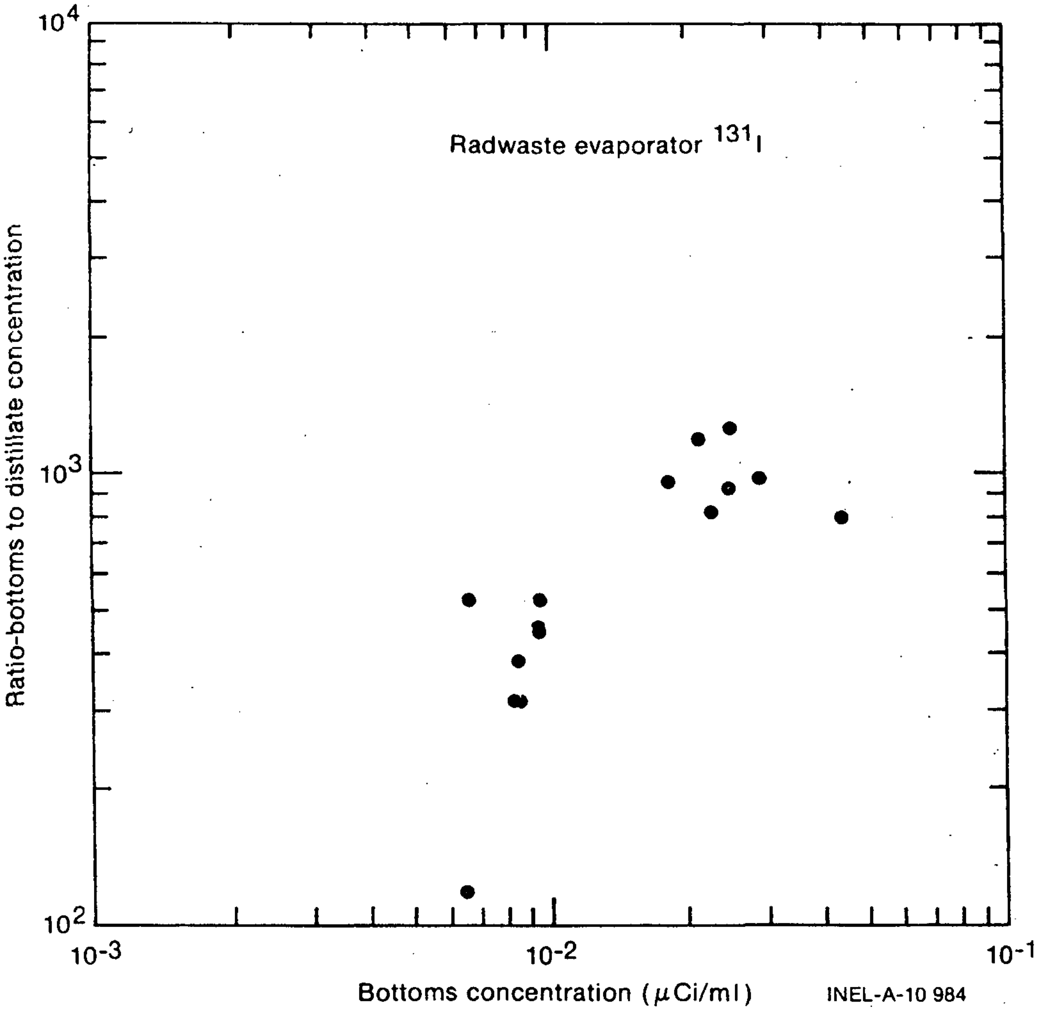

Figure 4.19

Correlation Between ^{54}Mn Concentration in Distillate and Bottoms, Radwaste Evaporator

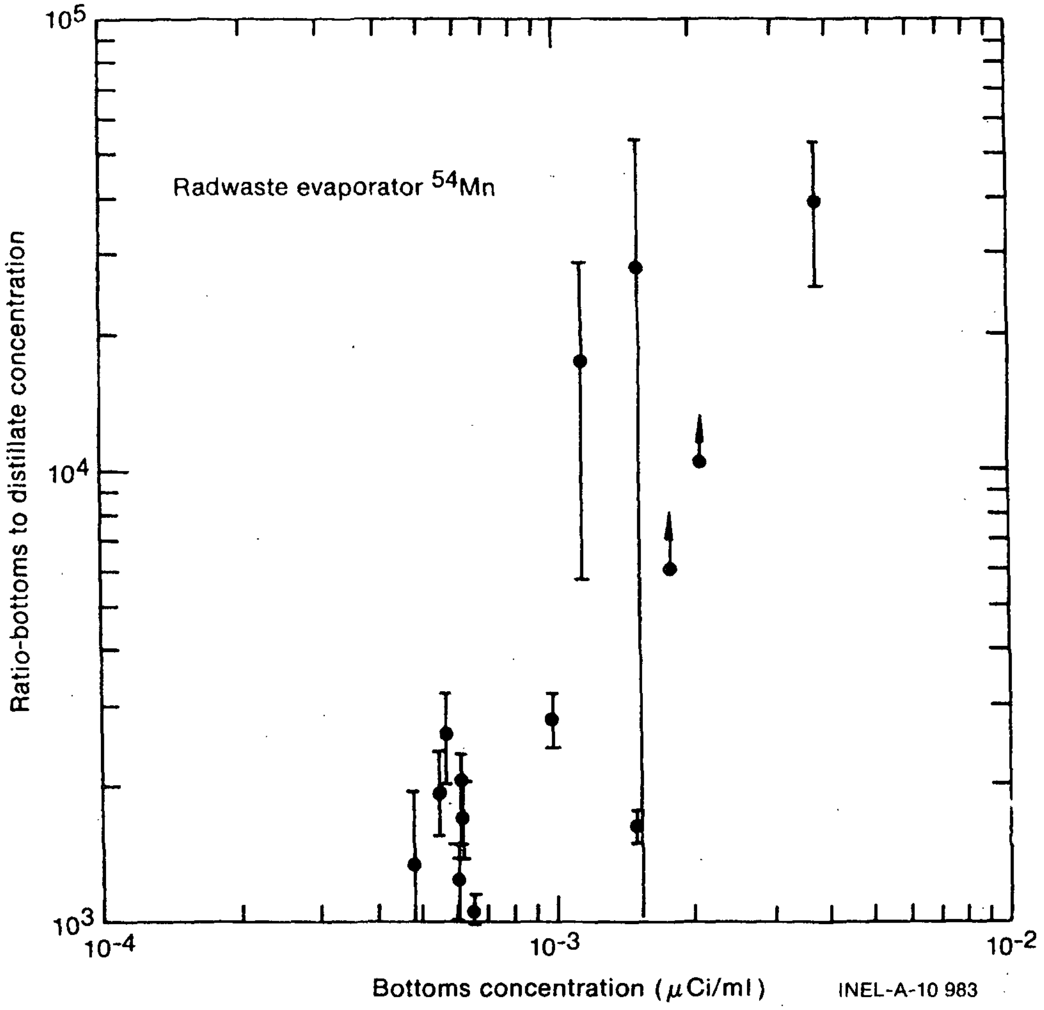

Figure 4.20

Correlation Between ^{60}Co Concentration in Distillate and Bottoms, Radwaste Evaporator

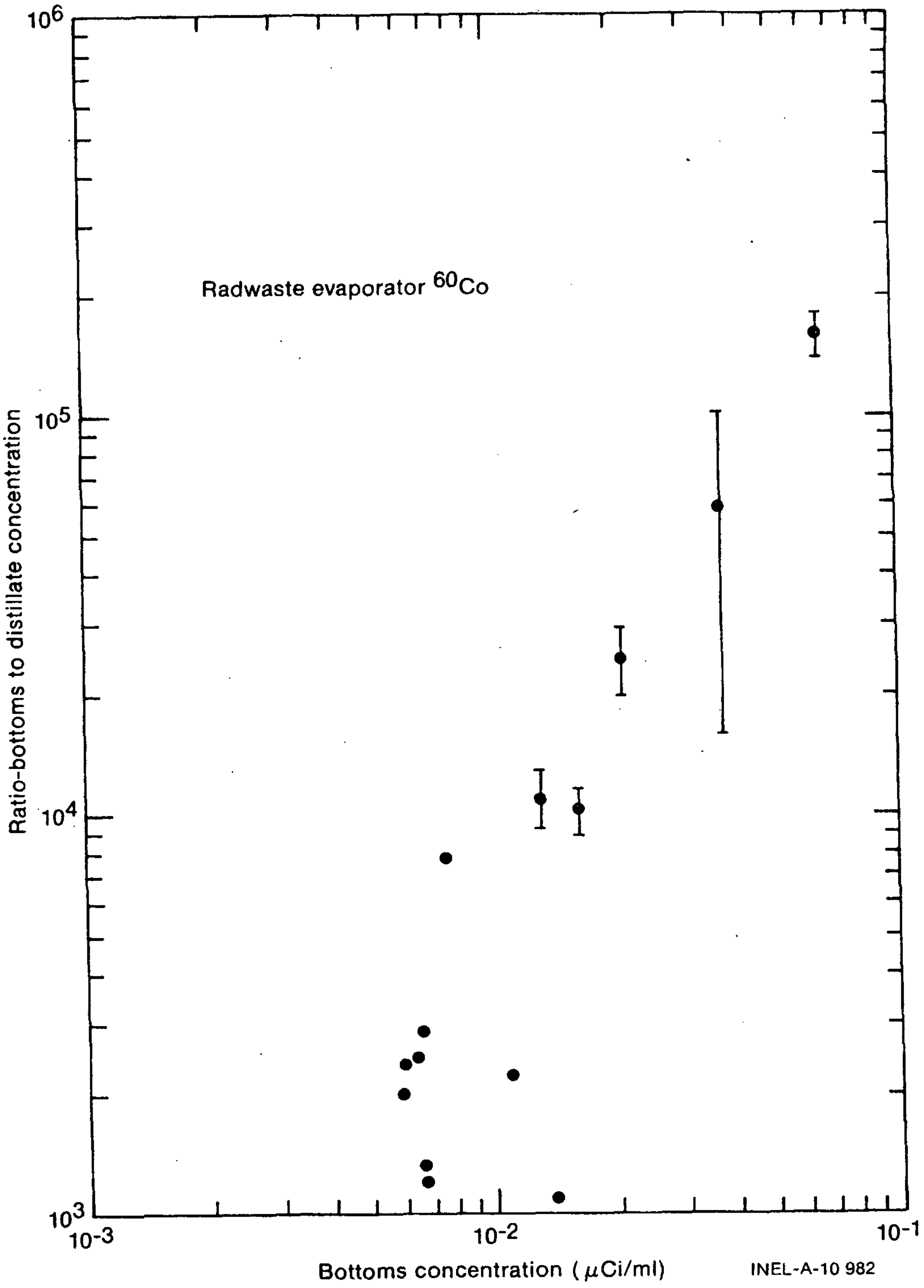

TABLE 4.12

"BEST VALUE" DF's FOR RADWASTE EVAPORATOR

Nuclide	"Best Value" DF
^{131}I	2.4(1)
^{133}I	4.1(2)
^{134}Cs	9.1(2)
^{136}Cs	3.7(1)
^{137}Cs	1.1(3)
^{14}C	1.3(1)
^{54}Mn	2.3(2)
^{55}Fe	4.0(1)
^{57}Co	1.4(2)
^{58}Co	5.1(2)
^{60}Co	4.4(2)
^{63}Ni	3.3(2)
^{90}Sr	5.6(1)
^{91}Y	8.0(1)
^{95}Zr	1.2(2)
^{95}Nb	1.1(2)
^{103}Ru	1.9(2)
^{110m}Ag	2.7(1)
^{124}Sb	1.0(3)
^{125}Sb	7.5(2)

4.3.3 Condensate Demineralizer

Five sets of measurements of the DF across the radwaste evaporator condensate demineralizer were made. Measurement data can be found in Appendix Table B.25. Table 4.13 lists the resulting DF's. Since very little activity was detected in the inlet and outlet for this demineralizer (even using resin concentration techniques), only a limited number of DF's were obtained, and these DF's showed considerable variation. For example, the DF for ^{131}I ranged from 2.5 to 17 for essentially the same inlet concentration and the DF for ^{58}Co ranged from 18 to 1100 while the inlet concentration varied by about a factor of 23. Cesium concentrations in the outlet were approximately constant even though the inlet concentration changed and cesium DF's were less than 1.0. This indicates that the cesium concentrations in the inlet had probably been higher in the past.

Because of the sparse number of DF values, no information concerning the relationship between DF and inlet concentration can be inferred. Table 4.14 lists means and ranges for radionuclide concentration and "best value" DF's for the radwaste evaporator condensate demineralizer.

4.3.4 Test Demineralizer

Although actual samples of feed to and outlet from the test demineralizer train could not be obtained, an average batch DF could be obtained by sampling the tank (waste holdup tank #2) feeding this system and the monitor tank (monitor tank A, B, or C in the radwaste building) that the test system was feeding. This was possible because the test demineralizer was used to process batches of liquid radwaste. That is, a batch of liquid was transferred from waste holdup tank #1 to waste holdup tank #2 (10,000 gal.). This batch of liquid was then processed through the test demineralizer and deposited into one of the 5000 gal. monitor tanks (that was initially empty at the start of the run). When this tank was filled, the outlet flow from the test demineralizer system was diverted to another (empty) monitor tank. Therefore, by sampling waste holdup tank #2 while a specific monitor tank was being filled and then sampling this monitor tank after it was full, an average DF could be obtained. Data for these samples appear in Appendix B, Tables B.26 to B.28.

Table 4.15 lists the measured batch DF's for the test demineralizer system (demineralizer and filter). Only nuclides that were consistently observed in the monitor tanks are listed. A comparison of the DF's for this test demineralizer with those for the radwaste evaporator system (evaporator and condensate demineralizer) indicates that DF's for iodine and cesium are higher (factors of about 2 to 20) for the test demineralizer, and DF's for cobalt, manganese, antimony, and silver are higher (factors of about 5 to 200) for the evaporator system. Since sampling of the test demineralizer system was not ideal (i.e., only the tanks could be sampled, not the actual inlet and outlet) and no information concerning the test demineralizer resin was available, no further interpretation of the data could be made.

TABLE 4.13

DF's FOR RADWASTE EVAPORATOR CONDENSATE DEMINERALIZER

Nuclide	1/6/78	1/10/78	1/11/78	2/1/78	4/28/78
^{131}I	6.1 ± 0.3(0)	3.7 ± 0.2(0)	4.8 ± 0.2(0)	1.7 ± 0.1(1)	2.5 ± 0.1(0)
^{133}I	*	*	>4(-1)	*	2.5 ± 0.3(0)
^{134}Cs	2 ± 1(-1)	<4(-1)	2.1 ± 0.8(-1)	<3(-1)	2.3 ± 0.7(-1)
^{137}Cs	<2(-1)	6 ± 6(-2)	<2(-1)	<2(-1)	1.1 ± 0.9(-1)
^{3}H	**	**	1.03 ± 0.05(0)	**	**
^{14}C	**	**	9.7 ± 1.4(-1)	**	**
^{54}Mn	>3.5(0)	>5(0)	>2.6(-1)	<2.9(1)	1.9 ± 1.0(0)
^{55}Fe	**	**	<1.6(-2)	**	**
^{57}Co	>5(-1)	>2.1(0)	*	*	*
^{58}Co	3.6 ± 2.1(2)	1.1 ± 1.1(3)	>2.4(1)	1.8 ± 1.1(1)	1.9 ± 0.3(1)
^{60}Co	>4.9(0)	>5.2(1)	>4.9(0)	1.2 ± 0.9(1)	2.3 ± 0.5(1)
^{63}Ni	**	**	<1.4(-1)	**	**
^{89}Sr	**	**	>6(0)	**	**
^{90}Sr	**	**	2.3 ± 0.5(0)	**	**
^{91}Y	**	**	<4.4(0)	**	**
^{95}Zr	*	*	*	*	>4.2(0)
^{103}Ru	>5(-1)	*	*	*	*
^{110m}Ag	*	*	*	*	>3.6(0)
^{124}Sb	*	*	*	*	3.3 ± 1.6(0)
^{125}Sb	*	*	*	*	2.8 ± 0.4(0)

* Radionuclide not detected
** Radionuclide not measured

TABLE 4.14

MEANS AND RANGES FOR RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's FOR RADWASTE EVAPORATOR CONDENSATE DEMINERALIZER

Nuclide	Inlet Concentration (μCi/ml) Mean	Inlet Concentration (μCi/ml) Range	Outlet Concentration (μCi/ml) Mean	Outlet Concentration (μCi/ml) Range	"Best Value" DF
^{131}I	2.2(-5)	1.14-2.7(-5)	4.9(-6)	0.18-1.09(-5)	4.6(0)
^{134}Cs	1.2(-7)	0.96-1.7(-7)	5.9(-7)	4.2-7.5(-7)	2(-1)
^{137}Cs	9.7(-8)	0.62-<3(-7)	1.1(-6)	0.84-1.3(-6)	9(-2)
^{3}H	3.2(-2)	***	3.1(-2)	***	1.0(0)
^{14}C	5.8(-7)	***	5.6(-7)	***	1.0(0)
^{54}Mn	2.7(-7)	0.53-5.0(-7)	7.9(-8)	0.068-1.9(-7)	3.5(0)
^{57}Co	1.1(-7)	0.43-1.7(-7)	<8(-8)		>1.3(0)
^{58}Co	1.0(-5)	0.10-2.5(-5)	5.8(-8)	0.23-<2(-7)	1.7(2)
^{60}Co	2.8(-6)	0.63-5.2(-6)	1.6(-7)	0.053-<1(-6)	1.8(1)
^{89}Sr	6(-8)	***	<1(-8)	***	>6(0)
^{90}Sr	2.5(-8)	***	1.1(-8)	***	2.3(0)
^{91}Y	<6(-8)	***	1.4(-8)	***	<4.4(0)
^{95}Zr	4.2(-8)	***	<1(-8)	***	>4.2(0)
^{110m}Ag	7.2(-8)	***	<2(-8)	***	>3.6(0)
^{124}Sb	4.0(-8)	***	1.2(-8)	***	3.3(0)
^{125}Sb	1.4(-7)	***	5.0(-8)	***	2.8(0)

*** Results based on one measurement

TABLE 4.15

DECONTAMINATION FACTORS FOR TEST DEMINERALIZER TRAIN

Nuclide	4/25/78; 10:30	4/26/78; 13:30	4/29/78; 11:28	5/2/78; 14:14	5/10/78; 15:44	5/16/78; 17:55
^{131}I	4 ± 2(3)	>1.4(3)	>9.6(2)	>7.7(3)	>1.2(3)	1.3 ± 0.2(3)
^{134}Cs	8.3 ± 3.8(2)	8.5 ± 3.3(2)	2.8 ± 0.6(2)	>8.8(2)	>1.6(3)	>6.5(2)
^{137}Cs	2.3 ± 1.2(2)	5.1 ± 0.7(2)	3.1 ± 0.3(2)	6.0 ± 1.6(2)	>2.8(3)	>1.6(3)
^{54}Mn	4.0 ± 0.5(1)	>6.4(1)	1.3 ± 0.1(2)	6.2 ± 0.8(1)	2.9 ± 0.2(1)	>3.6(2)
^{57}Co	2.2 ± 1.1(2)	>9	1.5 ± 0.7(2)	>2.5	>1.4(1)	>3.6(1)
^{58}Co	3.1 ± 0.2(2)	1.5 ± 0.4(3)	1.2 ± 0.1(3)	4 ± 1	2.7 ± 0.1(2)	4.4 ± 0.3(2)
^{60}Co		2.0 ± 0.2(2)	3.0 ± 0.3(2)	1.2 ± 0.1(2)	4.6 ± 0.3(1)	3.7 ± 0.4(2)
^{95}Nb	4.1 ± 0.8(1)	>5.8(1)	>3.9(2)	>1.7(2)	>6.6(1)	>1.1(2)
^{110m}Ag	6.2 ± 2.3(1)		>1.1(2)	>6.6(1)	2.4 ± 1.2(1)	1.1 ± 0.2(1)
^{124}Sb	>1.2(2)	>4.7(1)	>7.0(1)	>7.0(1)	3.6 ± 0.9(1)	>4.7(1)
^{125}Sb	>0.6	>3.9(1)	9.7 ± 3.9(1)	>1.5(2)	2.8 ± 0.3(1)	4.8 ± 1.6(1)

Nuclide	5/20/78; 11:10	5/23/78; 13:55	5/25/78; 08:50
^{134}Cs	6.8 ± 2.6(2)	1.0 ± 0.4(3)	>7.5(2)
^{137}Cs	1.8 ± 0.8(3)	2.1 ± 1.4(3)	>8.7(2)
^{54}Mn	8.3 ± 0.8(1)	6.7 ± 1.5(1)	9.2 ± 1.6(1)
^{58}Co	6.3 ± 0.8(2)	2.8 ± 0.5(2)	2.9 ± 0.2(2)
^{60}Co	1.7 ± 0.1(2)	1.3 ± 0.1(2)	2.6 ± 0.7(2)
^{124}Sb	>4.7(1)	>5.0(1)	7.3 ± 1.6(1)
^{125}Sb	2.4 ± 0.5(1)	4.8 ± 2.1(1)	7.7 ± 1.5(1)

4.4 Radionuclide Concentrations in Tanks

During measurements at Turkey Point, samples were obtained from the various holdup and monitor tanks. The objective in obtaining these samples was twofold: (1) to characterize feed streams to evaporators and demineralizers and (2) to characterize the radionuclide concentration in the tanks and obtain information concerning radionuclide inventory in the plant. Appendix B, Tables B.14, B.15, B.21, B.26-B.30, contain the results from analysis of these samples. Note that the radionuclide concentrations in the feed to the boric acid recovery system and radwaste evaporator are characteristic of the concentrations in the holdup tanks and waste holdup tank No. 1, respectively. Plots of the levels in the holdup, waste holdup tank #1, and auxiliary building monitor tanks are shown in Appendix B Figures B.17, B.18 and B.21, respectively. Information concerning the levels in waste holdup tank No. 2 and the radwaste building monitor tanks was unavailable.

Means and ranges for radionuclide concentration in the holdup tanks, waste holdup tanks, and monitor tanks are listed in Tables 4.16-4.18.

During the measurement period (1/11/77-6/1/78), total releases from the auxiliary building monitor tanks were 2.74(6) gallons. Of this total, 1.78(6) gallons were processed through the boric acid recovery system and 9.6(5) gallons through the radwaste evaporator system. In addition, 5.2(5) gallons of liquid processed through the test demineralizer were released from the radwaste building monitor tanks. Using the mean radionuclide activities measured in the monitor tanks (see Tables 4.17 and 4.18) the extrapolated annual average releases from the monitor were obtained (Table 4.19). It must be noted that these annual averages were extrapolated from monitor tank concentrations obtained during a very short period (4/29-5/25/78) and may not be representative of the releases during the total 11/1/77-6/1/78 period.

4.5 Conclusions

The following conclusions have been reached with regard to the operation of the two evaporator systems.

1. Spikes from the reactor coolant do propagate to the feed of the boric acid and radwaste evaporator systems. The holdup tanks reduce the effect by allowing the short-lived radionuclides to decay before entering the evaporator system. The base cation resin reduces the effect in the evaporator inlet by removing the cation radionuclides, such as cesium, and filtering out some of the crud-associated radionuclides, e.g., the cobalt. Iodine-131 on the other hand is not removed by the cation resin and enters the evaporator system essentially unchanged. In the radwaste evaporator only one tank collects waste and feeds the evaporator so the retention time is not as great. However, the spike levels are much diluted with the addition of "older"

TABLE 4.16

RADIONUCLIDE CONCENTRATIONS IN HOLDUP AND WASTE HOLDUP TANKS

	Holdup Tanks A, B, and C[†]		Waste Holdup Tank No. 1[††]		Waste Holdup Tank No. 2[†††]	
Nuclide	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{131}I	1.8(-3)	0.0002-1.00(-2)	7.4(-4)	0.08-2.7(-3)	1.9(-4)	0.73-4.6(-4)
^{132}I	*		1.0(-5)	0.48-1.4(-5)	6.5(-6)	5.2-8.1(-6)
^{133}I	*		4.9(-5)	0.025-2.64(-4)	7.1(-5)	0.124-1.45(-4)
^{134}I	*		1.8(-4)	0.056-5.5(-4)	9.9(-6)	0.45-1.58(-5)
^{135}I	*		7.8(-5)	0.050-3.2(-4)	3.1(-5)	0.76-6.38(-5)
^{134}Cs	5.4(-4)	0.030-2.16(-3)	2.1(-4)	0.11-7.5(-4)	1.3(-4)	0.88-1.98(-4)
^{136}Cs	*		5.5(-6)	0.10-2.3(-5)	3.4(-6)	0.93-7.2(-6)
^{137}Cs	9.0(-4)	0.0042-3.24(-3)	4.0(-4)	0.053-1.6(-4)	2.2(-4)	1.6-3.6(-4)
^{3}H	3.5(-2)	***	1.0(-3)	0.685-2.9(-2)	4.7(-2)	3.22-6.34(-2)
^{14}C	8.0(-6)	***	2.6(-6)	1.5-3.69(-6)	2.1(-5)	1.19-3.54(-5)
^{32}P	3.2(-5)	***	2.2(-5)	***	1.9(-5)	1.20-2.71(-5)
^{24}Na	*		5.1(-6)	1.7-8.6(-6)	7.8(-6)	0.11-1.6(-5)
^{51}Cr	2.0(-4)	0.019-8.2(-4)	1.8(-4)	0.23-7.1(-4)	3.9(-5)	0.11-1.3(-4)
^{54}Mn	5.3(-4)	0.0058-2.57(-3)	9.6(-5)	0.11-4.7(-4)	3.9(-5)	0.184-1.01(-4)
^{55}Fe	4.0(-4)	***	2.3(-4)	0.549-4.06(-4)	7.4(-4)	5.22-9.53(-4)
^{59}Fe	5.8(-5)	0.0010-2.5(-4)	2.5(-5)	0.28-7.9(-5)	7.8(-6)	0.74-8.2(-6)
^{57}Co	1.9(-5)	0.025-9.1(-5)	1.7(-5)	0.14-9.6(-5)	3.6(-6)	0.84-9.1(-6)
^{58}Co	1.1(-2)	0.0043-4.29(-2)	6.7(-3)	0.041-4.0(-2)	4.0(-4)	0.0024-1.35(-3)
^{60}Co	2.6(-3)	0.0050-1.35(-2)	1.7(-3)	0.18-9.3(-3)	5.3(-4)	0.24-1.6(-3)
^{63}Ni	3.8(-5)	***	1.2(-4)	0.734-1.66(-4)	1.5(-4)	0.996-2.29(-4)
^{65}Zn	1.9(-5)	0.06-5.1(-5)	3.0(-5)	0.34-6.2(-5)	5.2(-6)	0.17-1.8(-5)
^{89}Sr	1.4(-6)	***	7.5(-6)	0.276-1.22(-5)	8.8(-6)	0.376-1.80(-5)
^{90}Sr	8.8(-8)	***	4.7(-7)	3.3-6.2(-7)	1.1(-6)	0.322-2.41(-6)
^{91}Y	3.7(-7)	***	7.6(-7)	0.49-1.04(-6)	5.5(-7)	2.6-7.4(-7)
^{95}Zr	2.6(-5)	0.032-1.15(-4)	2.9(-5)	0.29-1.10(-4)	2.6(-5)	0.026-1.4(-4)
^{95}Nb	4.4(-5)	0.048-2.02(-4)	4.7(-5)	0.022-1.50(-4)	2.5(-5)	0.57-8.6(-5)
^{99}Mo	9.3(-5)	<0.0033-6.13(-4)	1.5(-5)	0.35-2.6(-5)	7.3(-6)	0.14-3.4(-5)

TABLE 4.16 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN HOLDUP AND WASTE HOLDUP TANKS

	Holdup Tanks A, B, and C†		Waste Holdup Tank No. 1††		Waste Holdup Tank No. 2†††	
Nuclide	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{103}Ru	5.7(-6)	0.08-3.45(-5)	2.7(-5)	0.017-1.2(-4)	3.1(-6)	1.1-6.1(-6)
^{106}Ru	7.8(-6)	0.092-3.7(-5)	5.1(-5)	0.062-1.7(-4)	4.7(-5)	0.097-1.4(-4)
^{110m}Ag	8.4(-5)	0.018-<5.8(-4)	8.7(-6)	0.29-1.2(-5)	1.7(-5)	0.17-9.6(-5)
^{124}Sb	1.3(-4)	0.015-6.2(-4)	1.7(-4)	0.10-9.2(-4)	1.2(-5)	0.47-2.8(-5)
^{125}Sb	1.8(-4)	0.0046-1.06(-3)	1.8(-4)	0.010-1.0(-3)	2.7(-5)	1.3-6.1(-5)
^{129m}Te	*		1.6(-5)	<0.11-4.8(-5)	1.3(-4)	0.88-1.98(-4)
^{140}Ba	*		*		1.0(-5)	0.34-2.7(-5)
^{140}La	6.7(-5)	0.0018-3.77(-4)	3.5(-6)	0.56-7.7(-6)	5.7(-6)	0.20-1.31(-5)
^{141}Ce	1.8(-6)	<0.36-7.4(-6)	*		*	
^{144}Ce	2.0(-6)	<0.83-4.6(-6)	*		*	

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* Radionuclide not detected

*** One measurement, only, for radionuclide

† Data obtained from inlet to base cation demins.

†† Data obtained from feed to radwaste evaporator.

††† Based on the following samples

1130, 4/25/78
1434, 4/26/78
1143, 4/29/78
1424, 5/2/78
1044, 5/10/78

1611, 5/16/78
1755, 5/16/78
1110, 5/20/78
1250, 5/23/78
0853, 5/25/78

TABLE 4.17

RADIONUCLIDE CONCENTRATIONS IN RADWASTE BUILDING MONITOR TANKS

	Monitor Tank A†		Monitor Tank B††		Monitor Tank C†††	
Nuclide	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)	Mean (μCi/ml)	Range (μCi/ml)
^{131}I	5(-8)	**	1(-7)	**	<1(-7)	
^{134}Cs	2.6(-7)	1.1-6.3(-7)	6.5(-8)	**	<7(-8)	
^{137}Cs	4.1(-7)	0.07-1.0(-6)	1.2(-7)	<0.8-2.7(-7)	5(-8)	**
^{3}H	4.5(-2)	4.0-4.9(-2)	3.8(-2)	3.3-4.2(-2)	3.0(-3)	***
^{12}C	5.7(-7)	0.28-1.1(-6)	3.6(-6)	0.82-6.3(-6)	5.5(-7)	***
^{32}P	2.1(-7)	1.1-3.1(-7)	<4(-7)		<9(-7)	
^{54}Mn	4.3(-7)	2.9-7.8(-7)	4.0(-7)	<1-7.4(-7)	7.1(-7)	6.6-7.9(-7)
^{55}Fe	5.4(-6)	0.65-9.7(-6)	8.3(-6)	0.44-1.22(-5)	1.1(-5)	***
^{57}Co	5(-8)	3.8-6.2(-8)	<4(-8)		<6(-8)	
^{58}Co	7(-7)	0.34-1.1(-6)	6.4(-7)	5.0-8.9(-7)	1.5(-6)	0.88-2.7(-6)
^{60}Co	2.1(-6)	<0.2-3.9(-6)	2.7(-6)	0.99-4.8(-6)	5.4(-6)	4.8-6.1(-6)
^{63}Ni	2.6(-6)	0.18-5.8(-6)	5.6(-6)	0.085-1.03(-5)	1.9(-6)	***
^{89}Sr	1.5(-8)	<0.35-3.8(-8)	<6(-9)		1.3(-8)	***
^{90}Sr	2.0(-8)	0.84-3.6(-8)	3.2(-8)	2.8-3.6(-8)	3.9(-8)	***
^{91}Y	2(-9)	<2-5(-9)	3(-9)	2.1-4(-9)	4(-9)	***
^{95}Nb	1(-7)	<0.93-1.6(-7)	<5(-8)		<1(-7)	
^{99}Mo	<1(-7)		5(-8)	**	<6(-8)	
^{106}Ru	1(-6)	**	<4(-7)		1(-6)	<0.08-2.4(-6)
^{110m}Ag	1(-7)	**	1.4(-7)	<0.7-3.3(-7)	3.5(-7)	0.71-8.8(-7)
^{124}Sb	2(-7)	**	1.3(-7)	**	8(-8)	0.44-1.4(-7)
^{125}Sb	5.1(-7)	3.1-6.8(-7)	3(-7)	<2-4.6(-7)	5.1(-7)	0.78-9.0(-7)
^{140}Ba	<1(-7)		<2(-7)		1.4(-7)	**

† Samples 4/25/78; 1032 5/20/78; 1110 (gamma analysis only)
4/26/78; 1330 5/23/78; 1355 (gamma analysis only)
4/29/78; 1128 5/25/78; 1545 (gamma analysis only)

†† Samples 5/2/78; 1414
5/8/78; 1743 (gamma analysis only)
5/16/78; 2135

††† 5/7/78; 1513
5/10/78; 1544 (gamma analysis only)
5/25/78; 1020 (gamma analysis only)

** Radionuclide detected in only one sample
*** One measurement, only, for this radionuclide.

TABLE 4.18

RADIONUCLIDE CONCENTRATIONS IN AUXILIARY BUILDING MONITOR TANKS

	Tank A†		Tank B††	
Nuclide	Mean (µCi/ml)	Range (µCi/ml)	Mean (µCi/ml)	Range (µCi/ml)
^{131}I	5.7(-6)	<0.0097-1.70(-5)	1.7(-5)	0.015-5.0(-5)
^{133}I	1(-7)	<0.8-1.4(-7)	<2(-8)	
^{134}Cs	2.7(-8)	0.98-5.7(-8)	6(-8)	<5-8.1(-8)
^{137}Cs	1.9(-7)	1.5-2.3(-7)	<4(-8)	
^{3}H	6.7(-2)	0.159-1.00(-1)	7.5(-3)	***
^{14}C	2.9(-6)	0.24-4.3(-6)	5.1(-7)	***
^{32}P	3.5(-7)	<4-9(-7)	<6(-7)	
^{51}Cr	<5(-7)		8(-7)	**
^{54}Mn	4(-8)	0.38-8.2(-8)	1(-7)	<0.7-2.1(-7)
^{55}Fe	5.2(-6)	0.21-1.11(-5)	1.9(-6)	***
^{58}Co	4.9(-7)	0.70-9.4(-7)	6.2(-7)	0.091-1.62(-6)
^{60}Co	3.6(-7)	0.88-8.9(-7)	7.3(-7)	0.25-1.8(-6)
^{63}Ni	6.0(-7)	3.7-7.8(-7)	9.1(-7)	***
^{89}Sr	1(-8)	<0.3-2.7(-8)	<4(-9)	
^{90}Sr	7.6(-9)	0.28-1.2(-8)	1.3(-8)	***
^{91}Y	1.2(-8)	0.22-2.7(-8)	2.4(-8)	***
^{95}Zr	1.1(-7)	<1-1.9(-7)	2(-7)	**
^{95}Nb	1.0(-7)	<0.8-2.3(-7)	3(-7)	**
^{99}Mo	<6(-8)		6(-8)	3.0-8.7(-8)
^{103}Ru	<6(-8)		3(-8)	**
^{106}Ru	<7(-7)		3(-7)	**
^{110m}Ag	1(-7)	<1-1.4(-7)	6(-8)	**
^{125}Sb	3(-7)	<2-6.2(-7)	1.3(-7)	<1-1.8(-7)

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† Samples
4/29/78, 11:24
5/16/78, 14:48
5/18/78, 11:16

†† Samples
5/2/78, 11:17 (gamma analysis only)
5/8/78, 18:13 (gamma analysis only)
5/10/78, 14:06

** Radionuclide detected in only one sample.
*** One measurement, only, for this radionuclide.

TABLE 4.19

EXTRAPOLATED ANNUAL RELEASES FROM MONITOR TANKS[†]

Nuclide	Extrapolated Annual Release (μCi)
^{131}I	1.9(5)
^{134}Cs	1.3(3)
^{137}Cs	2.6(3)
^{3}H	1.0(9)
^{14}C	5(4)
^{32}P	7(3)
^{51}Cr	9(3)
^{54}Mn	3(3)
^{55}Fe	1.0(5)
^{57}Co	1.3(2)
^{58}Co	1.3(4)
^{60}Co	2(4)
^{63}Ni	2(4)
^{89}Sr	1.8(2)
^{90}Sr	3(2)
^{91}Y	3(2)
^{95}Zr	3(3)
^{95}Nb	4(3)
^{99}Mo	1.0(3)
^{103}Ru	5(2)
^{106}Ru	8(3)
^{110m}Ag	2(3)
^{124}Sb	5(2)
^{125}Sb	2(3)
^{140}Ba	3(2)

[†] Extrapolated values based on radionuclide concentrations measured during 4/25-5/25/78 period and volume of liquid released during 7-month period from 11/1/77 to 6/1/78.

water from other sources. There is a correlation of the activity levels in the evaporator bottoms with the distillate such that a higher level in the bottoms is reflected as a higher concentration in the distillate.

2. The DF's across the base cation demineralizer when loaded with a mixed-bed resin show a high correlation with inlet concentration for ionic species such as ^{131}I and $^{134-137}$Cs. The crud-associated radionuclides do not show this correlation.

3. The crud-associated radionuclides show a high correlation between the feed concentration and the DF across the evaporator (inlet/distillate). This correlation is apparently valid for all evaporators studied at three nuclear power plants. The radwaste evaporator showed a similar correlation for cesium and iodine radionuclides. The boric acid evaporator had insufficient levels of $^{134-137}$Cs to establish a correlation and the iodine levels dropped to such a level that an accurate determination DF's was not possible and any correlation could not verified.

4. Because of the effects noted in 1-3 above, the boric acid recovery system and the radwaste evaporator system tend to attenuate, if not stop, spikes that reach their inlets and prevent the spikes from propagating to the monitor tanks.

5. The actual efficiency of the evaporator is related to the bottoms concentration rather than the feed. This was shown to be true when the feed concentration was drastically reduced when compared to the bottoms and the DF actually dropped to a value less than one. During this time the bottoms-to-distillate ratio remained relatively constant.

6. The radwaste evaporator exhibited the phenomenon of having less cobalt activity in the distillate when the bottoms or feed was more concentrated. The opposite case was observed for ^{131}I. The boric acid evaporator exhibited a correlation between distillate and bottoms concentrations for ^{131}I. No correlation was found for cesium and cobalt.

5. SPENT FUEL PIT

5.1 System Description

There are two spent fuel pits (SFP) at Turkey Point, one for each reactor. The fuel pits and associated cooling, purification and ventilation systems are identical with the following exceptions. Spent fuel pit #3 has a leak recovery system as well as its own ventilation release vent. Spent fuel pit #4 does not have a leak recovery system and ventilation exhaust feeds the main plant exhaust stack.

A detailed drawing of spent fuel pit cooling and purification systems for Units #3 and #4 is shown in Appendix B Figure B.14. The cooling system consists of a pump, heat exchangers, filters and a mixed-bed demineralizer. In normal operation, water from the SFP is circulated through the heat exchangers and returned to the SFP. A nominal flow of 2000 gallons per minute results in one SFP volume (330,000 gallons) change every 2.75 hours. The purification loop for the cooling system consists of three 25-micron flushable filters and the mixed-bed demineralizer. The mixed-bed demineralizer bed has a depth of 5.5 feet and a diameter of 31.5 inches (5.4 ft^2 cross sectional area) and contains 30 ft of resin (Rohm & Haas Amberlite IRN-150 or equivalent). Nominal flow through the purification loop is 100 gallons per minute. Based on this flow and a 30 ft^3 bed volume, the bed residence time is 2.3 minutes.

The SFP's ventilation system consists of two supply fans and an exhaust fan (see Figure 1.2). The exhaust fan is rated at 20,000 cubic feet per minute. The supply fans have a total capacity of 3000 cubic feet per minute, the balance of the exhaust flow coming from in-leakage. The SFP ventilation exhaust is processed through a series of prefilters and HEPA filters (40 of each type filter) before going to the environment. The prefilters are two feet square by two inches deep while the HEPA filters are two feet square by 11.5 inches deep. None of the filters has ever been changed.

Also, as noted in Figure B.14, each SFP has a spent fuel pit skimmer system. These skimmers were not in use during the measurement program at Turkey Point.

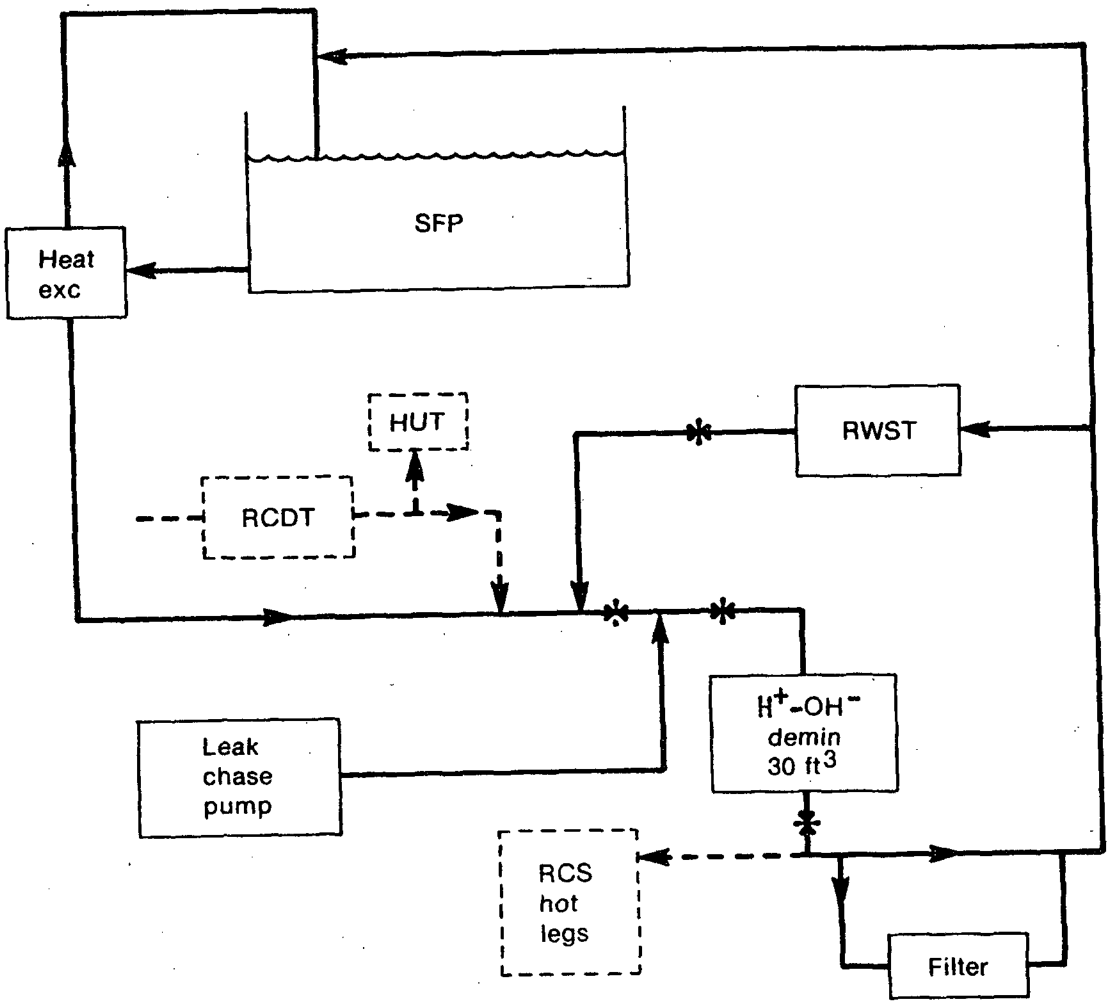
The leak recovery system for Unit #3 SFP was used intermittently to remove water, which had leaked between the SFP stainless steel and concrete liners. The recovered liquid was processed through the SFP purification system. When operating, the flow was nominally 1-2 gallons per minute.

5.2 Measurements

Figure 5.1 shows a schematic diagram of the Unit #3 SFP cooling and purification system. The indicated sample points are the sampling locations used in the study. Sample 1 was a dip sample taken directly out of the SFP. Samples 2-4 were collected through permanently installed sample lines.

Figure 5.1

Schematic Diagram of Unit #3 Spent Fuel Pit System



* Sampling stations

In the Unit #3 SFP study, the ventilation exhaust was monitored for ^{131}I, particulates, ^{14}C, and ^{3}H. Results of the measurement period, which extended from 12/8/77 to 6/1/78, are in Appendix B, Tables B.72 and B.82. Data associated with the SFP demineralizer DF measurements are in Appendix B Table B.31. Tables B.32 and B.33 of Appendix B contain the results for samples of the spent fuel pit and associated water for beta-only-emitting and gamma-emitting radionuclide analyses.

Sampling methods used in the study are described in reference 4.

5.3 Results and Discussion

After Unit #3 went down for its fourth refueling, 40 fuel assemblies were transferred from the Unit #3 reactor core to the Unit #3 SFP. The fuel assemblies were transferred between 1/4/78 and 1/25/78. The original ^{235}U enrichment of the transferred fuel assemblies ranged from 1.8% to 2.7%. The ^{235}U content of the fuel assemblies, when transferred, ranged from 0.44% to 0.50%. The transferred assemblies had a combined useage of 72,676 megawatt days. Unit #3 spent fuel pit previously contained 107 fuel assemblies from prior refuelings.

During the interval 3/23/78 to 4/25/78 all fuel assemblies in Unit #3 SFP were transferred to Unit #4 SFP. This was done to facilitate repair of the Unit #3 SFP liner. The water from #3 SFP was processed through the #3 BAE during May, 1978 (see section 4.2).

5.3.1 Unit #3 Fuel Pit Area Extrapolated Annual Gaseous Releases for ^{131}I, ^{3}H, and ^{14}C

The average ^{3}H and ^{14}C release rates downstream of the HEPA exhaust filters from Unit #3 SFP via the vapor pathway are given in Table 5.1 together with extrapolated annual releases. The releases for both radionuclides are based on sampling interval data (Table B.72 of Appendix B) where both analysis of oxidized and unoxidized species was obtained. The annual releases presented include data for the refueling and non-refueling interval, the fuel movement from SFP #3 to SFP #4 interval, and the interval of water removal from SFP #3. By including the fuel transfer and water removal operations, uncommon practices, one would expect the release rates to be lower than during normal operations since there were intervals with no fuel or water in the #3 SFP. However, for these two radionuclides (^{3}H and ^{14}C), the average release rates are lower if the release rates during the fuel movement and water removal operations are excluded. The release rates obtained by excluding the release rates during these operations are 2.9(-2) and 9.8(-3) µCi/sec for ^{3}H and ^{14}C respectively. Consequently, the reported releases (Table 5.1) are upper limits i.e., the release rates would be lower during more normal power operation. It should be emphasized that the reported ^{14}C and ^{3}H releases are for Unit #3 SFP only. To correct to total plant extrapolated annual releases from the SFP's, the ^{3}H release

TABLE 5.1

EXTRAPOLATED ANNUAL RELEASES OF GASEOUS TRITIUM, ^{131}I AND ^{14}C FROM THE UNIT #3 FUEL PIT AREA

(For Refueling and Non-refueling Combined)

Nuclide	Average Release Rate (μCi/sec)	Extrapolated Annual Release (Ci/year)
^{3}H	8.8(-2)	2.7
^{14}C	1.2(-2)	0.4
^{131}I	4.8(-4)	0.02

should be multiplied by approximately 2. This is based on FPL ^{3}H analyses of both Unit #3 and Unit #4 SFP's waters. The two analyses gave approximately the same results. Although ^{14}C analyses were not performed for the SFP waters, the same argument could be applied to the ^{14}C extrapolated total plant annual releases from the SFP's. Extrapolated radionuclide annual releases in this section are obtained by multiplying the average release rate by the number of seconds per year (3.15(7)).

Also shown in Table 5.1 is the extrapolated annual release of ^{131}I downstream of the exhaust HEPA filter. This result is discussed in detail in Section 8. Species data for ^{131}I from the Unit #3 SFP are also presented and discussed in Section 8. The only gaseous particulate radionuclide detected in the Unit #3 SFP ventilation exhaust was ^{137}Cs. The respective release rates, downstream of the HEPA filters, were 5.0(-7), 3.5(-7) and 6.0(-7) µCi/sec during the combined refueling-non-refueling interval, the non-refueling interval, and the refueling interval (Tables 2.5, 2.7, 2.8).

For comparison purposes the ^{131}I, ^{3}H, and ^{14}C average release rate, downstream of the exhaust HEPA filter, during the refueling interval, the non-refueling interval, the fuel transfer from Unit #3 to Unit #4 SFP interval and the Unit #3 water removal intervals are shown in Table 5.2.

The measured distributions of ^{3}H and ^{14}C chemical species are shown in Table 5.3. The average levels of oxidized forms of ^{3}H and ^{14}C are 53% and 24%, respectively. The reason for the chemical species variability is unknown.

5.3.2 Unit #3 Spent Fuel Pit and Associated Water Tritium Mass Balance

The data in Table 5.4 represent a ^{3}H mass-balance before and after fuel movement from the Unit #3 core. Fuel movement occurred during the interval 1/14-25/78. The total ^{3}H in the refueling water storage tank (RWST), the reactor coolant, and the spent fuel pit waters was observed to decrease from approximately 18 curies prior to the outage to approximately 11 curies during the outage. Tritium can be released into the ventilation air and into the monitor tanks via the boric acid evaporator. Ventilation measurements indicate that only a small fraction of the 7-curie balance (i.e., 0.1-0.2 curies) was released via the air pathway during the period 11/21/77-1/11/78. Although it is not possible to identify the portion of ^{3}H in the liquid wastes that originated from Unit #3, the total release is sufficiently large to account for the 7-curie difference observed during refueling of Unit #3. For example, during December, 1977 and January, 1978 a total of 75 monitor tank volumes were released. In order to account for 7 curies of ^{3}H by the release of 75 monitor tanks (10(4) gallons each), the average ^{3}H concentration in the monitor tanks would have to be 2.5(-3) µCi/ml. Although ^{3}H measurements in monitor tank liquids

TABLE 5.2

AVERAGE RELEASE RATES OF GASEOUS ^{3}H, ^{14}C, AND ^{131}I FROM UNIT #3 FUEL PIT AREA

(For refueling, non-refueling, fuel transfers, and water removal)

	Interval			
Nuclide	Refueling (μCi/sec)	Non-refueling (μCi/sec)	Fuel Transfers (μCi/sec)	Water Removal (μCi/sec)
^{3}H	2.9(-2)	1.2(-1)	2.0(-2)	8.6(-2)
^{14}C	9.8(-3)	1.4(-2)	2.1(-2)	1.1(-3)
^{131}I	7.5(-4)	2.6(-4)	5.6(-5)	4.7(-5)

TABLE 5.3

UNIT #3 FUEL PIT AREA DUCT
GASEOUS ^{3}H AND ^{14}C SPECIES

Sample Period	HTO (%)[A]	CO_2 (%)[B]
12/8-12/12/77	**	**
12/14-12/28/77	[C]	[C]
12/28-1/11/78	83	33
1/11-1/25/78	67	9
1/25-2/8/78	47	21
2/8-2/22/78	[C]	[C]
2/22-3/9/78	[C]	[C]
3/9-3/15/78	[D]	[D]
3/21-4/3/78	88	35
4/3-4/20/78	24	2
4/20-5/4/78	57	58
5/4-5/18/78	7	27
5/18-6/1/78	53	11

[A] Oxidized fraction (%) of total ^{3}H in sample.

[B] Oxidized fraction (%) of total ^{14}C in sample.

[C] Oxidized ^{3}H and ^{14}C only.

[D] Short sample period due to power failure.

** - No Sample

TABLE 5.4

UNIT #3 TRITIUM MASS BALANCE

Date	Sample	Concentration (μCi/ml)	Volume (x 10^3 gal)	Activity (Curies)
11/21/77[1]	SFP	2.3(-3)	296.9	2.58
	RWST	4.3(-3)	328.0	5.34
	Reactor Coolant	3.8(-2)	70.5	10.14
	Total		695.4	18.06
12/30/77[2]	SFP	3.0(-3)	331.2	3.76
	RWST	4.4(-3)	270.0	4.50
	Reactor Coolant	1.7(-2)	70.5	4.50
	Total		671.7	12.76
1/3/78[3]	SFP	2.8(-3)	332.0	3.52
	RWST	3.7(-3)	35.0	0.49
	Reactor Coolant	5.1(-3)	361.5	6.98
	Total		728.5	10.99
1/11/78[4]	SFP	3.2(-3)	326.5	3.95
	RWST	3.7(-3)	37.0	0.52
	Reactor Coolant	4.5(-3)	361.5	6.16
	Total		725.0	10.63

---

[1] Samples were collected during power operations, before outage.

[2] Samples collected during outage. The transfer canal had been flooded and its contents (^3H activity) are included in the SFP total. Reactor cavity had not been flooded.

[3] Samples collected during outage. The transfer canal had been flooded and its contents (^3H activity) are included in the SFP total. Also the reactor cavity had been flooded. The reactor cavity contents (^3H activity) are included in the reactor coolant total. Fuel movement from the core to the SFP had not started.

[4] Samples collected during outage. After fuel movement from core to SFP had started. The transfer canal and reactor cavity ^3H activities are included in the SFP and reactor coolant totals.

were not performed during the Unit #3 refueling period, subsequent measurements made in April and May (see section 4.4) indicate an average ^{3}H concentration of 4(-2) µCi/ml in monitor tanks. Therefore, the 7 curie ^{3}H balance can be accounted for by as little as 6% of the ^{3}H in the monitor tanks originating from Unit #3 refueling waters.

5.3.3 Unit #3 Spent Fuel Pit Demineralizer Decontamination Factors

During February and April, five sets of samples were taken from the #3 SFP demineralizer inlet and outlet streams to determine demineralizer decontamination factors. Table 5.5 lists pertinent sample parameters for these sample sets.

Table 5.6 presents the measured DF's. The mixed-bed resin was replaced January 20, 1978, and was not replaced again during the SFP demineralizer study.

The inlet samples obtained during February, 1978 were single 450 ml samples taken at the beginning of each measurement. The effluent samples were nominally 100 liter samples collected on ion exchange resin samplers (4) for approximately 22 hours. For the 4/01/78 measurement, three sets of inlet samples were collected. Each set consisted of duplicate 450 ml samples which were collected at the beginning, middle, and end of the 24-hour sampling period. Average radionuclide concentratives for the 6 samples are presented in Appendix B Table B.31. The effluent sample was a 216 liter sample collected again in the ion exchange sampler. Inlet and outlet samples obtained on 4/15-16/78 were 450 ml.

As indicated in Table 5.6, the DF's measured on 4/1/78 were exceptionally high in comparison to the results obtained in February. During this time period, fuel elements were being transferred from #3 SFP to #4 SFP. The mode of operation during this period was to secure the #3 SFP purification loop when fuel was being moved. If the purification loop was in service, turbidity of the SFP waters hindered visibility. Consequently, the SFP purification system was put into service on weekends only. Samples were collected during purification system operation. The bed volumes, taken from plant information, denoted in Table 5.5 reflect this mode of operation.

Measurements (see Appendix B, Table B.31) indicated that on 4/1/78 the radionuclide concentration in the inlet to the SFP demineralizer had increased (e.g., by approximately a factor of 2 for cobalt, 10 for antimony and cesium, and 100 for iodine) while the radionuclide concentration in the outlet had decreased (e.g., by approximately a factor of 100 for cobalt and iodine, 1000 for antimony, and 10 for cesium). The tendency for demineralizer DF's to be directly releated to inlet concentration observed for other mixed-bed demineralizers (see section 2.2.7) may be responsible for a fraction, but not all, of this increase in DF's, The full explanation for the unusually high DF's observed on 4/1/78 has not yet been found.

TABLE 5.5

SAMPLE INFORMATION FOR UNIT #3 SFP DEMINERALIZER TESTS

Parameter	2/5/78	2/6/78	4/1/78	4/15/78	4/16/78
Bed Volumes	1.0(4)	1.1(4)	4.1(4)	4.3(4)	4.4(4)
pH	4.76	4.83	4.93	5.00	5.01
Boron (ppm)	2100	2120	2010	2000	1970
Conductivity (μmhos)	6.76	6.75	6.2	5.95	6.03
Temperature SFP (°F)	97	96	97	97	95

TABLE 5.6

MEASURED DF's FOR UNIT #3 SFP DEMINERALIZER

Nuclide	2/6/78	2/7/78	4/1/78	4/15/78	4/16/78
^{131}I	2.1 ± 0.3(0)	2.9 ± 0.9(0)	3.8 ± 0.4(4)	*	*
^{134}Cs	3.0 ± 0.8(2)	1.9 ± 0.4(2)	7.5 ± 0.4(4)	9.5 ± 0.7(-1)	8.8 ± 0.6(-1)
^{137}Cs	2.9 ± 0.4(2)	1.2 ± 0.2(2)	7.1 ± 0.3(4)	8.5 ± 0.6(-1)	7.9 ± 0.3(-1)
^{51}Cr	1.70 ± 0.08(1)	4.3 ± 0.2(1)	8.1 ± 0.9(3)	*	*
^{54}Mn	5.8 ± 0.6(1)	5.1 ± 0.4(1)	1.37 ± 0.05(5)	3.4 ± 0.9(0)	5.0 ± 1.1(0)
^{59}Fe	6.8 ± 1.3(0)	1.4 ± 0.5(1)	3.3 ± 0.4(4)	*	*
^{57}Co	1.90 ± 0.11(2)	1.4 ± 0.2(2)	4.0 ± 0.3(4)	*	*
^{58}Co	1.62 ± 0.04(2)	1.32 ± 0.06(2)	1.8 ± 0.1(5)	2.7 ± 0.2(1)	4.3 ± 0.2(1)
^{60}Co	5.2 ± 0.1(2)	3.6 ± 0.1(2)	4.0 ± 0.2(5)	5.8 ± 0.2(1)	5.8 ± 0.4(1)
^{65}Zn	3.0 ± 0.9(2)	*	*	*	*
^{95}Zr	1.6 ± 0.1(0)	1.0 ± 0.3(0)	1.6 ± 0.2(4)	*	*
^{95}Nb	7.0 ± 0.7(0)	5.8 ± 0.5(0)	1.48 ± 0.08(4)	3.2 ± 1.1(0)	1.2 ± 0.4(0)
^{103}Ru	2.08 ± 0.05(1)	1.7 ± 0.2(1)	1.2 ± 0.2(4)	*	*
^{106}Ru	1.9 ± 0.3(1)	1.8 ± 0.4(1)	*	*	*
^{110m}Ag	6.7 ± 0.7(1)	4.2 ± 1.0(1)	8.7 ± 0.9(4)	*	*
^{124}Sb	3.2 ± 0.2(0)	3.1 ± 0.1(0)	5.3 ± 0.5(4)	1.1 ± 0.1(0)	1.1 ± 0.1(0)
^{125}Sb	*	2.7 ± 0.1(0)	2.1 ± 0.1(4)	1.0 ± 0.1(0)	1.3 ± 0.1(0)
^{129m}Te	2.0 ± 0.1(0)	1.7 ± 0.3(0)	*	*	*
^{129}Te	9.5 ± 2.0(0)	*	*	*	*
^{141}Ce	1.5 ± 0.2(1)	2.3 ± 0.3(1)	*	*	*
^{144}Ce	2.5 ± 0.4(1)	2.0 ± 0.3(1)	6.6 ± 3.1(4)	*	*

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* Radionuclide not detected

Inspection of Table 5.6 also indicates that on 4/15-16/78 the DF's were much lower than observed in February although the inlet concentrations were in the same range. One reason for the observed decrease in DF's may be that the resin was becoming saturated (with both radioactive and non-radioactive species) due to high inlet concentrations caused by stirring up of SFP water during fuel transfer.

The DF's for beta-only-emitting radionuclides for the mixed-bed demineralizer are shown in Table 5.7. Table 5.8 lists the means and ranges for radionuclide concentrations in #3 SFP demineralizer inlet and outlet streams together with "best value" DF's. In obtaining these means, ranges, and DF's, data from the 4/1/78 measurements were not included due to the presence of high particulate concentrations. Comparison of these DF's with DF's obtained for the mixed-bed CVCS demineralizers (Tables 3.12 and 3.15) indicates that when the inlet concentrations were in the same range, the DF's were in the same range also. In cases where CVCS inlet concentrations were higher than for the SFP demineralizer, the CVCS demineralizer exhibited larger DF's. This gives further support to the observation that DF is related to inlet concentration.

TABLE 5.7

UNIT #3 SFP DEMINERALIZER DF's FOR BETA-ONLY EMITTING RADIONUCLIDES

Date	^{3}H	^{14}C	^{91}Y	^{89}Sr	^{90}Sr	^{55}Fe	^{63}Ni
11/21/77	0.98	0.30	32	>930	324	12.4	>1650
12/30/77	0.97	0.82	>22.5	>120	100	5.1	>6900
1/25/78	1.04	0.96	13.1	>830	58	1.4	127

TABLE 5.8

MEANS AND RANGES FOR RADIONUCLIDE CONCENTRATIONS AND "BEST VALUE" DF's FOR UNIT #3 SFP DEMINERALIZER

Nuclide	Inlet Concentration (μCi/ml) Mean	Inlet Concentration (μCi/ml) Range	Outlet Concentration (μCi/ml) Mean	Outlet Concentration (μCi/ml) Range	"Best Value" DF
^{131}I	5.3(-8)	5.3-5.3(-8)	2.1(-8)	1.8-2.5(-8)	2.5(0)
^{134}Cs	6.0(-6)	0.11-1.0(-5)	5.9(-6)	0.00037-1.22(-5)	1.0(0)
^{137}Cs	7.8(-6)	0.22-1.34(-5)	8.1(-6)	0.00086-1.65(-5)	1.0(0)
^{14}C	3.5(-8)	1.6-5.3(-8)	5.1(-8)	4.4-5.4(-8)	7(-1)
^{51}Cr	2.3(-5)	1.29-3.3(-5)	7.6(-7)	7.6-7.7(-7)	3.0(1)
^{54}Mn	1.9(-6)	1.5-2.1(-6)	2.2(-7)	0.36-4.4(-7)	8.6(0)
^{55}Fe	4.1(-5)	2.96-5.20(-5)	1.1(-5)	0.42-2.18(-5)	3.7(0)
^{59}Fe	3.6(-7)	1.7-5.5(-7)	3.1(-8)	2.5-3.8(-8)	1.2(1)
^{57}Co	2.0(-6)	1.8-2.15(-6)	1.3(-8)	1.13-1.5(-8)	1.5(2)
^{58}Co	4.0(-4)	2.49-5.8(-4)	4.8(-6)	3.14-5.8(-6)	8.3(1)
^{60}Co	4.6(-4)	3.55-5.7(-4)	3.8(-6)	1.05-6.6(-6)	1.2(2)
^{63}Ni	6.8(-4)	2.76-9.9(-4)	2(-6)	<0.04-6(-6)	3.4(2)
^{65}Zn	3.6(-6)	***	1.2(-8)	***	3.0(2)
^{95}Zr	1.0(-7)	0.82-1.2(-7)	7.8(-8)	7.8-7.9(-8)	1.3(0)
^{95}Nb	1.1(-6)	0.80-1.9(-6)	4.2(-7)	1.33-8.3(-7)	2.7(0)
^{89}Sr	9.4(-6)	0.12-1.86(-5)	<1(-8)		>9.4(2)
^{90}Sr	2.1(-6)	1.02-2.92(-6)	2(-8)	0.9-4.0(-8)	1.0(2)
^{91}Y	1.0(-6)	0.18-2.62(-6)	7.1(-8)	<0.09-2.0(-7)	1.4(1)
^{103}Ru	1.0(-6)	0.95-1.08(-6)	5.3(-8)	5.2-5.5(-8)	1.9(1)
^{106}Ru	1.2(-6)	1.2-1.3(-6)	6.8(-8)	6.4-7.3(-8)	1.8(1)
^{110m}Ag	6.4(-7)	6.1-6.7(-7)	1.3(-8)	0.91-1.6(-8)	4.9(1)
^{124}Sb	6.6(-6)	5.3-8.0(-6)	4.5(-6)	1.64-7.5(-6)	1.5(0)
^{125}Sb	7.7(-6)	3.16-1.1(-5)	6.3(-6)	1.19-8.9(-6)	1.2(0)
^{129m}Te	3.3(-6)	3.3-3.4(-6)	1.8(-6)	1.66-1.98(-6)	1.8(0)
^{141}Ce	5.5(-7)	5.2-5.8(-7)	3.0(-8)	2.5-3.5(-8)	1.8(1)
^{144}Ce	2.8(-6)	1.9-3.7(-6)	1.2(-7)	0.93-1.47(-7)	2.3(1)

*** Radionuclide detected in one measurement set only.

6. SECONDARY SYSTEM

6.1 Introduction

This section presents the results of studies of primary-to-secondary leakage at the Turkey Point Plant. Unit #3 operated with a primary-to-secondary leak in the C steam generator from late August 1977 until late November 1977 when the unit was shut down for scheduled refueling. During this period, Unit #3 also experienced main condenser tube leakage resulting in high chloride levels in the secondary system water due to sea water in-leakage. Primary-to-secondary leakage studies on Unit #3 were performed during the time period 11/9-21/77.

Primary-to-secondary leakage occurred in the 4A steam generator in mid-January 1978 and continued until mid-February 1978 when Unit #4 was shut down to repair the leaking steam generator. Studies on Unit #4 were conducted from 1/8/78 to 2/9/78.

Figure 6.1 is a diagram of the Turkey Point secondary system which represents both Units #3 and #4. Rated flows for the various secondary system flow paths are included on Figure 6.1. Figure 6.2 is a flow diagram for both Units #3 and #4 secondary systems. This figure shows the analysis points where samples were taken. Results from these samples were used to evaluate the performance of the secondary system components during a primary-to-secondary leak.

The following system description applies to both Unit #3 and Unit #4.

6.2 System Description

6.2.1 Steam Generators

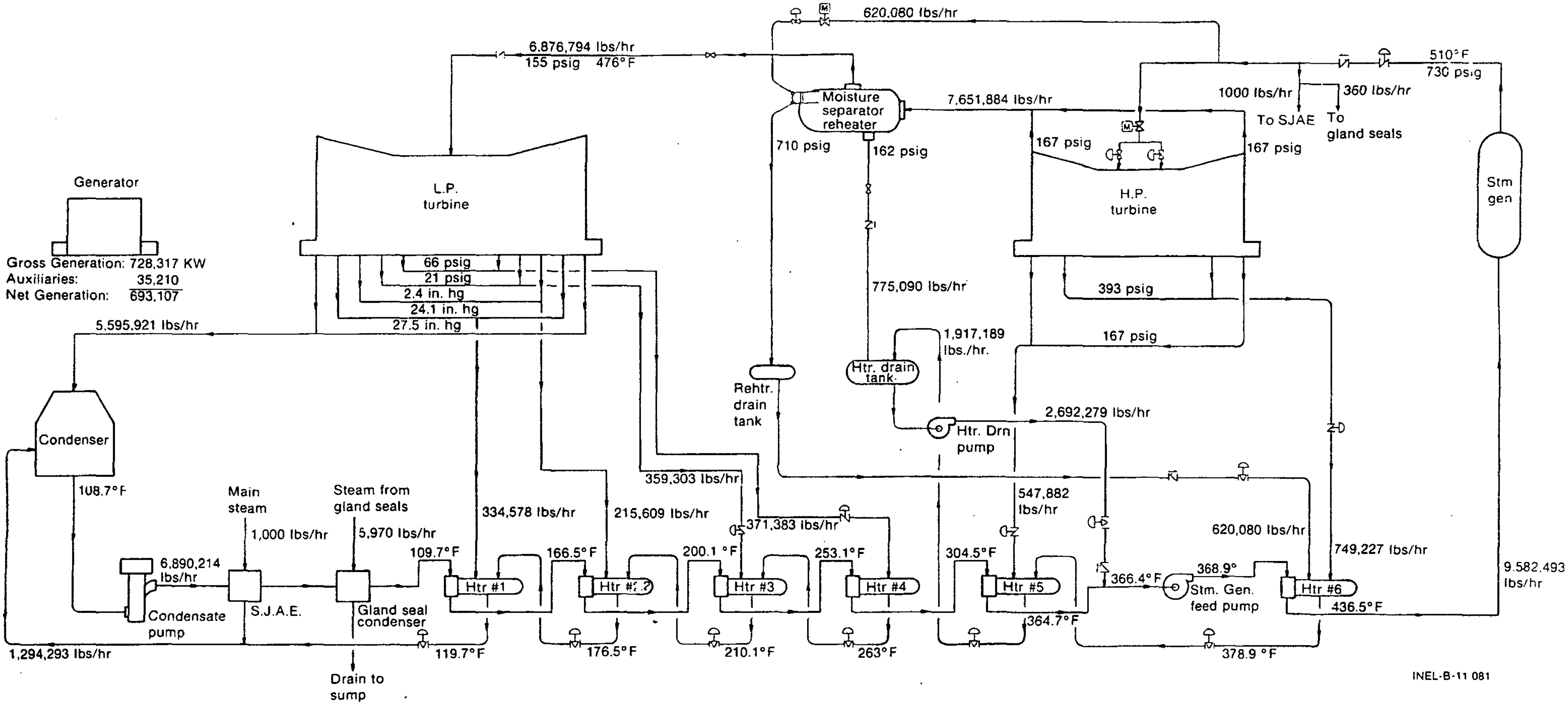
There are three Westinghouse U-tube steam generators per nuclear unit. Each generator is rated at 3.2(6) lbs/hr steam flow at 730 psig, 510°F and 0.25% moisture content. Normal operating volume is 25,000 gallons. Swirl Vane assemblies and chevron mist extractors remove moisture from the steam as it exits the top of the steam generator.

6.2.2 Turbine Train

The turbine train was fabricated by Westinghouse and consists of one high pressure (HP) and two low pressure (LP) turbine units.

1. HP Turbine - double flow type with one impulse stage and seven rows of reaction blades at each end of the turbine.
2. LP Turbine - double flow type with nine rows of reaction blades at each end of the turbine.

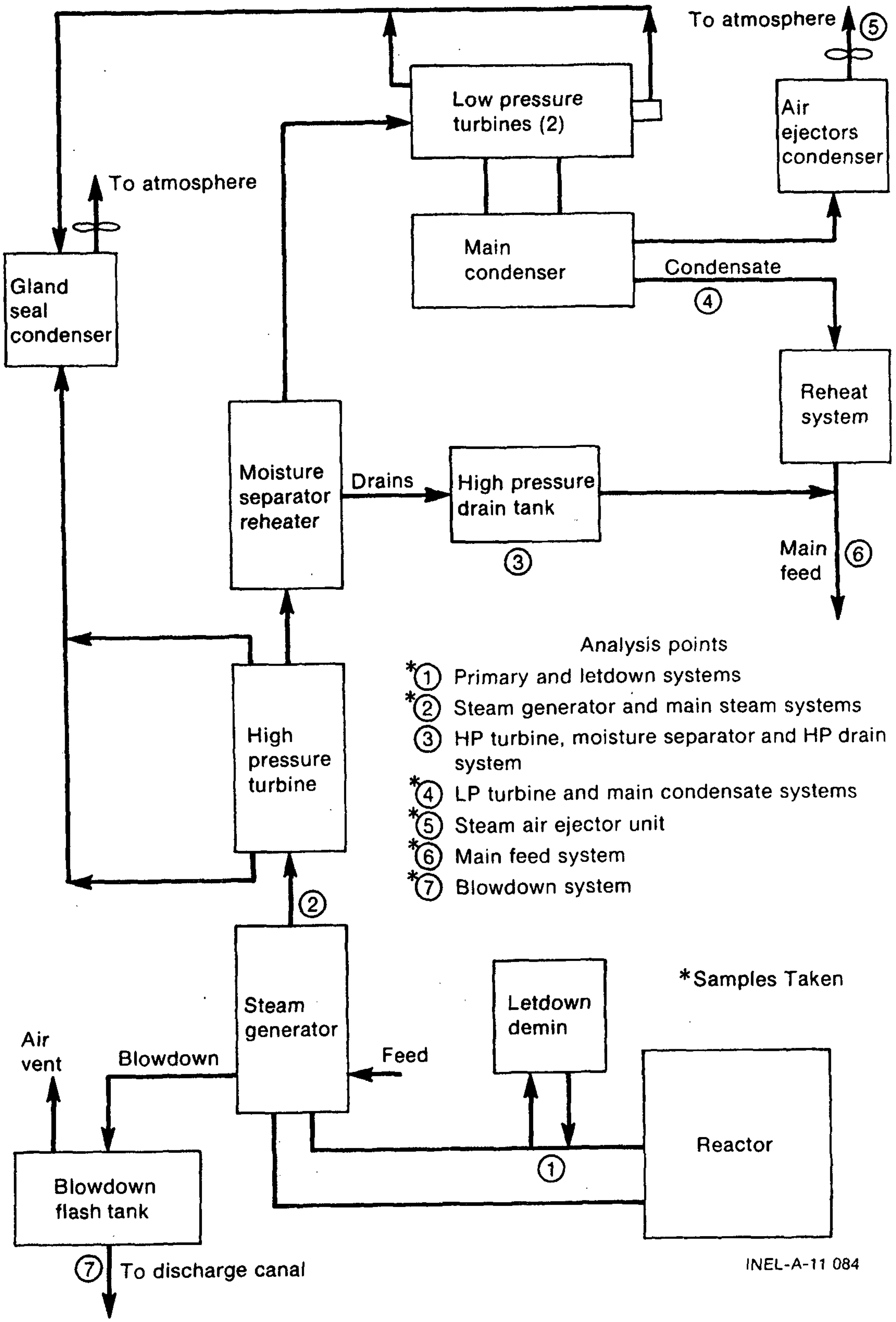
Figure 6.1
Diagram of Secondary System



Note: Numerical values shown are at 100% of rated flow. Flow values (lbs/hr) are for total plant flow.

Figure 6.2

Schematic Diagram of Secondary System



Analysis points

- *① Primary and letdown systems
- *② Steam generator and main steam systems
- ③ HP turbine, moisture separator and HP drain system
- *④ LP turbine and main condensate systems
- *⑤ Steam air ejector unit
- *⑥ Main feed system
- *⑦ Blowdown system

*Samples Taken

3. Turbine Train Rating

Output - 728 MW
Speed - 1800 RPM
Steam Inlet Pressure - 730 psig
Steam Inlet Temp. - 510°F
Exhaust Pressure - 1.5 in. Hg
Speed Control - Oil Governor
Overspeed Trip - 1998 RPM
Low Vacuum Trip - 20 in. Hg

6.2.3 Gland Seal

The steam used in the gland seal comes from two sources. At less than 15% HP turbine speeds, the gland seal is provided to the HP and LP turbines from main steam through a 3- to 5-lb pressure regulator. Rated steam flow is 5,280 lbs/hr. At greater than 15% HP turbine speeds, leakage from the HP turbine supplies steam to the gland seal.

6.2.4 Moisture Separator Reheater (MSR)

There are four of these U-tube and shell type reheaters per turbine train. The MSR's remove moisture from the steam between the HP and LP turbine units. As steam passes through knit wire demisters, 10% by volume of the entering steam leaves as moisture, the remaining 90% exits to the LP turbine as superheated steam.

6.2.5 Steam Jet Air Ejectors (SJAE)

Foster Wheeler (2 types)

1. Hogging Ejector - used for startups and emergencies. Flow rating unknown.
2. Main jet bank - the main SJAE bank consists of two sets of two-stage steam jet air ejectors and is used when the main condenser vacuum is between 25 and 29 inches. The flow rating is 15 cfm/set. One set is used while the other remains in standby.

Both types of SJAE's utilize low pressure (approximately 200 psig) steam for operation.

6.2.6 Main Condenser

The main condenser was fabricated by Foster Wheeler and consists of 2 shells per turbine unit. Each shell serves one LP turbine. The shells are interconnected with equaliziing lines between the steam space and the condenser hotwell. Hotwell level is maintained automatically between 25,000 and 40,000 gallons. Makeup water is supplied automatically from the condensate storage tank.

6.2.7 Condensate Storage Tank

The condensate storage tank has a capacity of 250,000 gallons, of which 185,000 gallons (80% level) is reserved for emergency cooldown. It is used to supply makeup to the main condenser hotwell by pump (450 gpm) during startup and automatically by gravity feed when the condenser is under vacuum. Makeup is shut off if the tank level falls below 79.3% level.

6.2.8 Condensate Pumps

There are two 4-stage, 1170 RPM vertical condensate pumps per unit. These pumps are rated at 8300 GPM (60% of full condensate system flow) with a total discharge head of 980 ft of water. They are designed to operate at a maximum condensate temperature of 180°F.

6.2.9 Feedwater Reheaters

1. High Pressure reheaters - there are two of these U-tube and shell reheaters. They utilize the HP turbine and moisture separator reheater drains to reheat feedwater. The drain water returns to the main feed system.
2. Low Pressure reheaters
   a. The air ejector and gland seal condensers are used to initially reheat the main condensate. Condensed steam from the air ejectors or gland seal return to the condenser hotwell.
   b. Four U-tube and shell reheaters utilize the low pressure turbine drains to reheat the main condensate. The LP turbine drain water returns to the main condenser hotwell.

6.2.10 Chemical Injection

There is one chemical tank and one chemical addition pump per unit. In addition there is one pump that can be shared by both units. The pumps are positive displacement.

6.2.11 Feed Water Pumps

There are two motor driven pumps per unit, each rated at 60% of full feedwater system flow. These pumps are horizontal, centrifugal, multi-stage split case units built by the Byron Jackson Co. The pumps are directly connected to 3600 RPM, 7000 horsepower drip proof GE motors. Pump speed/capacity is controlled by the steam generator level control system.

6.2.12 Circulating Water Pumps

There are four Foster Wheeler vertical, mixed-flow circulating water pumps per unit. Each pump is rated at 156,250 GPM with a dynamic water head of 23 feet. The pumps are driven at 236 RPM by 1250 horsepower Westinghouse motors.

6.2.13 Rated Flows

Tables 6.1 and 6.2 contain rated flows for a single unit in both lbs/hr and gm/sec. These values apply to both Unit #3 and #4 and are the flows used for calculations in this report.

6.3 Sample Points

During the sampling program, samples from the secondary system were taken locally and/or at a sampling sink located on the mezzanine level of the turbine deck.

Local samples were taken directly from the sampled component. These samples were:

a. Blowdown flash tank liquid stream and air vent
b. Condensate storage and recovery tanks
c. Air ejector exhaust

The condensate storage and recovery tanks were purged for 10 minutes at 2 liters/min prior to sampling.

The sampling sink contained sampling points for both Units #3 and #4. Samples taken at this location were routed through sample coolers. Samples available at the sink were:

d. Main Steam Samples - plant procedures require a flow of 1.1 liters/min for a representative sample. These sample lines are about 250 feet long and require a 30-minute purge prior to sampling.

e. Steam Generator Blowdown Samples - plant procedures require a flow of 1.2 liters/min for a representative sample. These lines are about 350 feet long and require a 45-minute purge prior to sampling.

f. Main Condensate Samples - plant procedures require a flow of 1.2 liters/min for a representative sample. These sample lines are about 250 feet long and require a 30-minute purge prior to sampling.

g. Main Feed Samples - plant procedures require a flow of 1.2 liters/min for a representative sample. These sample lines are about 250 feet long and require a 30-minute purge prior to sampling.

TABLE 6.1

RATED FLOWS FOR SECONDARY SYSTEM

System	Flow lbs/hr	Flow gm/sec
Main Steam (total)	9.6(6)	1.2(6)
Main Steam One (1) Steam Generator	3.2(6)	4.0(5)
High Pressure Drain	2.7(6)	3.4(5)
Main Condensate	6.9(6)	8.7(5)
Main Feed	9.6(6)	1.2(6)
Steam Jet Air Ejectors Fan Exhaust	15 cfm	7.1(3)

Makeup Rate = 120 gal/hr per 1000 lbs/hr of blowdown

High Pressure Drains (condenser bypass) = 28 percent of total flow

Condensate System = 72 percent of total flow.

TABLE 6.2

RATED FLOWS FOR PRIMARY SYSTEM

System	Flow lbs/hr	Flow gm/sec
Primary Coolant	1.3(7)	1.7(6)
Primary Letdown	5.4(4)	6.9(3)

Conversion Factor 1 lb/hr = 0.12623 gm/sec

6.4 Sample Types and Procedures

Samples obtained at Turkey Point were collected using the procedures outlined in reference 4. This included liquid, resin and gaseous samples:

a. Grab Samples - 450 ml of the liquid sample stream were collected in a glass bottle containing 9 ml of concentrated HCl and counted.

b. Resin Samples - a measured volume of liquid sample stream (100 ml/min) was passed through premeasured volumes of cation and anion resins. Total sample volumes varied from 10 to 40 liters. The resins were transferred to plastic vials and counted.

c. Iodine species samples - a measured volume (at 0.25 cfm) of the gaseous sample stream was passed through a species sample train. The sampler was disassembled and the individual species cups placed in plastic vials and counted.

d. Noble gas samples - 250 ml glass bombs were purged (at 0.7 l/min) with the gaseous sample stream for 10 bomb volumes (about 4 minutes) then sealed. The glass bombs were then counted directly.

e. ^{14}C-^{3}H Samples - a measured volume (at 100 ml/min) was passed through a sample train. The sample train was returned to INEL for processing and counting by liquid scintillation methods (12).

f. Air ejector and blowdown flash tank vent samples - portions of the sample streams were diverted to a sampler (iodine species sample train or 250 ml glass bomb) through 1/4 inch stainless steel tubing (probe) which had a 90° bend near the sampling end. The probe was placed in the center of the exhaust tube stream. This was accomplished in the blowdown flash tank vent (which rises about 12 feet above the main steam safety deck) by hanging the probe over the lip of the open vent and moving it toward the center of the vent.

Radionuclide concentrations for all samples (liquid and gaseous) obtained from the secondary system can be found in Appendix B, Tables B.34-B.55.

6.5 Results

6.5.1 Plant Chemistry

6.5.1.1 Reasons for Chemistry Control

In a PWR, the separation between the primary and secondary system fluids is at the steam generators. If this separation is breached, then the higher pressure (approximately 2000 psig) reactor coolant leaks into the lower pressure (approximately 700 psig) secondary system fluid. The result is a release of a portion of the radioisotopic inventory, which has accumulated in the reactor coolant from various sources, to the secondary system fluid in the steam generator. Once released to the secondary system, it is possible for a portion of these radioisotopes to be released to the environment via liquid and/or gaseous discharges from the secondary system.

Other objectives of chemistry control are the following. Chemicals are added to the reactor coolant system in order to reduce corrosion and to aid in reactivity control. Chemicals are added to the secondary waters in order to prevent corrosion and to reduce the fouling of heat transfer surfaces.

6.5.1.2 Reactor Coolant System

At Turkey Point hydrogen is added to the reactor coolant system through the chemical and volume control system to prevent corrosion by reducing the oxygen content of the reactor coolant. Lithium hydroxide (LiOH) is a chemical agent added for pH control. Boric acid is added to the reactor coolant to aid in reactivity control of the nuclear core by absorbing neutrons. A sidestream of reactor coolant is reduced in pressure and passed through filters and ion exchangers in order to remove ionic corrosion products, certain fission products, and insoluble corrosion products.

It has been determined (11) that the principal iodine species formed from fission product iodine are iodide (I^-), iodate ($I^{+5,+7}$), iodine (I_2), and organic iodine (CH_3I) and that thermal and radiation reductions occurring in the core yield largely I^- and some I_2. The principal iodine species expected in the reactor coolant, therefore, is I^- because of hydrogen overpressure, alkalinity, and the occurrence of radiation reduction reactions.

Decontamination factors (DF's) for the reactor coolant system at Turkey Point (see Section 3.3) indicate that > 99% of the radioiodine in the reactor coolant is iodide (I^-). Earlier studies on reactor coolant cleanup systems have also indicated that iodide (I^-) is the principal form present in the reactor coolant (11).

Tables 6.3 to 6.5 tabulate the reactor coolant chemistry conditions for Units #3 and #4 during the leak studies. It should be noted that Unit #3 was near end of core life at the time of the leak study.

6.5.1.3 Secondary Chemistry

Previous studies (5,6,11) of radioiodine behavior in secondary system fluids during periods of primary to secondary leakage have yielded variable results. Based on these studies and the reducing chemistry conditions maintained in the secondary system the following radioiodine behavior could be expected.

TABLE 6.3

AVERAGE PRIMARY CHEMISTRY - UNIT #3*

Period: 11/9-21/77

Limit	Reactor Coolant	Measurement	Pressurizer Liquid	Limit
4.2-10.5	7.80	pH	7.90	4.2-10.5
<1-40	7.60	Conductivity µmhos	7.41	<1-40
<0.10	<0.005	Oxygen (O_2) ppm	<0.005	<0.10
<0.15	<0.05	Chloride (Cl^-) ppm	<0.05	<0.15
<0.15	<0.04	Fluoride (F^-) ppm	<0.04	<0.15
0-4000	21.62	Boron (B) ppm	21.76	0-40001
	1.1	Gross β-γ 15 min µCi/ml		
	1.8(-2)	Gross β-γ 7 day µCi/ml		
	44.4	Demin Flow GPM		
0.22-2.22	0.57	Lithium (Li) ppm	0.58	0.22-2.22
25-35 Normal 15-50 Off-Normal	19.50	Hydrogen (H_2) cc/Kg	12.73	25-35 Normal 15-50 Off-Normal
$\leq$ 1.0		Crud ppm		
		Gross α µCi/ml		
		$^{131}I/^{133}I$		
	6.8(-2)	Tritium (H_3) µCi/ml		
		Chromate (CrO_4) ppm		

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* FPL analysis.

TABLE 6.4

AVERAGE PRIMARY CHEMISTRY - UNIT #4*

Period: 1/18-26/78

Limit	Reactor Coolant	Measurement	Pressurizer Liquid	Limit
4.2-10.5	6.68	pH	6.71	4.2-10.5
<1-40	12.1	Conductivity μmhos	13.1	<1-40
<0.10	<0.005	Oxygen (O_2) ppm	<0.005	<0.10
<0.15	<0.05	Chloride (Cl^-) ppm	<0.05	<0.15
<0.15	<0.04	Fluoride (F^-) ppm	<0.04	<0.15
0-4000	513	Boron (B) ppm	513	0-4000
	2.5(-1)	Gross β-γ 15 min μCi/ml		
	5.5(-3)	Gross β-γ 7 day μCi/ml		
	63.4	Demin Flow GPM		
0.22-2.22	1.10	Lithium (Li) ppm	1.11	0.22-2.22
25-35 Normal 15-50 Off-Normal	18.03	Hydrogen (H_2) cc/Kg	5.5	25-35 Normal 15-50 Off-Normal
$\leq$ 1.0		Crud ppm		
		Gross α μCi/ml		
		$^{131}I/^{133}I$		
	1.9(-1)	Tritium (H_3) μCi/ml		
		Chromate (CrO_4) ppm		

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* FPL analysis

TABLE 6.5

AVERAGE PRIMARY CHEMISTRY - UNIT #4*

Period: 2/3-9/78

Limit	Reactor Coolant	Measurement	Pressurizer Liquid	Limit
4.2-10.5	6.67	pH	6.80	4.2-10.5
<1-40	10.8	Conductivity µmhos	10.3	<1-40
<0.10	<0.005	Oxygen (O_2) ppm	0.006	<0.10
<0.15	<0.05	Chloride (Cl^-) ppm	<0.05	<0.15
<0.15	<0.04	Fluoride (F^-) ppm	<0.04	<0.15
0-4000	450	Boron (B) ppm	458	0-4000
	1.9(-1)	Gross β-γ 15 min µCi/ml		
	1.7(-2)	Gross β-γ 7 day µCi/ml		
	62	Demin Flow GPM		
0.22-2.22	0.99	Lithium (Li) ppm	0.99	0.22-2.22
25-35 Normal 15-50 Off-Normal	17.6	Hydrogen (H_2) cc/Kg	8.0	25-35 Normal 15-50 Off-Normal
≤ 1.0	<0.01	Crud ppm		
	4.7(-10)	Gross α µCi/ml		
		$^{131}I/^{133}I$		
	1.6(-1)	Tritium (H_3) µCi/ml		
		Chromate (CrO_4) ppm		

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* FPL analysis.

1. Radioiodine in the steam generator water probably exists as I^-. This valence state is favored by the anerobic and alkaline conditions existing in the steam generator as a result of feedwater chemical treatment.

2. Radioiodine in the steam probably exists as volatile and non-volatile fractions. The volatile fraction could constitute up to 25% of the total iodine fraction coming over in the steam. Possible iodine species in the volatile fraction are I_2, HOI, IOX and CH_3I. The non-volatile fraction could constitute 75% to >95% of the total iodine fraction coming over in the steam. Possible iodine species in the non-volatile fraction is I^-.

3. Iodide (I^-) passing through the turbines and main condenser may convert to other species of iodine as a result of air in-leakage and moist air. Possible iodine species are I_2 and HOI.

4. Iodide entering the air ejectors or gland seal exhausts could convert to other species of iodine and be discharged to the atmosphere. Possible iodine species are I_2, HOI, and CH_3I.

5. Iodide entering the secondary system in the steam could deposit on system surfaces as a result of iodine species conversion.

6. Iodine returning to the steam generators in the feedwater is probably I^-. This valence state is favored by the addition of hydrazine (N_2H_4) and other corrosion reducing chemicals to the feedwater.

Pressurized water reactors (PWR's) are subjected to a number of system changes which can result in a change of radioisotopic concentrations and/or changes in the secondary system chemistry. These changes could influence the behavior of radioiodine in the secondary system. The observed changes are:

1. Changes of the primary to secondary leak rate. This can result in increases or decreases in the amount of radioiodine entering the secondary system.

2. Power level changes usually result in a temporary elevation of radioisotopic concentrations in the reactor coolant. This phenomena known as spiking does result in temporary increases of radioiodine entering the secondary system.

3. Water loss from the system as a result of leaks and/or planned releases from the steam generator to reduce the total dissolved solids in the generator water (this operation is known as steam generator blowdown) result in the loss of radioiodine from the system.

4. Water replacement (this operation is known as makeup) to the system results in an apparent loss of iodine because the system volume is diluted.

5. The main condenser is operated under vacuum to increase turbine efficiency. Leaks in the main condenser result in raw circulating water being introduced into the secondary system waters. This can result in steam generator fouling, pH depression and changes in the reducing potential of the system.

6. During periods of primary to secondary leakage, boric acid (H_3BO_3) used in the reactor coolant as a reactivity control agent can leak into the secondary system. If the core is relatively new, then H_3BO_3 concentrations are high and leakage to the secondary system could result in pH depression.

At Turkey Point, ammonium hydroxide (NH_4OH) is added to Unit #3 secondary water in order to maintain system pH between 8.5 to 9.0 in the steam generators. Hydrazine (N_2H_4) is added to suppress oxygen. In Unit #4, morpholine (tetrahydro-1,4-isoxazine) is added to maintain pH between 8.5 to 9.0 in the steam generators. Morpholine is recommended by Westinghouse for plants using sea water cooling systems. Hydrazine (N_2H_4) is added to suppress oxygen.

In addition to these measures, in both Units #3 and #4 steam generator blowdown is utilized to control total dissolved solids, thereby reducing the fouling of heat transfer surfaces.

During the in-plant measurement study, Unit #3 periodically experienced a high chloride problem due to sea water leaking into the main condenser.

Tables 6.6 through 6.10 represent the average secondary chemistry conditions existing during each of the leak study periods. Tables 6.6 and 6.9 represent nontypical chemistry days for each unit. Table 6.6 shows the chemistry for Unit #3 at reduced power (50%), and Table 6.9 shows the chemistry for Unit #4 when power was increased from hot shutdown to 100%.

All secondary chemistry measurements were made by FPL personnel.

TABLE 6.6

AVERAGE SECONDARY CHEMISTRY - UNIT #3

Period: 11/9/77

	Steam Generator					
Measurement	A	B	C	Main Feed Water	Main Condensate	Limits
pH	7.56	7.74	7.33	8.87	8.89	*SG 8.5-9.0 Feed & Cond. 8.8-9.2
Cation Conductivity	50.0	50.0	190.0			SG only <2.0 µmhos
Total Conductivity				2.90		Feed & Cond. only <4.0 µmhos
Sodium (Na^+)	1.74	2.10	3.23			SG only <0.10 ppm
Chloride (Cl^-)	3.75	5.35	14.87		<0.05	SG - Feed - Cond. <0.15 ppm
Silica (SiO_2)	0.15	0.22	0.25			SG only <1.0 ppm
Total Hydroxide THC(OH^-) ppm	0.22	0.19	0.15			SG only
Ammonia (NH_3) ppm	0.16	0.10	0.14	0.34		SG - Feed - Cond.
Hydrazine (N_2H_4) ppm	0.005	0.005	0.004	0.008		Feed - Cond. 0.005 ppm > O_2 ppm
Free Hydroxide (OH^-) ppm	+0.06	+0.09	+0.01			SG only <+0.05 ppm
Oxygen (O_2) Dissolved ppm				<0.005	0.005	SG - Feed - Cond. <0.005 ppm
Iron (Fe^{+3}) ppm				<0.01		Feed-Cond. <0.01 ppm
Copper (Cu^{+2}) ppm				<0.005		Feed-Cond. <0.005 ppm
Gross β-γ Activity (Composite)						SG only <mDA
Tritium Activity (Composite)		1.8 (-4) µCi/ml				SG only <mDA
^{131}I Activity (Composite)						SG only Tech Spec 3.8
Individual Gross β-γ	5.8(-5) µCi/ml	6.0(-5) µCi/ml	2.8(-3) µCi/ml			SG only
NH_4OH - Unit #3 Morpholine - Unit #4						SG's only

TABLE 6.6 (cont'd)

AVERAGE SECONDARY CHEMISTRY - UNIT #3

Period: 11/9/77

Chemical Treatment

Volumes in Liters

	Unit #3			Unit #4	
	Hydrazine	NH_4OH		Hydrazine	Morpholine
3ASG			4ASG		
3BSG			4BSG		
3CSG			4CSG		
3FW		2.0	4FW		
Total		2.0	Total		

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* SG = Steam Generator

TABLE 6.7

AVERAGE SECONDARY CHEMISTRY - UNIT #3

Period: 11/14-21/77

Measurement	Steam Generator A	Steam Generator B	Steam Generator C	Main Feed Water	Main Condensate	Limits
pH	8.8	8.8	8.7	9.1	9.0	SG 8.5-9.0 Feed & Cond. 8.8-9.2
Cation Conductivity	1.0	1.6	1.3			SG only <2.0 μmhos
Total Conductivity				3.3	3.4	Feed & Cond. only <4.0 μmhos
Sodium (Na^+)	0.02	0.03	0.03			SG only <0.10 ppm
Chloride (Cl^-)	0.12	0.10	0.08			SG Feed-Cond. <0.15 ppm
Silica (SiO_2)	0.03	0.06	0.05			SG only <1.0 ppm
Total Hydroxide THC(OH^-) ppm	0.33	0.30	0.29			SG only
Ammonia (NH_3) ppm	0.26	0.24	0.21	0.46		SG - Feed - Cond.
Hydrazine (N_2H_4) ppm	0.04	0.04	0.05	0.02		Feed - Cond. 0.005 ppm > O_2 ppm
Free Hydroxide (OH^-) ppm	+0.05	+0.03	+0.05			SG only <+0.05 ppm
Oxygen (O_2) Dissolved ppm				<0.005	0.011	SG - Feed - Cond. <0.005 ppm
Iron (Fe^{+3}) ppm				<0.01		Feed-Cond. <0.01 ppm
Copper (Cu^{+2}) ppm				<0.005		Feed-Cond. <0.005 ppm
Gross β-γ Activity (Composite)						SG only <mDA
Tritium Activity (Composite)		1.3(-4) μCi/ml				SG only <mDA
^{131}I Activity (Composite)						SG only Tech Spec 5.8
Individual Gross β-γ	1.6(-4) μCi/ml	2.1(-4) μCi/ml	2.5(-3) μCi/ml			SG only
NH_4OH - Unit #3 Morpholine - Unit #4						SG's only

TABLE 6.7 (cont'd)

AVERAGE SECONDARY CHEMISTRY - UNIT #3

Period: 11/14-21/77

Chemical Treatment

Volumes in Liters

	Unit #3			Unit #4	
	Hydrazine	NH_4OH		Hydrazine	Morpholine
3ASG			4ASG		
3BSG			4BSG		
3CSG			4CSG		
3FW	10.3	1.74	4FW		
Total	10.3	1.74	Total		

TABLE 6.8

AVERAGE SECONDARY CHEMISTRY - UNIT #4

Period: 1/18-24/78

Measurement	Steam Generator			Main Feed Water	Main Condensate	Limits
	A	B	C			
pH	8.66	8.78	8.67	9.05	9.05	SG 8.5-9.0 Feed & Cond. 8.8-9.2
Cation Conductivity	1.72	0.89	1.06			SG only <2.0 µmhos
Total Conductivity				3.00	3.19	Feed & Cond. only <4.0 µmhos
Sodium (Na^+)	0.02	0.02	0.02			SG only <0.10 ppm
Chloride (Cl^-)	<0.05	<0.05	<0.05			SG - Feed - Cond. <0.15 ppm
Silica (SiO_2)	0.04	0.05	0.06			SG only <1.0 ppm
Total Hydroxide THC(OH^-) ppm	0.37	0.42	0.36			SG only
Ammonia (NH_3) ppm	0.19	0.27	0.20	0.42		SG - Feed - Cond.
Hydrazine (N_2H_4) ppm	0.05	0.04	0.05	0.025		Feed-Cond. 0.005 ppm > O_2 ppm
Free Hydroxide (OH^-) ppm	+0.02	-0.05	-0.05			SG only <+0.05 ppm
Oxygen (O_2) Dissolved ppm				<0.005	<0.005	SG - Feed - Cond. <0.005 ppm
Iron (Fe^{+3}) ppm				<0.01		Feed-Cond. <0.01 ppm
Copper (Cu^{+2})				<0.005		Feed-Cond. <0.005 ppm
Gross β-γ Activity (Composite)						SG only <mDA
Tritium Activity (Composite)	9.0(-5) µCi/ml					SG only <mDA
^{131}I Activity (Composite)						SG only Tech Spec 5.8
Individual Gross β-γ	1.5(-4) µCi/ml	2.3(-5) µCi/ml	2.9(-5) µCi/ml			SG only
NH_4OH - Unit #3 Morpholine - Unit #4	0.80	0.91	0.87			SG's only

TABLE 6.8 (cont'd)

AVERAGE SECONDARY CHEMISTRY - UNIT #4

Period: 1/18-24/78

Chemical Treatment

Volumes in Liters

	Unit #3			Unit #4	
	Hydrazine	NH_4OH		Hydrazine	Morpholine
3ASG			4ASG		
3BSG			4BSG		
3CSG			4CSG		
3FW			4FW		0.62
Total			Total		0.62

TABLE 6.9

AVERAGE SECONDARY CHEMISTRY - UNIT #4

Period: 1/26/78

	Steam Generator					
Measurement	A	B	C	Main Feed Water	Condensate	Limits
pH	8.06	8.21	8.07	8.75	8.76	SG 8.5-9.0 Feed & Cond. 8.8-9.2
Cation Conductivity	2.7	3.5	2.7			SG only <2.0 µmhos
Total Conductivity				2.50	2.45	Feed & Cond. only <4.0 µmhos
Sodium (Na^+)	0.12	0.26	0.15			SG only <0.10 ppm
Chloride (Cl^-)	0.15	0.30	0.15		0.05	SG - Feed - Cond. <0.15 ppm
Silica (SiO_2)	0.06	0.07	0.07			SG only <1.0 ppm
Total Hydroxide THC(OH^-) ppm						SG only
Ammonia (NH_3) ppm						SG - Feed - Cond.
Hydrazine (N_2H_4) ppm				0.11		Feed - Cond. 0.005 ppm > O_2 ppm
Free Hydroxide (OH^-) ppm						SG only <+0.05 ppm
Oxygen (O_2) Dissolved ppm				<0.005	<0.005	SG - Feed - Cond. <0.005 ppm
Iron (Fe^{+3}) ppm				<0.01		Feed-Cond. <0.01 ppm
Copper (Cu^{+2}) ppm				<0.005		Feed-Cond. <0.005 ppr
Main Steam ^3H Composite		3.2(-4) µCi/ml				SG only <mDA
Tritium Activity (Composite)		4.8(-4) µCi/ml				SG only <mDA
^{131}I Activity (Composite)						SG only Tech Spec 3.8
Individual Gross β-γ	6.5(-3) µCi/ml	1.4(-3) µCi/ml	1.1(-3) µCi/ml			SG only
NH_4OH - Unit #3 Morpholine - Unit #4						SG's only

TABLE 6.9 (cont'd)

AVERAGE SECONDARY CHEMISTRY - UNIT #4
Period: 1/26/78

Chemical Treatment

Volumes in Liters

	Unit #3			Unit #4	
	Hydrazine	NH_4OH		Hydrazine	Morpholine
3ASG			4ASG		
3BSG			4BSG		
3CSG			4CSG		
3FW			4FW		1.0
Total			Total		1.0

TABLE 6.10

AVERAGE SECONDARY CHEMISTRY - UNIT #4

Period: 2/3-9/78

	Steam Generator					
Measurement	A	B	C	Main Feed Water	Condensate	Limits
pH	8.30	8.37	8.25	8.98	9.07	SG 8.5-9.0 Feed & Cond. 8.8-9.2
Cation Conductivity	1.62	1.69	1.80			SG only <2.0 µmhos
Total Conductivity				3.64	3.72	Feed & Cond. only <4.0 µmhos
Sodium (Na^+)	0.03	0.03	0.03			SG only <0.10 ppm
Chloride (Cl^-)	0.06	0.07	0.05			SG - Feed - Cond. <0.15 ppm
Silica (SiO_2)	0.05	0.06	0.06			SG only <1.0 ppm
Total Hydroxide THC(OH^-) ppm	0.44	0.60	0.57			SG only
Ammonia (NH_3) ppm	0.15	0.22	0.17	0.36		SG - Feed - Cond.
Hydrazine (N_2H_4) ppm	0.043	0.04	0.04	0.024		Feed - Cond. 0.005 ppm > O_2 ppm
Free Hydroxide (OH^-) ppm	-0.22	-0.17	-0.15			SG only <+0.05 ppm
Oxygen (O_2) Dissolved ppm				<0.005	<0.005	SG - Feed - Cond. <0.005 ppm
Iron (Fe^{+3}) ppm				<0.01		Feed-Cond. <0.01 ppm
Copper (Cu^{+2}) ppm				<0.005		Feed-Cond. <0.005 ppm
Gross β-γ Activity (Composite)						SG only <mDA
Tritium Activity (Composite)		6.9(-4) µCi/ml				SG only <mDA
^{131}I Activity (Composite)						SG only Tech Spec 5.8
Individual Gross β-γ	1.3(-3) µCi/ml	2.7(-4) µCi/ml	2.8(-4) µCi/ml			SG only
NH_4OH - Unit #3 Morpholine - Unit #4	2.45	2.70	2.71			SG's only

TABLE 6.10 (cont'd)

AVERAGE SECONDARY CHEMISTRY - UNIT #4

Period: 2/3-9/78

Chemical Treatment

Volumes in Liters

	Unit #3			Unit #4	
	Hydrazine	NH OH		Hydrazine	Morpholine
3ASG			4ASG		
3BSG			4BSG		
3CSG			4CSG		
3FW			4FW	2.5	1.58
Total			Total	2.5	1.58

6.5.2 Primary-to-Secondary Leak Rates

The source of the radioisotopes in the secondary waters is reactor coolant that leaks into the steam generator. In order to investigate the behavior of radioisotopes in the secondary waters, it is necessary to determine a viable leak rate for reactor coolant coming into the steam generator water.

One method of determining a primary-to-secondary leak rate is to use tritium (^3H) concentrations, because ^3H is volatile, has a long half-life, and does not plate out on the system surfaces. This is the method used by the plant to determine primary-to-secondary leak rates. Another method utilizes concentrations of other radionuclides (e.g., radioactive isotopes of iodine, sodium, or cesium). These radionuclides can yield valid leak rates only if there is no plate out on system surfaces and if effects of radioactive decay are considered. An indication of losses (plate out or any other) in the secondary system can be obtained by a comparison of the leak rate values determined using ^3H with corresponding values determined using the other radionuclides.

For each steam generator we can write the activity balance equation for a radionuclide

$$\frac{dA}{dt} = l\ C_P - b\ C_{SG} - s\ C_{MS} + s\ C_{FW} - \lambda M\ C_{SG}$$

where

A = total activity of the radionuclide in the steam generator

t = time

l = leak rate (gm/sec)

b = blowdown rate (gm/sec)

s = steaming rate (gm/sec)

λ = decay constant (sec^{-1}) for radionuclide

M = mass of water in the steam generator (gms)

C_P = radionuclide concentration in reactor coolant (µCi/gm)

C_{SG} = radionuclide concentration in steam generator bottoms (µCi/gm)

C_{MS} = radionuclide concentration in main steam (µCi/gm)

C_{FW} = radionuclide concentration in feedwater (µCi/gm)

At equilibrium $\frac{dA}{dt} = 0$. Therefore, if we assume equilibrium the activity balance equation can be solved for the leak rate l:

$$(1)\quad l = \frac{[C_{SG}(b + \lambda M) + s(C_{MS} - C_{FW})]}{C_P}$$

Summing equation (1) for the three steam generators yields

$$\text{Total Leak Rate } (L) = \frac{[\Sigma C_{SG}(b + \lambda M) + s(\Sigma C_{MS} - 3C_{FW})]}{C_P}$$

$$(2)\quad L = \frac{[\Sigma C_{SG}(b + \lambda M) + 3s\ (\text{average } C_{MS} - C_{FW})]}{C_P}$$

If we assume there are no losses in the secondary system except for the losses due to radioactive decay in the steam generator and due to steam generator blowdown (both of which are accounted for in equation (2)), then

$$C_{FW} = \text{Average } C_{MS}$$

and the second term of equation (2) = 0. We therefore get

$$(3)\quad L = \frac{\Sigma C_{SG}\ (b + \lambda M)}{C_P}$$

Plant leak rates, blowdown rates and steaming rates are usually expressed as gal/hr and lbs/hr. The metric conversions are:

1 gal/hr = 1.05 gm/sec

1 lb/hr = 0.12623 gm/sec

The data in Table 6.11 show that, except on 1/26/78 and 2/3/78, the leak rates determined using iodine, sodium, and cesium compare well with leak rates determined using ^{3}H. The reason for the differences between the leak rates calculated using ^{3}H and the other radionuclides on 1/26/78 and 2/3/78 is not apparent. In addition, except during periods when the reactor power level changed and equilibrium cannot be assumed, iodine, sodium, cesium, and ^{3}H yielded approximately the same leak rate. This indicates that there is little or no losses (such as plate out) of iodine, sodium, or cesium in the secondary system.

6.5.3 Relative Iodine Isotopic Age

The average isotopic ages relative to the reactor coolant were determined for the samples obtained from the secondary system (e.g., steam generator water, flash tank effluent, main steam, condensate

TABLE 6.11

PRIMARY-TO-SECONDARY LEAK RATE (gal/hr)

Date	Unit	Steam Generator Blowdown lb/hr	Power Level %	^{131}I	^{133}I	^{135}I	^{24}Na	^{134}Cs	^{137}Cs	Plant Valve (^{3}H)
11/9/77	3	8.3(3)	50**	3.2 ± 0.3	4.6 ± 0.4	†	4.4 ± 0.7	6.3 ± 0.8	7.4 ± 0.9	7.7
11/14/77*	3	1.2(4)	100	6.8 ± 0.4*	5.0 ± 0.2*	†	†	†	†	4.6
11/17/77	3	1.2(4)	100	6.9 ± 0.8	0.5 ± 0.5††	6.7 ± 0.5	4.7 ± 0.4	5.2 ± 0.5	6.6 ± 0.6	4.5
11/18/77	3	1.2(4)	100	6.7 ± 0.7	5.6 ± 0.7	5.5 ± 0.4	4.6 ± 0.5	6.0 ± 0.7	5.8 ± 0.6	4.9
11/21/77	3	1.1(4)	90**	5.7 ± 0.4	2.1 ± 0.1	4.4 ± 0.5	†	†	†	3.9
1/18/78	4	1.5(4)	100	1.0 ± 0.2	1.1 ± 0.2	1.1 ± 0.2	0.9 ± 0.2	1.1 ± 0.3	0.7 ± 0.2	1.3
1/19/78	4	1.5(4)	100	1.4 ± 0.1	1.4 ± 0.1	1.6 ± 0.2	1.3 ± 0.2	1.3 ± 0.6	1.3 ± 0.3	1.4
1/20/78	4	1.5(4)	100	1.5 ± 0.2	1.4 ± 0.2	1.2 ± 0.2	1.3 ± 0.2	1.5 ± 0.4	1.2 ± 0.3	1.7
1/22/78	4	1.5(4)	100	4.0 ± 0.5	4.0 ± 0.4	4.5 ± 0.5	3.3 ± 0.3	3.4 ± 0.5	3.3 ± 0.4	3.6
1/23/78	4	1.5(4)	100	4.4 ± 0.5	4.5 ± 0.4	4.5 ± 0.4	4.2 ± 0.5	3.3 ± 0.6	4.4 ± 0.5	3.0
1/24/78	4	1.5(4)	100	5.7 ± 0.7	5.9 ± 0.3	6.1 ± 0.5	4.1 ± 0.4	3.2 ± 0.4	4.1 ± 0.7	5.1
1/25/78 - Unit #4 In Hot Shutdown - Return to power 0530 1/26/78										
1/26/78 AM 0900	4	1.1(4)	**	30.0 ± 3.0	32.4 ± 2.8	21.2 ± 1.4	13.5 ± 1.1	24.3 ± 2.8	26.5 ± 3.0	16.4
1/26/78 PM 1300	4	1.0(4)	**	25.5 ± 2.7	26.1 ± 2.2	18.3 ± 1.2	13.5 ± 1.1	20.1 ± 2.2	22.3 ± 2.4	15.6
2/3/78	4	1.4(4)	**	37.8 ± 3.6	31.2 ± 3.0	28.8 ± 2.0	23.8 ± 2.6	28.4 ± 3.9	28.7 ± 3.4	16.9

* - Plant values used for calculations.
11/14/77 ^{131}I = 4.3(-5) μCi/gm and ^{133}I = 2.2(-4) μCi/gm for steam generator 3C.
11/21/77 ^{131}I = 4.4(-6), ^{133}I = 1.1(-5) and ^{135}I = 7.5(-6) μCi/gm for steam generator 3B
^{135}I = 3.5(-4) μCi/gm for steam generator 3C.

** - Transient dates when a plant power change occurred.

† - No data for calculation.

†† - Data is questionable.

and main feed) using ^{131}I to ^{133}I ratios. The method of calculation is shown in Table 6.12. Data for the calculations were taken from the Appendix tables. The calculations were made in order to determine the age of iodine in the secondary system and to estimate the relative residence times for iodine in the various components of the secondary system.

Analysis of the age data indicated the following. In Unit #3 the age of the water in all three steam generators was about the same (approximately 20 hours older than reactor coolant). This is to be expected because steam generator 3C had been leaking at a constant rate for almost 3 months and equilibrium conditions should exist. In Unit #4 the age of the iodine in the 4A steam generator was younger (about 6 hours) than the non-leaking steam generators. The other secondary system components (i.e., steam, air ejectors, condensate, feed) were the same age (about 8.5 hours older than reactor coolant) as the non-leaking steam generators. This is to be expected because the 4A steam generator had been leaking at a steadily increasing rate for a few days (Unit #4 had been leaking for 2 days before the study began) and equilibrium conditions should not exist. However, in Unit #4 all the component ages became older and the age difference between 4A steam generator and the other system components became smaller as time progressed, indicating that the system would reach an equilibrium in time.

The losses of iodine in the secondary system have been attributed to losses in the steam generator as a result of radioactive decay and blowdown (see Section 6.5.2). If we assume the average total blowdown rate for Unit #3 is 3.3(4) lbs/hr and for Unit #4 is 4.2(4) lbs/hr (see Table 6.11), the secondary system operating volume (H_2O) is 270,000 gallons (data supplied by FPL), and the rated secondary system steam flow is 9.2(6) lbs/hr (Table 6.1), then the secondary system recirculation time can be calculated to be about 15 minutes. In Unit #3 a complete exchange of the secondary water will occur in about 68 hours and in Unit #4 a complete exchange of water will occur in about 54 hours. If iodine losses were occurring in the secondary system due to deposition and resuspension, then the average system ages could approach or exceed these system exchange times. The measured system ages indicate that this is not the case. The average system ages of 20 hours older than reactor coolant for Unit #3 and 8.5 hours older than reactor coolant for Unit #4 point to steam generator blowdown as the principal source of iodine loss. This reinforces the conclusion that iodine losses in the secondary system occur as a result of radioactive decay and blowdown.

Analysis of the age data for the blowdown flash tank indicated the following. For both Units #3 and #4 the iodine entering the blowdown flash tank was the same age as the iodine leaving the tank. This means the transit time for iodine in the blowdown flash tank was short, indicating that the iodine enters and exits the tank in the liquid. The residence time for iodine in the blowdown flash tank would preclude losses due to deposition and/or iodine conversion in the tank.

TABLE 6.12

ISOTOPIC AGE CALCULATIONS

The equation used for calculations is:

$$R = R_o e^{(\lambda_{131}-\lambda_{133})t}$$

Solving for t

$$t = \ln \frac{R}{R_o} \times \frac{1}{\lambda_{131}-\lambda_{133}}$$

Where $\lambda = \frac{\ln 2}{t_{1/2}}$ and $t_{1/2}\begin{cases} {}^{131}I = 8.04 \text{ days} = 192.96 \text{ hours} \\ {}^{133}I = 20.8 \text{ hours} \end{cases}$

$$\lambda_{131} = \frac{0.69315}{192.96 \text{ hours}} = 3.59(-3)/\text{hours}$$

$$\lambda_{133} = \frac{0.69315}{20.8 \text{ hours}} = 3.33(-2)/\text{hours}$$

R = ${}^{133}I/{}^{131}I$ ratio in a liquid

R_o = ${}^{133}I/{}^{131}I$ ratio in a source (i.e., primary coolant)

t = time interval between R_o and R

6.5.4 Blowdown Flash Tank

The blowdown from each of the three steam generators for a unit discharges to a common blowdown flash tank (BDFT). Water leaving the blowdown flash tank is routed to the discharge canal or the radwaste system depending on the activity level of the effluent. During the in-plant studies, all blowdown from both secondary units went to the discharge canal. Water vapor "flashing off" in the tank is vented directly to the atmosphere. Samples were taken from each individual steam generator blowdown and the BDFT liquid effluent on both Units #3 and #4. In addition, an iodine species and two noble gas samples were taken from the Unit #4 BDFT vent.

Average inlet values were calculated from the steam generator blowdown concentrations for radionuclides entering the BDFT. The average value of the three steam generator blowdown radionuclide concentrations and the total blowdown rates for a given sample day were used in this calculation. Table 6.13 tabulates these data for radioiodine for Units #3 and #4. Table 6.14 tabulates the same data for the other radionuclides detected in Units #3 and #4.

Direct measurements of the vapor flow through the BDFT vent and the liquid effluent flow could not be made. Direct determination of the release rate (μCi/sec) of radionuclides leaving the BDFT, therefore, cannot be made. It is possible, however, to estimate the fractions of the blowdown that leave the BDFT as vapor and as liquid by assuming that all the ^{24}Na that enters the BDFT leaves it in the liquid effluent (i.e., ^{24}Na is not volatile so no ^{24}Na leaves via the BDFT vent). The rate at which ^{24}Na enters the BDFT (i.e., ^{24}Na concentration in blowdown times total blowdown rate) then is equal to the rate at which it leaves the BDFT (i.e., ^{24}Na concentration in BDFT liquid effluent times liquid effluent flow rate), and the liquid effluent flow rate can be calculated. Table 6.15 presents the calculated fractions of blowdown water leaving the BDFT in the liquid and vapor phases. Average fractional flows are 56 ± 12% liquid, 44 ± 12% vapor for Unit #3 and 77 ± 3% liquid, 23 ± 3% vapor for Unit #4.

Results obtained from one iodine species and two noble gas samples taken on the Unit #4 BDFT vent are tabulated in Table 6.16. As indicated, no radioiodine was detected, but low concentrations of cobalt and cesium were detected in the iodine species sample and one of the noble gas samples. No radioactive noble gases were detected in the noble gas samples. An upper limit for radioiodine leaving the BDFT vent can be obtained by using the lower limits of the iodine species sample (5.8(-11) μCi/cc for ^{131}I and 9.8(-10) μCi/cc for ^{133}I), the average total blowdown rate for Unit #4 (4.2(4) lbs/hr), and the average fractional flow through the BDFT vent for Unit #4 (23%). Resulting upper limits are 7.1(-8) μCi/sec for ^{131}I and 1.2(-6) μCi/sec for ^{133}I. Comparing these upper limits with the inlet values obtained on the same date as the iodine species sample (Table 6.13) indicates that less than 7(-4)% of the ^{131}I and less than 9(-3)% of the ^{133}I which enters in the blowdown liquid leaves the BDFT through the vent.

TABLE 6.13

BLOWDOWN FLASH TANK IODINE ACTIVITY

Date	Unit	Blowdown Rate lb/hr	Inlet Activity Rate† (μCi/sec) ^{131}I	^{133}I
11/9/77	3	2.0(4)	1.6(-1)	2.9(-2)
*11/14/77	3	3.7(4)	1.0(-1)	4.7(-1)
1/18/78	4	4.5(4)	7.4(-3)	1.2(-2)
1/19/78	4	4.5(4)	9.7(-3)	1.4(-2)
1/20/78	4	4.5(4)	1.0(-2)	1.3(-2)
1/22/78	4	4.5(4)	2.4(-2)	3.5(-2)
1/23/78	4	4.5(4)	3.1(-2)	4.6(-2)
1/24/78	4	4.5(4)	3.5(-2)	5.3(-2)
1/26/78	4	3.2(4)	1.8	8.9(-1)
1/26/78	4	3.0(4)	1.2(-1)	6.1(-1)
2/3/78	4	4.2(4)	2.0(-1)	3.5(-1)

Conversion Factor 1 lb/hr = .12623 cc/sec

† Calculated using the equation

$$\text{Inlet Activity Rate} = \frac{A + B + C}{3} \times BD$$

where

A,B,C = Steam Generator Bottom Radionuclide Concentrations (μCi/cc)

BD = Total Blowdown Rate (cc/sec) of Steam Generators

* - Plant data used for S.G. Blowdown 'C'.

TABLE 6.14

BLOWDOWN FLASH TANK INLET

		Inlet Activity Rate† (μCi/sec)								
Date	Unit	^{24}Na	^{54}Mn	^{58}Co	^{60}Co	^{65}Zn	^{134}Cs	^{136}Cs	^{137}Cs	^{138}Cs
11/9/77	3	6.5(-3)	<2.3(-4)	<6.0(-4)	<5.5(-5)	<7.1(-4)	7.3(-3)	1.0(-3)	1.4(-2)	4.0(-2)
11/14/77	3	Insufficient samples to calculate these values								
1/18/78	4	5.3(-3)	1.5(-3)	3.4(-3)	3.0(-3)	<4.7(-4)	8.1(-4)	1.7(-4)	1.1(-3)	*
1/19/78	4	6.3(-3)	<6.4(-4)	<1.5(-3)	<2.7(-3)	<1.2(-3)	1.0(-3)	<8.0(-4)	2.0(-3)	9.1(-2)
1/20/78	4	5.9(-3)	1.6(-4)	<4.7(-4)	<3.7(-2)	<5.4(-4)	2.6(-3)	<5.9(-4)	2.3(-3)	<2.6(-2)
1/22/78	4	1.3(-2)	<2.4(-3	<1.3(-3)	3.8(-4)	<7.7(-4)	2.9(-3)	<8.6(-4)	5.6(-3)	1.9(-2)
1/23/78	4	2.0(-2)	<2.0(-3)	<1.5(-3)	<1.0(-3)	<1.3(-3)	3.5(-3)	<4.7(-4)	8.2(-3)	1.3(-2)
1/24/78	4	2.2(-2)	<2.6(-3)	<2.2(-3)	<1.2(-3)	<1.1(-3)	4.4(-3)	<1.2(-3)	8.7(-3)	2.0(-2)
1/26/78	4	3.7(-2)	<1.1(-2)	7.3(-3)	1.2(-3)	<5.1(-4)	5.5(-2)	2.8(-2)	8.3(-2)	7.8(-2)
1/26/78	4	3.6(-2)	<8.7(-)	<4.9(-3)	3.1(-3)	<1.5(-3)	4.0(-2)	1.9(-2)	6.2(-2)	5.3(-2)
2/3/78	4	8.1(-2)	<1.6(-3)	5.4(-4)	<1.2(-3)	<1.8(-3)	2.3(-2)	<1.1(-3)	4.5(-2)	1.1(-1)

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* - Radionuclide not detected.

† - Calculated using equation in footnote to Table 6.12.

TABLE 6.15

FLOW THROUGH BLOWDOWN FLASH TANK

		^{24}Na Concentration (μCi/ml)		Estimated Fractional Outlet Flows	
Date	Unit	Inlet	Outlet	Liquid (%)[†]	Vapor (%)[††]
11/9/77	3	2.6 ± 0.3(-6)	4.6 ± 0.8(-6)	56 ± 12	44 ± 12
1/18/78	4	7.2 ± 1.1(-7)	1.0 ± 0.2(-6)	72 ± 18	28 ± 18
1/19/78	4	1.11 ± 0.09(-6)	1.8 ± 0.3(-6)	62 ± 11	38 ± 11
1/20/78	4	1.0 ± 0.1(-6)	<9.2(-7)		
1/22/78	4	2.3 ± 0.1(-6)	3.4 ± 0.2(-6)	68 ± 5	32 ± 5
1/23/78	4	3.4 ± 0.2(-6)	4.2 ± 0.4(-6)	81 ± 9	19 ± 9
1/24/78	4	3.8 ± 0.2(-6)	5.2 ± 0.4(-6)	73 ± 7	27 ± 7
1/26/78	4	9.1 ± 0.4(-6)	1.15 ± 0.08(-5)	79 ± 7	21 ± 7
1/26/78	4	9.5 ± 0.3(-6)	1.07 ± 0.09(-5)	89 ± 5	11 ± 5
2/3/78	4	1.53 ± 0.04(-5)	2.1 ± 0.1(-5)	73 ± 4	27 ± 4

[†] $\% \text{ Liquid} = \frac{^{24}\text{Na Inlet Concentration}}{^{24}\text{Na Outlet Concentration}} \times 100$

[††] % Vapor = 100 - % Liquid

TABLE 6.16

BLOWDOWN FLASH TANK VENT

			Radionuclide Concentrations (μCi/cc)								
Date	Unit	Sample	^{131}I	^{132}I	^{133}I	^{134}I	^{135}I	^{134}Cs	^{137}Cs	^{58}Co	^{60}Co
1/19/78	4	Noble Gas	<4.9(-8)	*	<3.0(-7)	*	<3.5(-6)	*	*	*	*
1/20/78	4	Noble Gas	<9.7(-8)	*	<2.2(-7)	*	*	6.4 ± 3.8 (-8)	7.9 ± 3.8 (-8)	<6.3(-8)	<1.5(-7)
1/20/78	4	Iodine	<5.8(-11)	*	<9.8(-10)	*	*	2.2 ± 2.1 (-10)	5.8 ± 1.8 (-10)	3.9 ± 1.1 (-10)	<1.1(-9)

---

* Radionuclide not detected.

6.5.5 Steam Generator Decontamination Factors

Steam generator decontamination factors (DF's) can be used to determine information about the operation of a steam generator and about radionuclides entering the secondary system via the main steam. The steam generator DF is defined as

$$DF = \frac{C_{SG}}{C_{MS}}$$

where

C_{SG} - radionuclide concentration in steam generator water

C_{MS} - radionuclide concentration in main steam.

For any radionuclide the activity in the main steam is made up of two components - the activity in the vapor and the activity entrained in moisture droplets. Since activity is the product of concentration and mass, we can write

$$C_{MS}\, M_{MS} = C_V\, M_V + C_M\, M_M$$

where

C_{MS}, C_V, C_M - radionuclide concentration in main steam, vapor component, moisture droplet component

M_{MS}, M_V, M_M - mass of main steam, vapor component, moisture droplet component.

Solving for M_M/M_{MS} which is the entrainment fraction (moisture carryover fraction) and noting that the concentration in the moisture droplets is equal to concentration in the steam generator water (i.e., $C_M = C_{SG}$), we get

$$\frac{M_M}{M_{MS}} = \frac{C_{MS}}{C_M} - \frac{C_V}{C_M}\,\frac{M_V}{M_{MS}}$$

For a non-volatile radionuclide (such as ^{24}Na), $C_V = 0$. Hence

$$\text{Entrainment Fraction} = \frac{M_M}{M_{MS}} = \frac{C_{MS}\ \text{(non-volatile radionuclide)}}{C_M\ \text{(non-volatile radionuclide)}}$$

$$= \frac{1}{DF\ \text{(non-volatile radionuclide)}}$$

For a volatile radionuclide (such as radioiodine) $C_V \neq 0$ and the partition factor (PF) can be defined

$$PF = \frac{C_V}{C_{SG}}$$

Using the above equations we get

$$PF = \frac{C_V}{C_{SG}} = \frac{1}{C_{SG}} \frac{1}{M_V} (C_{MS} M_{MS} - C_M M_M)$$

$$= \frac{M_{MS}}{M_V} (\frac{C_{MS}}{C_{SG}} - \frac{M_M}{M_{MS}})$$

$$= \frac{M_{MS}}{M_V} \left[\frac{1}{\text{DF (volatile radionuclide)}} - \frac{1}{\text{DF (non-volatile radionuclide)}}\right]$$

In a steam generator, the moisture carryover is small (e.g., the Turkey Point steam generators are rated at 0.25%) so $M_V \approx M_{MS}$. Hence

$$PF \approx \frac{1}{\text{DF (volatile radionuclide)}} - \frac{1}{\text{DF (non-volatile radionuclide)}}$$

In order to evaluate DF's and PF's for the steam generators, the data obtained from the sets of secondary samples (see Figure 6.2 for sample points) were analyzed. The initial analysis indicated several inconsistencies. When the measured radionuclide concentrations in the main steam were used to determine DF's, the results indicated that the steam generators were delivering excessive quantities of entrained moisture to the main steam. For example, the indicated entrainment factors for both units averaged about 1.2% which is greatly in excess of the manufacturer's design value of 0.25%. In addition, the average concentrations of the radionuclides observed (i.e., ^{24}Na, ^{131}I, ^{133}I, ^{135}I, ^{134}Cs, ^{137}Cs) in the main steam greatly exceeded (by up to about a factor of 10) the corresponding concentrations in the condensate and main feed. This would imply that large amounts of the radionuclides were lost somewhere in the secondary system between the main steam and the condenser. This conclusion is inconsistent with the conclusion in section 6.5.2 that no such loss existed. The only conclusion, therefore, that can be drawn is that the main steam samples were biased.

At Turkey Point, main steam samples are taken using main steam samples probes illustrated in Figure 6.3 (6). A steam sample is taken by pulling a portion of the main steam through the probe holes and into a cooler where the sample is condensed. This sample is supposed to quantitatively represent the main steam composition. The probe is designed isokinetically in order to measure the two-phase main steam flow. Samples are condensed and cooled to about 100°F in the sample cooler.

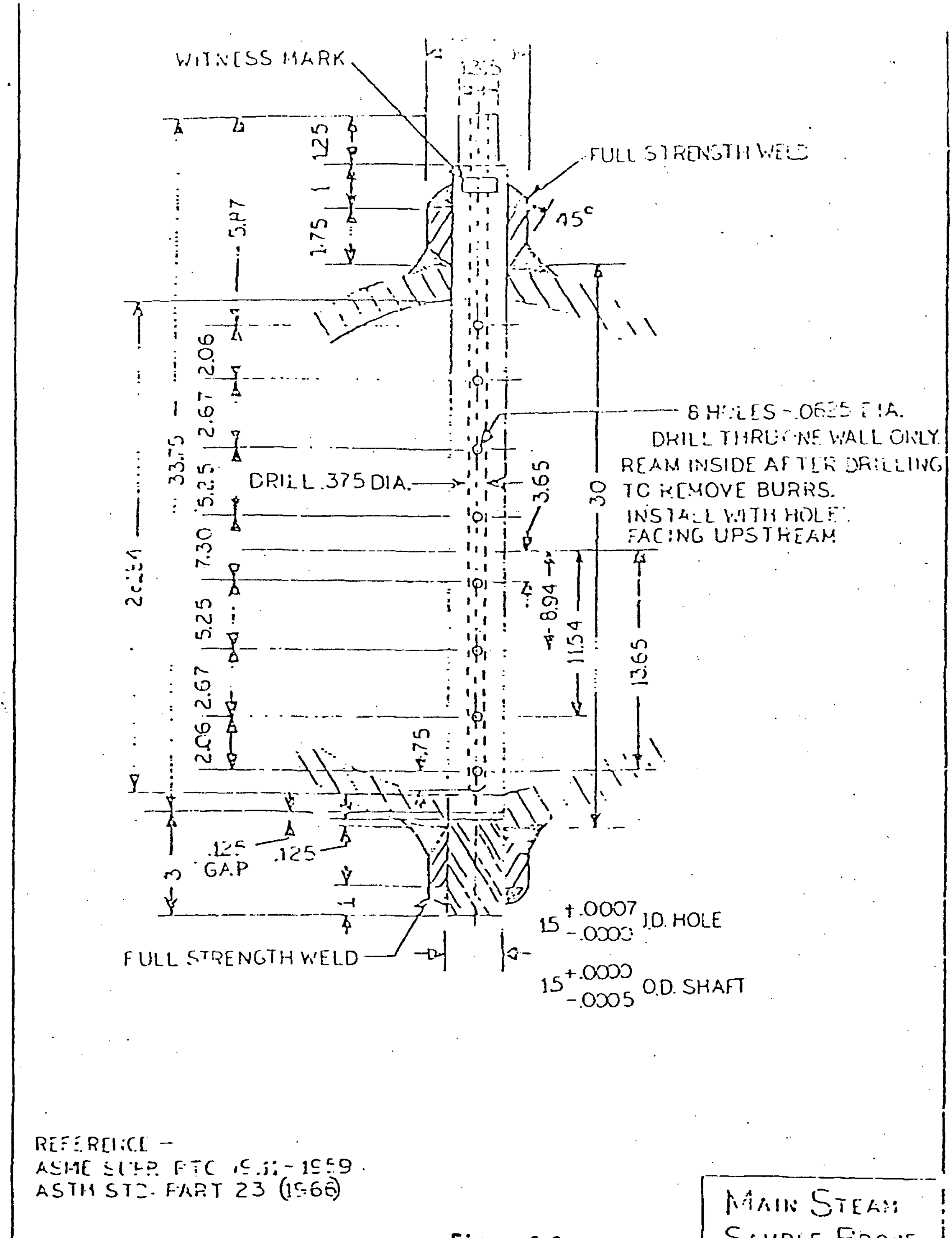

Figure 6.3

MAIN STEAM SAMPLE PROBE

There has been some controversy about the quantitativeness of the main steam probe. Some authors have obtained results that indicate the probe to be positively biased by as much as 60% (6). It is believed by some scientists that the steam probe is preferential to entrained moisture simply as a result of its presence in the main steam stream (15). These scientists feel that flow perturbations created in the area of the probe result in the concentration of moisture droplets in the area of the probe. The result of such a moisture concentration would be a bias of the probe for entrained species.

It appears that the main steam probes at Turkey Point are biased. Since the assumption made in section 6.5.2 that the radionuclide concentration in the feed equals the average concentration in the main steam appears to be valid, the feed concentration was used with the average steam generator concentration to determine average DF's. Table 6.17 contains the results of these determinations. Using these DF's, average entrainment fractions were found to be <0.5% for Unit #3 and 0.29 ± 0.02% for Unit #4. Average partition factors for iodine and cesium for Unit #4 were found to be 9 ± 4(-4) and 2.0 ± 0.5(-3), respectively. The very low partition factor for iodine indicates that there was very little volatile iodine in the secondary system.

6.5.6 High Pressure Drains

No samples could be obtained from the high pressure (HP) drain system because no adequate sample points were available. An indirect method was therefore used to determine the amount of activity passing through this system. The main feed is made up of two components: 28% of the main feed flow comes from the HP drains and 72% comes from the main condenser. The following equation can be written for the activity passing through the HP drains into the main feed:

$$A_{HP} = F_{HP}\, C_{HP} = F_F\, C_F - F_c\, C_c$$

where

A_{HP} - activity passing through HP drains

C_{HP}, C_F, C_c - radionuclide concentrations in HP drains, main feed, and condensate

F_{HP}, F_F, F_c - flow rates through HP drains, main feed, and condensate

The fraction of the feed activity that came via the HP drains is

$$1 - \frac{0.72\, C_c}{C_F}$$

TABLE 6.17

AVERAGE STEAM GENERATOR DF's

		Average DF				
Date	Unit	^{24}Na	^{131}I	^{133}I	^{134}Cs	^{137}Cs
11/4/77	3	>2.6(1)	>6.3(2)	>3.9(2)	*	>5.1(1)
11/14/77	3	*	2.0 ± 0.6(2)[†]	3.1 ± 2.0(2)[†]	*	*
11/17/77	3	>3.1(1)	>6.6(1)	2.5 ± 2.9(1)	>6.1(0)	>3.9(1)
1/18/78	4	>3.3(1)	>1.0(2)	>2.1(1)	>2.7(0)	>2.8(0)
1/19/78	4	>1.7(1)	>7.4(1)	>4.4(1)	>2.6(0)	9 ± 8(0)
1/20/78	4	>7.4(1)	>2.2(1)	>4.6(1)	6 ± 3(0)	>7.7(0)
1/22/78	4	5.3 ± 0.9(2)	3.3 ± 0.1(2)	3.5 ± 0.2(2)	2.5 ± 0.6(2)	2.5 ± 0.5(2)
1/23/78	4	2.0 ± 0.2(2)	1.83 ± 0.05(2)	1.81 ± 0.05(2)	1.5 ± 0.2(2)	1.8 ± 0.1(2)
1/24/78	4	3.2 ± 0.3(2)	3.7 ± 0.1(2)	3.8 ± 0.1(2)	2.6 ± 0.5(2)	2.5 ± 0.3(2)
1/26/78 AM	4	>2.7(1)	4.6 ± 0.2(1)	4.8 ± 0.3(1)	1.8 ± 2.1(2)	3.8 ± 0.8(1)
1/26/78 PM	4	>6.9(1)	2.4 ± 0.1(2)	2.0 ± 0.2(2)	1.2 ± 0.7(2)	>1.5(2)
2/3/78	4	>4.8(2)	2.1 ± 0.7(2)	2.5 ± 0.8(2)	>3.9(1)	>1.0(2)
Unit #3 Average		*	2.0 ± 0.6(2)	3.1 ± 2.0(2)	*	*
Unit #4 Average [††]		3.5 ± 0.3(2)	2.7 ± 0.2(2)	2.7 ± 0.2(2)	1.9 ± 0.3(2)	2.3 ± 0.2(2)

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* Insufficient data to determine value.

[†] Plant data

[††] Only real values obtained on 1/22/78, 1/23/78, 1/24/78, 1/26/78 PM, and 2/3/78 were used to determine average.

Table 6.18 lists the fraction of activity in the main feed due to the HP drains calculated for Unit #4. The data were insufficient to perform similar calculations for Unit #3. The results in Table 6.18 indicate that an average of 75% of the activity in the feed come from the HP drains even though only 28% of the flow follows that path. This high fraction is not unexpected since the DF data (section 6.5.5) indicates that most of the activity gets into the main stream entrained in moisture droplets and the water removed by the moisture separator enters the HP drain system. The results in Table 6.18 also indicate that the relative amounts of radiosodium, radiocesium, and radioiodine in the HP drains are equal. This is consistent with the conclusion in section 6.5.5 that there is very little volatile iodine in the main steam (i.e., most of the iodine is entrained in moisture droplets).

6.5.7 Main Steam Air Ejector

Iodine species samples were obtained from the air ejector vent on several occasions for each unit. Iodine activity data obtained from these samples are given in Table 6.19. The measured iodine release rates were very low (e.g., 1.6(-6) to 8.7(-4) μCi/sec for ^{131}I).

Since the main steam samples are assumed to be biased, the main steam/air ejector partition factors cannot be determined. However, the fraction of the iodine in the steam that is released via the air ejector can be obtained. Table 6.19 lists the estimated percent of main steam activity released through the air ejector vent. These releases are based on main steam activities determined using measured steam generator activities and average steam generator DF's (see section 6.5.5). The average percent of main steam iodine activity released via the air ejector is 1.3 ± 0.4(-1)% for Unit #3 and 1.0 ± 0.1(-1)% for Unit #4. This small fraction of iodine leaving the secondary system via the air ejector is consistent with the observation (section 6.5.5) that there was very little volatile iodine in the secondary system.

Based on the chemistry of the secondary system (section 6.5.1), the iodine species which could be expected in the air ejector vent are I_2, HOI, and CH_3I (2,11). The iodine species samples taken from the air ejector vent indicated that the principal iodine species discharged was organic iodine. The amount of organic iodine discharged averaged about 85 percent of the total air ejector discharge for both units. It is therefore concluded that the air ejector vents are discharging less than 1 percent of the iodine activity entering the secondary system and that this iodine discharge is principally organic iodine.

6.5.8 Turbine Gland Seal Exhaust Vent

The gland seal exhaust vent is another possible discharge path for iodine. Unfortunately, because of plant location of these exhaust fans, measurements of the gland seal exhaust vents were not made. However, results of another study (7) made at the Point Beach Nuclear Facility revealed that the gland seal exhaust was discharging

TABLE 6.18

FRACTION OF FEED ACTIVITY COMING FROM HP DRAINS FOR UNIT #4

	Fractional Activity of Radionuclide				
Date	^{24}Na	^{131}I	^{133}I	^{134}Cs	^{137}Cs
1/22/78	0.65 ± 0.11	0.67 ± 0.02	0.65 ± 0.03	0.60 ± 0.23	0.68 ± 0.11
1/23/78	0.85 ± 0.02	0.83 ± 0.01	0.84 ± 0.01	0.87 ± 0.04	0.83 ± 0.03
1/24/78	0.76 ± 0.05	0.71 ± 0.02	0.70 ± 0.02	0.60 ± 0.10	0.74 ± 0.05
1/26/78 AM	*	0.95 ± 0.01	0.95 ± 0.01	*	>0.88
1/26/78 PM	*	0.76 ± 0.03	0.85 ± 0.02	0.55 ± 0.34	<0.68
2/3/78	*	>0.36	>0.74	*	*
Average[†]	0.75 ± 0.04	0.74 ± 0.01	0.76 ± 0.01	0.66 ± 0.11	0.75 ± 0.04

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* Insufficient data to perform calculation.

[†] Average does not include data obtained on 1/26/78 AM because of nonequilibrium conditions.

TABLE 6.19

AIR EJECTOR IODINE SPECIES SAMPLE

		Activity Release Rate (μCi/sec)*		Est. % Activity Released Through AE†	
Date	Unit	^{131}I	^{133}I	^{131}I	^{133}I
11/9/77	3	8.7 ± 1.1(-4)	7.2 ± 0.9(-4)	2.3 ± 0.8(-1)	1.6 ± 1.1(-1)
11/14/77	3	6.7 ± 0.8(-5)	3.5 ± 0.6(-5)	5.1 ± 1.7(-2)	9 ± 6(-2)
1/18/78	4	9.2 ± 1.0(-6)	8.5 ± 1.1(-6)	1.6 ± 0.2(-1)	9.1 ± 1.4(-2)
1/20/78	4	1.6 ± 0.5(-6)	2.5 ± 0.6(-6)	2.0 ± 0.6(-2)	2.4 ± 0.7(-2)
1/24/78	4	4.2 ± 0.3(-5)	5.9 ± 0.4(-5)	1.5 ± 0.2(-1)	1.4 ± 0.1(-1)

---

* Activity release rate via air ejector determined using equation

$$A_{AE} = C_{AE} F_{AE}$$

where

A_{AE} - activity release rate through air ejector (μCi/sec)

C_{AE} - radionuclide concentration in air ejector vent (μCi/cc)

F_{AE} - flow rate through air ejector vent (cc/sec)

† Percent activity in main steam released through air ejector determined using the equation

$$\% \text{ Activity} = (A_{AE}/A_{MS}) \times 100$$

where

A_{AE} - activity release rate through air ejector (μCi/sec)

A_{MS} - activity transport rate in main steam (μCi/sec)

A_{MS} can be determined from the average radionuclide concentration in steam generator water ($\overline{C}_{SG}$), the average steam generator DF for the radionuclide ($\overline{DF}$), and the total main steam flow (F_{MS}):

$$A_{MS} = \overline{C}_{SG} F_{MS}/\overline{DF}$$

iodine at a rate 20 times greater than the air ejector exhaust. If this factor is applied to the highest air ejector activities (Table 6.19 - column 1) for each unit, then the worst possible case for Unit #3 is a 4.9% iodine discharge and for Unit #4 a 3.0% iodine discharge. The Point Beach study revealed that about 60% of the radioiodine discharged from the gland seal exhaust was particulate iodine and that less than 35% of the iodine discharged was volatile (7). Assuming the activity discharge situation is analogous between Point Beach and Turkey Point then there should be a total of less than 2% volatile and less than 5% total iodine being discharged from the air ejector and gland seal exhausts. The high percentage of particulate iodine in the gland seal exhausts indicates a possible deposition mechanism for iodine in the turbine train.

6.6 Conclusions

The following conclusions can be drawn from the data obtained from the secondary systems at Turkey Point:

1. The secondary system chemical treatment is successful in keeping iodine in solution.
2. The majority of the radioiodine (> 95%) leaving the the steam generator is non-volatile iodine which leaves in the entrained moisture.
3. Iodine exists in the secondary system water as predominently iodide (I^-) which is in solution as a result of secondary system chemical treatment.
4. The principal losses of iodine in the secondary system is due to radioactive decay and steam generator blowdown.
5. Volatile iodine losses are quite small ($\leq$ 2%).
6. Air ejector radioiodine discharges may be related to iodine conversion in the LP turbine or the main condenser.
7. Iodine exists in the reactor coolant as predominantly iodide (I^-).
8. Steam generator moisture entrainment fraction is about 0.3%.
9. Steam generator iodine partition factor is about 0.001.

7. WASTE GAS PROCESSING AND CONTAINMENT BUILDING SYSTEMS

7.1 Waste Gas Processing System

7.1.1 System Description

During plant operations, waste gases are generated from the following processes:

1. Degassing of reactor coolant in the chemical and volume control system (CVCS),
2. The addition of hydrogen to the CVCS for corrosion control in the reactor coolant system,
3. Displacement of cover gases as liquids accumulate in various tanks, e.g., holdup, CVCS, pressurizer, etc.,
4. Miscellaneous equipment vents and relief valves.

Of the above waste-gas sources, a major fraction of the waste is generated by the displacement of cover gases in various CVCS tanks as they fill with liquid. A schematic of the Waste Gas Processing System (WGPS) is shown in Figure 1.2. A more detailed description is shown in Figure 7.1 The WGPS system is common to both Units #3 and #4. It consists of a collection header, two compressors, and six waste gas decay tanks (WGDT).

Gas is collected via the waste gas collection header, compressed and then transferred to one of the WGDT's. Once in a WGDT, the waste gas is released to the environment or returned to one of the process tanks as the tank is being emptied. Before the contents of a WGDT may be discharged to the environment, its contents must be sampled and analyzed to determine activity. Depending upon the results of the analysis, the tank is discharged at a controlled rate through HEPA filters into the plant stack or isolated for further decay. The designed capacity of the six WGDT's is sufficient to permit 45 days of decay during normal plant operation before a WGDT must be released. The average decay time prior to release during the in-plant measurement period at Turkey Point was two days. This was due to the large quantities of gas generated during the frequent reactor startups and shutdowns. However, this does not imply that a WGDT was released every two days but that the radioactivity was sufficiently low to be released within two days.

7.1.2 Measurement Data and Methods

Various types of samples taken of the waste gas decay tanks included: iodine species, particulates, noble gases, ^{14}C, and ^{3}H. The iodine species and particulate samples were taken using the particulate-iodine species sampler (4). Noble gas samples were taken by filling an evacuated 250 cc glass cylinder with sample gas. The particulate, noble gas, and iodine samples were analyzed for radionuclides using the NRC mobile laboratory.

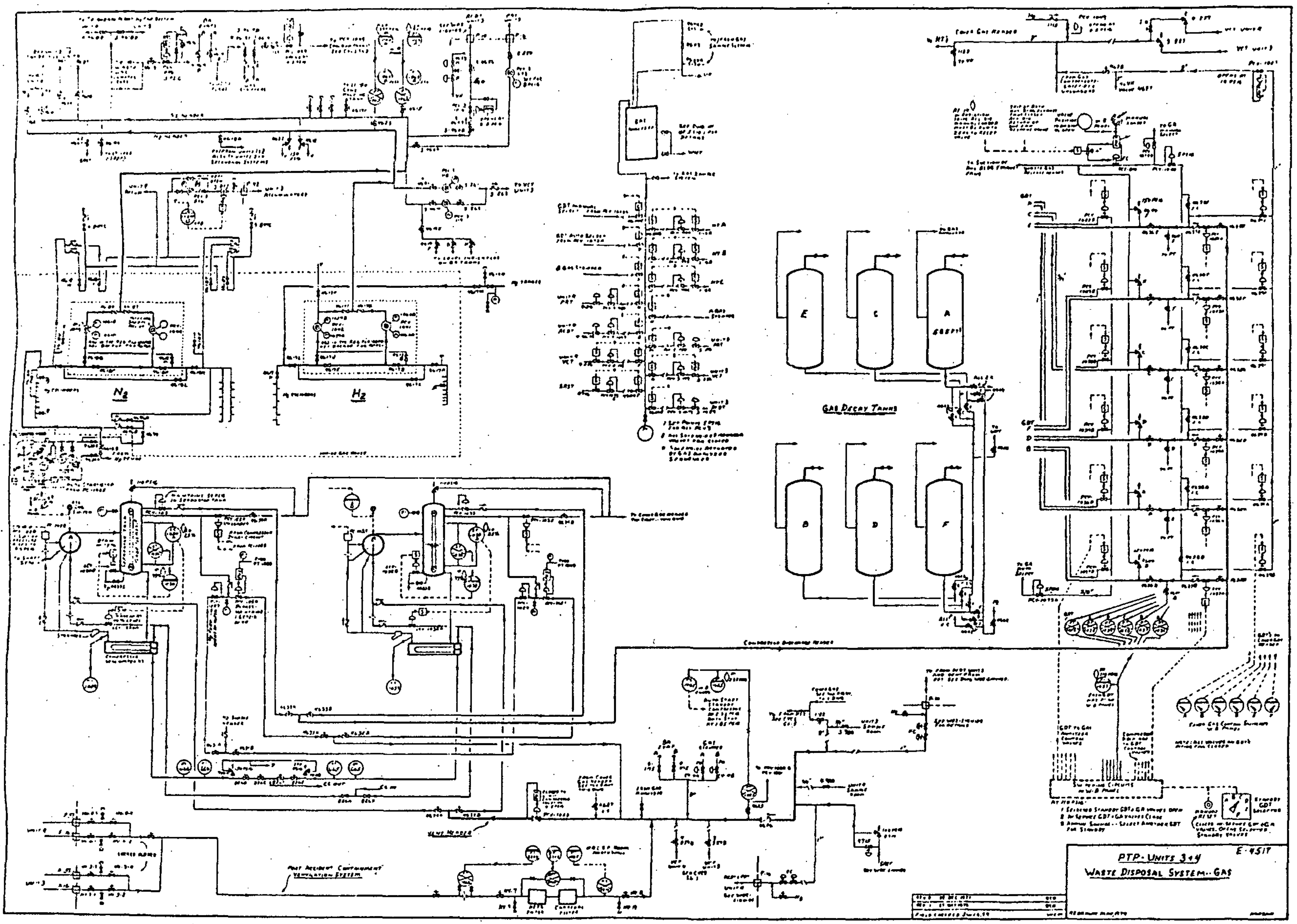

Figure 7.1

Schematic Diagram of Waste Gas Processing System

Carbon-14 and ^{3}H samples were collected by filling two 150 cc stainless steel cylinders to approximately 10 psig. These volumes are required to provide the required sensitivity for ^{3}H analysis. The cylinders were returned to INEL, where the contents were mixed with air to provide oxygen for the catalytic oxidizer. The amount of air added was too small and its activity too low to contribute any significant activity to the sample. The samples were then processed in the same manner as the ventilation samples (4).

Prior to sample collection, sample lines were purged for at least 30 minutes. The cylinders used for collecting the ^{14}C, ^{3}H and noble gas samples were evacuated and purged with sample gas for a minimum of 5 minutes before the sample was collected. Collection time for iodine species-particulate samples ranged from 30 minutes to 60 minutes.

The results of analysis of waste gas decay tank samples are shown in Appendix B Tables B.56-B.58.

7.1.3 Results and Discussion

During the measurement period at Turkey Point a total of 10 waste gas decay tank samples were taken. Of these 10 samples, 7 were analyzed for ^{14}C-^{3}H, 10 for iodine species-particulate and 7 for noble gas. The samples were taken over the period 1/31/78 to 5/2/78. Samples were obtained during the Unit #3 refueling outage, power operation after refueling, Unit #4 power operation, Unit #4 shutdown for steam generator repairs, and transfer of Unit #3 fuel pit water to the holdup tanks in preparation for repair of the SFP liner.

In an attempt to increase the data base for calculating extrapolated annual releases from the WGPS, a comparison of the in-plant measurement program analyses and Florida Power and Light (FPL) analyses was made. Of the 10 iodine species analyses performed by INEL personnel, 8 corresponding FPL analyses were available. The average of the INEL measurements was 1.43 ± 0.09(-7) µCi/cc. The average of the eight corresponding FPL analyses was 1.32(-7) µCi/cc with no quoted uncertainty. The quoted uncertainty for the INEL data includes counting statistics only. The INEL and FPL results, therefore, agree to within 2 sigma without including systematic errors. Table 7.1 lists the comparison measurements along with the FPL ^{131}I data associated with the 29 WGDT's released at Turkey Point through May in 1978. Similarily, corresponding FPL and INEL noble gas measurements were available for five waste gas decay tanks. The noble gas comparative values, corrected to the time of the WGDT release, are included in Table 7.2. The INEL noble gas data were taken from Appendix Table B.56.

The FPL data were used to calculate ^{131}I and noble gas extrapolated annual releases presented in Table 7.4 using the following equation:

TABLE 7.1

^{131}I ANALYSIS OF WASTE GAS DECAY TANKS
(FPL and INEL Measurements)

WGDT Release #	Sample Date; Time T_S	Release Date; Time T_R	Δt (hrs)	μCi/cc at T_S	μCi/cc corrected to T_R	Volumes Released ($x\ 10^6$ cc)	Ci per Release
78-1	1/28/78; 0850	1/31/78; 1011	74.2	7.0(-8)	5.4(-8)	88	4.7(-6)
78-2	1/30/78; 1500	1/30/78; 1320	22.3	2.1(-7)	1.9(-7)	81	1.6(-5)
78-3	1/31/78; 1150	2/1/78; 0533	17.7	1.4(-7)	1.3(-7) 1.29(-7) [1]	88	1.2(-5)
78-4	2/1/78; 1002	2/3/78; 1433	52.5	1.2(-7)	9.9(-8)	90	8.9(-6)
78-5	2/1/78; 1030	2/3/78; 1810	55.7	5.4(-7)	4.4(-7)	88	3.9(-5)
78-6	2/4/78; 0045	2/5/78; 0205	25.3	6.7(-7)	6.1(-7) 6.35(-7) [1]	90	5.5(-5)
78-7	2/4/78; 0400	2/5/78; 0538	25.6	1.1(-7)	1.0(-7)	88	8.8(-6)
78-8	2/5/78; 0815	2/5/78; 1818	10	4.7(-7)	4.5(-7)	92	4.2(-5)
78-9	2/5/78; 2020	2/7/78; 0950	37.5	4.5(-7)	3.9(-7)	86	3.4(-5)
78-10	2/6/78; 0835	2/7/78; 1100	26.5	1.6(-7)	1.5(-7) 2.08(-7) [1]	86	1.3(-5)
78-11	2/7/78; 0910	2/13/78; 0829	143.4	1.5(-7)	9.0(-8)	83	7.4(-6)
78-12	2/13/78; 0820	2/14/78; 0857	24.6	1.4(-6)	1.3(-6)	78	1.0(-5)
78-13	2/13/78; 0955	2/14/78; 1403	28.1	3.2(-7)	2.9(-7)	83	2.4(-5)
78-14	2/14/78; 1345	2/14/78; 1746	4	1.9(-7)	1.9(-7)	88	1.7(-5)
78-15	2/14/78; 1418	2/16/78; 1445	48.5	9.6(-7)	8.1(-7)	77	6.2(-5)
78-16	3/9/78; 0955	3/9/78; 1950	10	4.1(-7)	4.0(-7)	89	3.5(-5)
78-17	4/5/78; 1500	4/11/78; 1243	141.75	1.4(-7)	8.4(-8)	83	7.0(-6)
78-18	4/11/78; 1343	4/12/78; 0155	12.2	6.0(-8)	5.7(-8) 5.4(-8) [1]	91	5.2(-6)
78-19	4/15/78; 1400	4/20/78; 1345	119.75	3.6(-8)	2.3(-8) 2.86(-8) [1]	78	1.8(-6)
78-20	4/20/78; 1400	4/27/78; 0923	163.4	7.4(-8)	4.1(-8)	84	3.5(-6)

TABLE 7.1 (cont'd)

^{131}I ANALYSIS OF WASTE GAS DECAY TANKS (FPL and INEL Measurements)

WGDT Release #	Sample Date; Time T_S	Release Date; Time T_R	Δt (hrs)	µCi/cc at T_S	^{131}I µCi/cc corrected to T_R	Volumes Released (x 10^6 cc)	^{131}I Ci per Release
78-21	4/24/78; 1415	4/28/78; 1000	91.75	2.2(-8)	1.6(-8) 1.68(-8) [1]	93	1.5(-6)
78-22	4/28/78; 1120	5/2/78; 0023	85	2.1(-8)	1.5(-8) 1.55(-8) [1]	86	1.3(-6)
78-23	4/28/78; 1445	5/2/78; 0535	86.9	9.0(-8)	9.0(-8)	90	8.1(-6)
78-24	5/2/78; 0840	5/2/78; 1423	5.66	8.95(-8)	8.77(-8)	88	7.7(-6)
78-25	5/2/78; 0905	5/2/78; 1625	7.33	9.8(-8)	9.5(-8)	89	8.5(-6)
78-26	5/2/78; 1001	5/4/78; 0645	44.75	6.8(-8)	5.8(-8) 5.60(08) [1]	86	5.0(-6)
78-27	5/4/78; 0840	5/4/78; 1055	2.25	5.4(-8)	5.4(-8)	77	4.1(-6)
78-28	5/4/78; 1023	5/4/78; 1253	2.5	5.8(-8)	5.7(-8)	89	5.1(-6)
78-29	5/4/78; 1244	5/9/78; 2115	104.5	5.2(-8)	3.6(-8)	88	3.1(-6)
				Ave.	2.21(-7)	8.6(7)	

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[1] INEL analyses

Note:

INEL Avg. = 1.43 ± 0.17(-7) µCi/cc

FPL Avg. = 1.32(-7) µCi/cc

TABLE 7.2

NOBLE GAS ANALYSIS DATA OF WASTE GAS DECAY TANKS
(FPL and INEL Measurements)

Release #	^{85}Kr (μCi/cc)	^{131m}Xe (μCi/cc)	^{133}Xe (μCi/cc)	^{133m}Xe (μCi/cc)	^{135}Xe (μCi/cc)
78-1	1.1(-3)	3.3(-4)	8.7(-3)	5.4(-5)	7.5(-8)
78-2	1.9(-3)		3.1(-2)	2.6(-4)	9.0(-7)
78-3	1.7(-3)		3.2(-2)	3.6(-4)	1.5(-4)
78-4	1.6(-3)		3.2(-2)	2.6(-4)	1.0(-5)
78-5	2.1(-3)		3.2(-2)	2.4(-4)	6.5(-6)
78-6	1.9(-3)	1.1(-4)	6.1(-2)	7.2(-4)	1.4(-4)
78-7	1.4(-3)	3.3(-4)	1.8(-2)	1.2(-4)	2.0(-5)
78-8	1.1(-3)		4.8(-2)	5.9(-4)	1.5(-4)
78-9	3.0(-4)		3.8(-2)	3.3(-4)	6.9(-6)
78-10	1.8(-3)	1.0(-3)	4.8(-2)	5.7(-4)	1.3(-4)
*	1.61 ± 0.08(-3)	5.3 ± 0.6(-4)	5.55 ± 0.03(-2)	6.1 ± 0.2(-4)	1.55 ± 0.02(-4)
78-11	9.0(-4)		7.7(-5)	2.4(-2)	1.2(-4)
78-12	7.0(-4)		3.8(-2)	2.6(-4)	1.2(-6)
78-13	1.4(-3)		5.7(-4)	3.1(-2)	1.5(-4)
78-14	2.3(-4)	3.9(-4)	2.0(-2)	1.4(-4)	4.9(-5)
78-15	3.2(-4)		3.0(-2)	1.5(-4)	6.3(-8)
78-16	2.8(-4)	3.8(-4)	1.2(-2)	8.2(-5)	1.4(-5)
78-17	4.2(-4)	1.1(-4)	4.5(-2)	1.3(-4)	1.1(-7)
78-18	2.9(-4)		4.0(-2)	4.5(-4)	2.6(-4)
*	4.9 ± 0.5(-4)		3.8 ± 0.3(-2)	3.6 ± 0.3(-4)	2.1 ± 0.2(-4)
78-19	5.8(-4)	4.3(-4)	1.4(-2)	3.7(-5)	1.8(-7)
*	6.8 ± 0.5(-4)	3.6 ± 0.1(-4)	1.60 ± 0.02(-2)	3.1 ± 0.2(-5)	9.6 ± 0.6(-8)
78-20	2.8(-4)	1.2(-4)	5.7(-2)	2.7(-4)	4.9(-9)
78-21	1.0(-3)		2.4(-2)	6.5(-5)	
*	1.09 ± 0.06(-3)		2.63 ± 0.02(-2)	5.79 ± 0.02(-5)	
78-22	9.6(-4)	2.9(-4)	3.8(-4)		5.6(-9)
*	7.8 ± 0.6(-4)	2.07 ± 0.08(-4)	4.16 ± 0.02(-3)		5.0 ± 0.2(-10)
78-23	4.0(-4)	1.9(-4)	1.1(-1)	8.5(-4)	7.0(-6)
78-24	3.5(-4)	1.4(-4)	9.7(-2)	9.3(-4)	2.5(-4)
78-25	3.4(-4)	1.6(-4)	1.1(-1)	1.2(-3)	6.3(-4)
78-26	4.0(-4)	1.7(-4)	8.6(-2)	7.9(-4)	1.5(-4)
78-27	1.0(-3)	1.3(-4)	8.9(-2)	8.2(-4)	7.4(-4)
78-28	3.5(-4)	1.3(-4)	9.0(-2)	9.0(-4)	3.2(-4)
78-29	3.1(-4)	1.2(-4)	5.6(-2)	2.9(-4)	4.7(-7)
Average	8.76(-4)	2.6(-4)	4.4(-2)	2.3(-3)	1.2(-4)

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* INEL Measurements

$$R_{WG} = C_T \times A_V \times R_f \times 1 \times 10^{-6} \text{ Ci/year}$$

where

R_{WG} = Extrapolated annual release (Ci/year)

C_T = Average nuclide concentration in tank (µCi/cc)

A_V = Average volume released per tank (cc)

R_f = release frequency (year^{-1})

The ^{131}I and noble gas average concentrations employed in the equation were taken from Tables 7.1 and 7.2. The average gas volume released per tank was 8.6(7) cc (Table 7.1). The WGDT release frequency used was 64 tanks per year. The value of 64 is based on the number of WGDT's released at Turkey Point in 1977. This value is in good agreement with an extrapolated annual WGDT frequency of 65 obtained from the number of WGDT's released (38) during the seven-month in-plant measurement period at Turkey Point (Table 7.3).

Only INEL data were used to extrapolate annual ^{14}C, ^{3}H and particulate releases. The respective average concentrations for these radionuclides can be obtained from Appendix Table B.56. Again an average release frequency of 64 and an average tank volume of 8.6(7) cc were used.

Since the average WGDT radionuclide concentrations in Table 7.4 include radionuclide concentrations measured during both the refueling and non-refueling intervals, the average release for the combined refueling-non-refueling interval can be obtained (Table 2.5) by converting the reported Ci/y values to Ci/sec and applying a decontamination factor of 100 for particulates for the exhaust HEPA filters. Likewise, the release rates specific to the refueling (Table 2.8) and non-refueling (Table 2.7) intervals can be obtained (Table 7.5). The radionuclide concentrations used in Table 7.5 were taken from Appendix Table B.56 and Table 7.1. The Ci/year values were calculated from the above equation; however, the waste gas decay tank annual release frequencies used were 33 for refueling and 31 for non-refueling. These values are based on the number of WGDT's released which were associated with the refueling and non-refueling intervals during the January to May, 1978 interval at Turkey Point (Table 7.1). Releases 78-1 to 78-15 were associated with refueling and the balance was during non-refueling. Also it should be remembered that a decontamination factor of 100 must be applied for the particulates due to the exhaust HEPA filters.

The iodine species detected in the waste gas decay tanks were: I_2, HOI, and organic iodides. Only one sample showed any particulate iodine present (0.1%). The predominant species was found to be organic iodide, averaging 93.7% for ^{131}I, with a range of 89.4% to 96.8% (see Table 7.6). Other species of ^{131}I detected were: I_2 (0.8% average, range 0.1-2.5%) and HOI (5.5% average, range 1.9-9.0%). The data shown above

TABLE 7.3

TURKEY POINT WASTE GAS TANK RELEASES DURING IN-PLANT STUDY PERIOD

Release Number	Start Time	Stop Time	Volume (cm^3)
77-56	11/3/77 - 0200	11/3/77 - 0745	6.9(7)
77-57	11/3/77 - 1725	11/3/77 - 2315	7.6(7)
77-58	11/4/77 - 0040	11/4/77 - 0600	8.1(7)
77-59	11/4/77 - 0840	11/4/77 - 0940	8.8(7)
77-60	11/4/77 - 1105	11/4/77 - 1800	9.2(7)
77-61	11/4/77 - 2300	11/5/77 - 0100	8.7(7)
77-62	11/13/77 - 2200	11/13/77 - 2345	7.7(7)
77-63	11/14/77 - 2000	11/14/77 - 2315	8.6(7)
77-64	12/9/77 - 1250	12/9;77 - 1420	8.8(7)
78-1	1/31/78 - 0955	1/31/78 - 1028	8.3(7)
78-2	1/31/78 - 1305	1/31/78 - 1335	8.1(7)
78-3	2/1/78 - 0510	2/1/78 - 0555	8.8(7)
78-4	2/3/78 - 1405	2/3/78 - 1500	9.0(7)
78-5	2/3/78 - 1750	2/3/78 - 1830	8.8(7)
78-6	2/5/78 - 0120	2/5/78 - 0250	9.0(7)
78-7	2/5/78 - 0515	2/5/78 - 0600	8.8(7)
78-8	2/5/78 - 1755	2/5/78 - 1840	9.2(7)
78-9	2/7/78 - 0930	2/7/78 - 1010	8.2(7)
78-10	2/7/78 - 1040	2/7/78 - 1120	8.6(7)
78-11	2/13/78 - 0810	2/13/78 - 0845	8.3(7)
78-12	2/14/78 - 0840	2/14/78 - 0915	7.8(7)
78-13	2/14/78 - 1340	2/14/78 - 1425	8.3(7)
78-14	2/14/78 - 0527	2/14/78 - 0605	8.8(7)
78-15	2/16/78 - 1430	2/16/78 - 1500	7.7(7)
78-16	3/9/78 - 1930	3/9/78 - 2010	8.9(7)
78-17	4/11/78 - 1215	4/11/78 - 1310	8.3(7)
78-18	4/12/78 - 0130	4/12/78 - 0220	9.1(7)

TABLE 7.3 (cont'd)

TURKEY POINT WASTE GAS TANK RELEASES DURING IN-PLANT STUDY PERIOD

Release Number	Start Time	Stop Time	Volume (cm^3)
78-19	4/20/78 - 1325	4/20/78 - 1405	7.8(7)
78-20	4/27/78 - 0845	4/27/78 - 1000	8.9(7)
78-21	4/29/78 - 0930	4/29/78 - 1030	9.3(7)
78-22	5/2/78 - 0005	5/2/78 - 0040	8.6(7)
78-23	5/2/78 - 0520	5/2/78 - 0550	9.0(7)
78-24	5/2/78 - 1355	5/2/78 - 1450	8.8(7)
78-25	5/2/78 - 1550	5/2/78 - 1700	8.9(7)
78-26	5/4/78 - 0615	5/4/78 - 0715	8.6(7)
78-27	5/4/78 - 1030	5/4/78 - 1120	7.7(7)
78-28	5/4/78 - 1230	5/4/78 - 1315	8.9(7)
78-29	5/9/78 - 0850	5/9/78 - 0940	8.8(7)

TABLE 7.4

EXTRAPOLATED ANNUAL RADIONUCLIDE RELEASES FROM WGDT[1]

(Combined Refueling and Non-refueling)

Nuclide	C_T (μCi/cc)	R_{WG} (Ci/year)
^{85}Kr	8.8(-4)[5]	4.8(0)
^{131m}Xe	2.6(-4)[5]	1.4(0)
^{133}Xe	4.4(-2)[5]	2.4(2)
^{133m}Xe	2.3(-3)[5]	1.3(1)
^{135}Xe	1.2(-4)[5]	6.6(-1)
^{58}Co	1.6(-10)	8.8(-7)
^{60}Co	5.4(-11)	2.9(-7)
^{134}Cs	6.7(-12)	3.7(-8)
^{137}Cs	1.6(-11)	8.8(-8)
^{59}Fe	[2]	--
^{54}Mn	[2]	--
^{14}C	3.0(-4)	1.65[3]
^{3}H	4.4(-6)	2.4(-2)[4]
^{131}I	2.2(-7)[5]	1.2(-3)

---

[1] Based on release frequency of 64 WGDT releases per year and average tank volume of 8.6(7).

[2] Insufficient data for calculation.

[3] Includes total ^{14}C as $^{14}CO_2$, R^{14}C, or ^{14}CO.

[4] Includes total ^{3}H as HT, HTO, or RT.

[5] Based on FPL and INEL analysis of 29 tanks from January to May, 1978.

TABLE 7.5

EXTRAPOLATED ANNUAL RADIONUCLIDE RELEASES FROM WGDT's
(Refueling and Non-refueling)

	Refueling[1]		Non-refueling[2]	
Nuclide	C_T (μCi/cc)	R_{WG} (Ci/year)	C_T (μCi/cc)	R_{WG} (Ci/year)
^{58}Co	2.4(-10)	6.8(-7)	5.3(-11)	1.4(-7)
^{60}Co	1.4(-11)	3.9(-8)	1.0(-10)	2.7(-7)
^{134}Cs	3.3(-12)	9.4(-9)	1.2(-11)	3.2(-8)
^{137}Cs	1.5(-11)	4.3(-8)	1.5(-11)	4.0(-8)
^{14}C	3.0(-4)[3]	8.5(-1)	3.0(-4)[3]	8.0(-1)
^{3}H	6.4(-6)[4]	1.8(-2)	2.9(-6)[4]	7.7(-3)
^{131}I	3.5(-7)[5]	9.9(-4)	6.8(-8)[5]	1.8(-4)

---

[1] Based on 33 waste gas decay tanks released per year during refueling.

[2] Based on 31 waste gas decay tanks released per year during non-refueling.

[3] Includes total ^{14}C as $^{14}CO_2$, R^{14}C, or ^{14}CO.

[4] Includes total ^{3}H as HT, HTO, or RT.

[5] Based on FPL analysis of 29 waste gas decay tanks in Table 7.1. Tanks 78-1 to 78-15 were during refueling and tanks 78-16 to 78-29 were during non-refueling.

are averages and ranges for the 10 waste gas decay tanks isolated and sampled over the period 1/31-5/3/78 (see Table 7.6). The shorter-lived ^{133}I was detected in five of the ten samples mentioned above. Although the predominant species was still organic iodide (88.6% average), the range (56-100%) was much greater than that observed for ^{131}I. Individual sample species are shown in Appendix B Table B.57.

The distribution of chemical species for ^{14}C and ^{3}H is shown in Appendix B Table B.58. The average for the two radionuclides was 93% oxidizable ^{14}C and 43% oxidized ^{3}H.

7.2 Containment Building System

7.2.1 System Description

The containment purge, internal cleanup, and cooling systems are identical for both units. Both have a two-inch continuous vent line to the stack. The continuous vent lines are used for pressure control inside the reactor containments. Based on pressure buildup in containment, FPL personnel estimate the continuous vent line flow rate to be 20-30 ft^{3}/minute.

The containment purge system consists of one supply and one exhaust fan. The rated flow of both the supply and exhaust fans is 35,000 cfm. This flow is equivalent to 1.33 volume changes per hour. The containment purge exhaust duct feeds through a bank of 40 roughing filters (Dustfoe-35) into the plant's main stack (Figure 1.2). Each Dustfoe-35 filter has an accordian-type fold in the body of the filter and is 24" square by 12" deep.

The containment internal cleanup system consists of three emergency filter units. Each unit, in order of flow, consists of a prefilter, a HEPA filter, and a charcoal filter. Each unit has a rated flow of 37,500 cfm at 50 psig and 205°F. This system was not operated during the in-plant measurement program at Turkey Point. In fact, it has never been operated, except for efficiency testing. The system is held in standby for emergency use only. No decontamination factor measurements were made on the internal cleanup system.

The containment's internal cooling system has a design flow of 137,000 cfm for each of the four fan-coil units. During normal operation, three of the four units are operational. Air flow, in sequence, is through the cooling coils, fans, and discharge header. This system is designed to keep the containment temperatures at or below 120°F during normal operation.

7.2.2 Measurement Methods

Samples were taken from containment atmospheres of both Units #3 and #4 to determine iodine species, ^{14}C, ^{3}H and noble gases. The samples were taken using the plant sample lines. These sample lines are used by plant personnel to take samples on a weekly basis and also

TABLE 7.6

WASTE GAS DECAY TANKS IODINE SPECIES

Radionuclide & number of samples radionuclide detected		$T_{1/2}$	Particulate (%)		I_2 (%)		HOI (%)		Organic (%)	
			Avg	Range	Avg	Range	Avg	Range	Avg	Range
10	^{131}I	8.05 days	0.01	0-0.1	0.8	0.1-2.5	5.5	1.9-9.0	93.7	89.4-96.8
5	^{133}I	20.8 hrs	0	*	8.8	0-44	4.6	0-22.9	88.6	56-100
1	^{135}I	6.6 hrs	0	*	0	*	0	*	100	---

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* - Iodine activity not detected on this sampler component.

prior to any release due to a containment purge or vent. The sample lines were purged for at least 10 minutes prior to pulling any sample. A 250 cc glass cylinder was used for noble gas samples; the particulate-iodine sampler was used for the iodine species and particulate samples; and the ^{14}C-^{3}H sampler was used for ^{14}C and ^{3}H samples (4). All samplers are described in reference 4. The sampling period ranged from 2 to 24 hours for the iodine species samples and 18-24 hours for the ^{14}C and ^{3}H samples.

Five samples were obtained from Unit #3 containment. One sample (11/10/77) was taken just prior to shutdown for refueling, one sample (2/23/78) just after startup following refueling, and three samples (3/15, 4/18, and 5/3/78) during full power operation following refueling. The five samples were taken for various times, ranging from 3 to 20 days, after a prior purge. The results for Unit #3 containment airborne activities are shown in Appendix B, Tables B.59-B.62.

Three samples of Unit #4 containment atmosphere were taken over the period 1/12/78 to 5/10/78. These samples were taken from less than 1 day to as long as 27 days after a containment purge. The data obtained from analysis of these samples are presented in Appendix B, Tables B.63-B.65.

7.2.3 Results and Discussion

7.2.3.1 Reactor Coolant Effective Radionuclide Inventory Leakage Rates, Effective Partition Factors, and Iodine Species

To predict radionuclide releases from the containment building via the gaseous pathway, for a given radionuclide reactor coolant concentration, one must know the radionuclide leakage rate into the containment building, the time since the last containment purge, the radionuclide partition factor, and the performance characteristics of any effluent treatment systems (ETS). These data would allow one to estimate a containment radionuclide gaseous inventory and the subsequent radionuclide release rate at the time of a containment purge. However, these data are not easily obtained. In particular, the amount of partitioning (i.e., the gaseous to liquid distribution) that occurs for the different radionuclides is not known for conditions that exist in the containments. Consequently, actual reactor coolant leakage rates cannot be determined. Instead, effective reactor coolant leakage rates can be determined. Here an effective reactor coolant leakage rate is defined as the percent of a given radionuclide inventory in the reactor coolant that leaks into the containment building per day and becomes airborne. The utility of effective reactor coolant leakage rates can be seen when one considers that effective reactor coolant leakage rates, corrected for the time since last containment purge, yield the airborne radionuclide inventory in containment.

At Turkey Point results from samples taken of the containment atmosphere of both units, along with radionuclide reactor coolant concentrations, were used to calculate effective leakage rates of reactor coolant radionuclide inventories into the containment buildings. When possible, reactor coolant radionuclide concentrations used in the calculations were for the same day the containment atmosphere sample was taken. At other times the radionuclide reactor coolant concentration was interpolated to the time of the containment atmosphere sample. To increase the data base, a comparison of FPL and INEL measurements of the containment atmosphere was made. From the comparison it was concluded that measurements by both FPL or INEL personnel yield statistically the same results. Therefore, FPL's measurements have been included. Effective reactor coolant radionuclide inventory leakage rates for ^{3}H, radioiodines, and noble gases are presented. Also, experimentally derived effective partition factors for the radioiodines are included. Since the only containment effluent treatment system at Turkey Point consists of roughing filters, the ETS performance was not considered (cf section 7.2.3.3).

Depending on the radionuclide half-life, reactor coolant radionuclide inventory leakage rates were calculated by one of two methods. For radionuclides with half-lives on the order of a few days the leak rates were calculated using equation (1) and leak rates, based on ^{3}H, were calculated using equation (2). In both cases it is assumed a steady-state reactor

$$\frac{\left(\frac{C_c \times V_c}{1-e^{-\lambda\Delta t}}\right)\left(\frac{\ln 2}{t_{1/2}}\right)}{C_R \times V_R}\ (100\%) = LR \tag{1}$$

$$\frac{C_c\ V_c\ (100\%)}{\Delta t\ C_R\ V_R} = LR \tag{2}$$

where

C_c = Concentration of nuclide in containment atmosphere (µCi/cc)

V_c = Free volume of containment (4.4(10) cc)

Δt = Time between prior long-term purge and sample time (days)

$t_{1/2}$ = Nuclide half-life (days)

C_R = Concentration of nuclide in primary coolant (µCi/cc)

V_R = Volume of primary coolant (3.8(8) cc)

LR = Percent radionuclide inventory in primary coolant leakage to containment atmosphere per day (percent per day) coolant leak rate exists and that essentially all airborne activity is removed from containment during a long-term containment purge. Based on the long-term purge durations, flow rates, and the containment free volume it can be shown that the latter assumption is valid (cf section 7.2.3.3), i.e., greater than 99% of the airborne radioactivity is removed during a containment long-term (>4.0 hours) purge.

The reason two equations were used to calculate the radionuclide leak rates to containment is due to the time required for the different radionuclide gaseous concentrations to reach equilibrium following a containment purge. For example, in equation (1) equilibrium airborne radionuclide concentrations in containment are required to exist; but, on occasions the time between sampling and the previous purge is not sufficient to allow equilibrium radionuclide concentrations to be established. The term, $1-e^{-\lambda\Delta t}$, corrects short-lived radionuclides to equilibrium conditions. However, due to the relatively long half-life of ^3H, in comparison to times between samples and containment purges involved, equation (1) is inappropriate to calculate ^3H leak rates since large errors in the equilibrium correction term $(1-e^{-\lambda\Delta t})$ can occur. As a result equation (2), which does not require equilibrium conditions was used for ^3H leak rate calculations.

The average reactor coolant radionuclide inventory for ^3H and the radioiodines for Units #3 and #4 are presented in Table 7.7. Individual leak rates for ^3H, radioiodines and the noble gases are shown in Tables 7.8 and 7.9. Leak rates presented in Tables 7.8 and 7.9 are based on INEL measurements (Appendix Tables B.59-B.65). Leak rates listed in Tables 7.16 and 7.17 are based on FPL analyses and are included in the averages in Table 7.7. As indicated, all leak rates were calculated from equations (1) and (2) above. The containment free volume and primary coolant volume used were respectively 4.4(10) and 3.8(8) cc. In all cases the Δt values used were the time between the prior long-term purge for the respective containment and the sample time. The radioiodine reactor coolant concentrations included radioiodine spike concentrations. From these data, it can be concluded that on the average 3.4(-2) and 8.7(-4) percent of the ^3H and ^{131}I reactor coolant inventories leak into the containment buildings, respectively. This should not be interpreted as two different actual reactor coolant leakage rates, but as effective leak rates of the two radionuclides, i.e., the quantity of the two radionuclides present in the reactor coolant that leak to the containment building and is converted to the vapor state. The difference in the effective leak rates for the two radionuclides is due to the different partition factors (gaseous to liquid distributions) for ^3H and radioiodine.

Table 7.10 presents the effective partition factors (EPF) based on containment ^{131}I and ^3H atmosphere concentrations. The EPF is defined as the ratio of the containment normalized ^{131}I and ^3H concentrations where the ^{131}I and ^3H containment normalized concentrations are airborne radionuclide concentrations divided by the reactor coolant

TABLE 7.7

RADIONUCLIDE AVERAGE REACTOR COOLANT EFFECTIVE LEAK RATES TO THE CONTAINMENT BUILDING

(percent per day)

Nuclide	Unit #3	Unit #4	Combined	Total Number of Samples
^{131}I	1.1(-3)	3.8(-4)	8.7(-4) [1]	29
^{132}I	3.8(-4) [2]	[3]	3.8(-4)	3
^{133}I	7.8(-4)	4.6(-4)	6.7(-4) [4]	6
^{135}I	5.8(-4)	4.2(-4)	5.3(-4) [4]	6
^{3}H	3.4(-2)	1.3(-2)	2.7(-4) [4]	6

---

[1] The combined average is a weighted average based on 19 samples from Unit #3 and 10 samples from Unit #4 which includes FPL data (Tables 7.16 and 7.17).

[2] Based on three samples only.

[3] Radionuclide not detected.

[4] The combined average is a weighted average based on 4 samples from Unit #3 and 2 samples from Unit #4.

[5] Weighted average based on number of samples.

TABLE 7.8

RADIONUCLIDE EFFECTIVE LEAKAGE RATE TO CONTAINMENT BUILDING UNIT #3

	Percent reactor coolant inventory leakage per day				
Nuclide	11/10/77	2/23/78[1]	3/15/78	4/18/78	5/3/78
^{131}I	5.4(-3)	1.6(-4)	1.5(-3)	1.5(-3)	1.2(-3)
^{132}I	4.0(-4)	2.1(-4)	*	*	5.3(-4)
^{133}I	7.4(-4)	5.0(-4)	*	9.3(-4)	9.5(-4)
^{135}I	2.8(-4)	2.1(-4)	*	9.8(-4)	8.4(-4)
^{85m}Kr	*	5.3(-1)	*	6.1(-1)	*
^{133}Xe	*	9.8(-2)	*	*	9.0(-1)
^{135}Xe	*	1.8(-1)	1.5(-1)	*	4.9(-1)
^{3}H	6.8(-2)	1.3(-3)	2.4(-2)	*	3.0(-2)

---

* - Insufficient data for leakage rate calculation.

[1] This sample was taken approximately 5 days after startup from refueling, equilibrium in primary coolant or containment not yet reached.

TABLE 7.9

RADIONUCLIDE EFFECTIVE LEAKAGE RATE TO CONTAINMENT BUILDING UNIT #4

	Percent reactor coolant inventory leakage per day	
Nuclide	1/12/78	5/10/78
^{131}I	1.3(-3)	8.9(-5)
^{133}I	7.4(-4)	1.7(-4)
^{135}I	6.2(-4)	2.1(-4)
^{85m}Kr	*	*
^{133}Xe	*	1.7(1)
^{133m}Xe	*	1.5(1)
^{135}Xe	*	9.4(0)
^{3}H	9.2(-3)	1.6(-2)

---

* - Insufficient data for leakage rate calculation.

TABLE 7.10

CONTAINMENT EFFECTIVE PARTITION FACTORS[1]

Unit	Sample Date	$^{3}H_{G}$ (μCi/cc)	$^{3}H_{L}$ (μCi/cc)	$^{131}I_{G}$ (μCi/cc)	$^{131}I_{L}$ (μCi/cc)	EPF
3	11/10/77	9.9(-7)	1.7(-1)	1.5(-8)	2.0(-2)	1.3(-1)
3	2/23/78	1.9(-7)	4.2(-2)	8.0(-10)	5.4(-3)	3.3(-2)
3	3/15/78	7.6(-6)	1.9(-1)	6.8(-9)	1.5(-2)	1.1(-2)
3	5/3/78	9.6(-6)	3.0(-1)	6.0(-9)	7.5(-3)	2.5(-2)
4	1/12/78	3.4(-6)	1.6(-1)	7.3(-9)	7.0(-3)	4.9(-2)
4	4/11/78	1.2(-6)	2.1(-1)	2.5(-9)	9.0(-2)	4.8(-3)
4	5/10/78	7.4(-6)	2.0(-1)	6.6(-10)	7.5(-3)	2.4(-3)

---

[1] $$\text{EPF} = \frac{^{131}I_{G}/^{131}I_{L}}{^{3}H_{G}/^{3}H_{L}}$$

where the subscripts G and L refer to the gas and liquid phases, respectively.

concentrations. Again, it should be emphasized that the effective partition factors do not represent actual partition factors but represent the amount of partitioning that occurs between the radioiodine and ^3H in the reactor coolant. However, it should be pointed out that the EPF can be used to predict radioiodine or tritium containment airborne inventories for given reactor coolant concentration if either the radioiodine or tritium effective leak rates are known.

Tables 7.11 and 7.12 present the average iodine species distributions and ranges for the different radioiodines observed in the Unit #3 and Unit #4 containment buildings. These data are taken from Appendix Tables B.61 and B.64. Examination of the data in Tables 7.11 and 7.12 indicate a relationship between the half-lives and the fraction of organic iodine in the two containment buildings. This observation is consistent with data in other studies (2,3,7), i.e., the shorter the radioiodine half-life, the less highly enriched in organic iodine the radioiodine nuclide is. The reason for the exception in these data, high organic ^{135}I levels in Unit #4, is unknown. Also examination of appendix Tables B.61 and B.64 shows a definite trend in the percent organic iodide and the time since the previous containment purge. For Unit #3 this is illustrated in Figure 7.2, where the percent organic ^{131}I increases with the time since the last containment purge. This same trend was observed in the Unit #4 containment. For the sample collected on 4/11/78, less than one day after a containment purge, the organic fractions for ^{131}I and ^{133}I were respectively 35.0 and 30.8 percent. For the samples taken on 1/12/78 and 5/10/78, 27 and 26.5 days after a containment purge, a significant increase in the fraction of organic iodine is seen for both ^{131}I and ^{133}I. In addition, the fraction of ^{133}I in the organic form did not increase as much as did the organic ^{131}I fraction. The reason for the inconsistency of the ^{135}I organic to follow this tend is unknown. The fact that radioiodines become more organic as the length of time they persist in the containment atmosphere increases (i.e., longer half-lives and times since last containment purge) supports the conclusion that surfaces in containment, in particular concrete, can play an important role in the conversion of the more reactive iodine species, such as I_2 and HOI, into the organic form (13).

7.2.3.2 Containment Purge Frequency

As noted in the system description, both containments have 2-inch continuous vent lines for pressure control inside the containment buildings. However, the continuous vent line on Unit #3 had a tendency to become blocked. Alternately, pressure control in Unit #3 containment was maintained by turning on the exhaust fan for approximately five minutes. This mode of operation is hereafter called short-term purging and was characteristic of Unit #3 only. Tables 7.13 and 7.14 present the purge histories of Units #3 and #4 during the in-plant measurements at Turkey Point. The short-term purges for Unit #3 are indicated in Table 7.13.

TABLE 7.11

UNIT #3 CONTAINMENT ATMOSPHERE IODINE SPECIES AVERAGES

Number of Samples	Isotope	$t_{1/2}$	Particulate (%)		I_2 (%)		HOI (%)		Organic (%)	
			Avg	Range	Avg	Range	Avg	Range	Avg	Range
5	^{131}I	8.05 days	0.7	0.3-2.1	2.0	0.3-4.8	4.0	0.1-8.3	93.2	84.7-98.4
4	^{132}I	2.3 hours	0.0	---	14.6	0-25.3	20.8	0-73.7	64.4	0-100
5	^{133}I	20.8 hours	1.1	0-3.2	2.1	0-3.6	5.2	0.1-10.8	91.0	86-95.1
4	^{134}I	6.6 hours	2.7	0-8.1	7.3	0-23.8	12.6	0-28.5	77.6	39.7-100

TABLE 7.12

UNIT #4 CONTAINMENT ATMOSPHERE IODINE SPECIES AVERAGES

			Particulate (%)		I_2 (%)		HOI (%)		Organic (%)	
Number of Samples	Isotope	$t_{1/2}$	Avg	Range	Avg	Range	Avg	Range	Avg	Range
3	^{131}I	8.05 days	0.5	0.3-1.6	4.7	4.4-9.4	7.2	5.2-54.0	86.5	35.0-86.7
3	^{133}I	20.8 hours	1.2	1.2-2.0	10.7	8.1-13.2	15.1	8.1-58.4	73.2	30.8-82.7
3	^{135}I	6.6 hours	0	---	9.0	0-17.9	0	---	91.0	82.1-100

Note: The sample of 4/1/78 was not included in average as it was taken less than one day after purging. Equilibrium had not been established.

Figure 7.2

^{131}I Fractional Percent Organic Iodines as a Function of Time After Last Purge

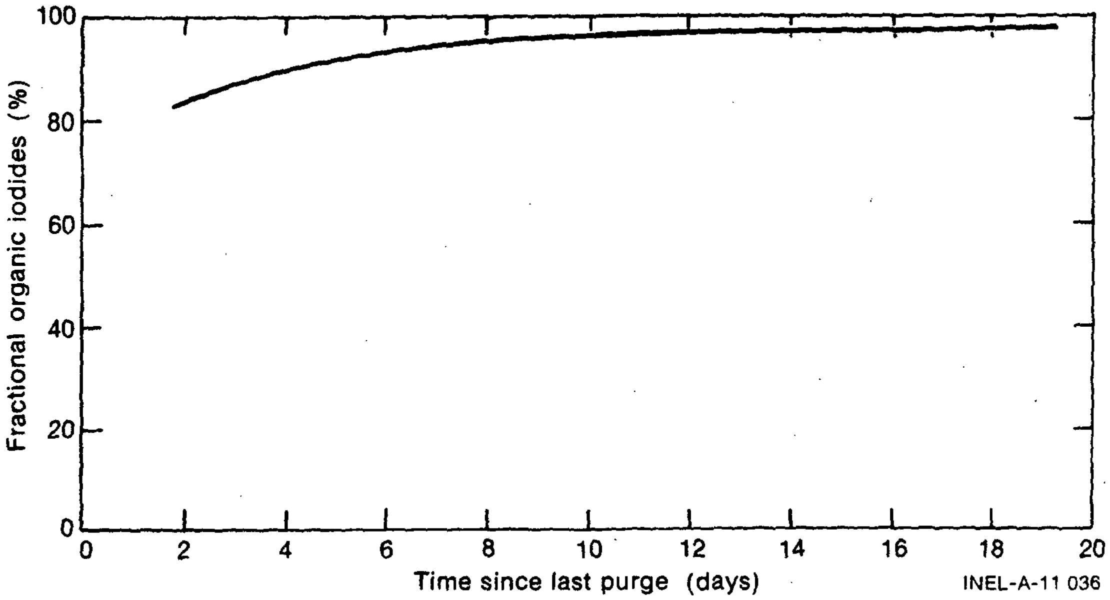

TABLE 7.13

TURKEY POINT UNIT #3
CONTAINMENT PURGES AND VENTS [1]

Purge #	Start Time		Stop Time
77-43	11/7/77 - 1821		11/8/77 - 0235
77-44	11/19/77 - 1355		11/19/77 - 1845
77-45	11/24/77 - 0040		1/21/78 - 1130
78-1	1/25/78 - 2300		2/17/78 - 1912
78-2	2/25/78 - 0600		2/25/78 - 1000
78-3	2/28/78 - 0935	[2]	2/28/78 - 0938
78-4	3/9/78 - 1345	[2]	3/9/78 - 1346
78-5	3/13/78 - 1120	[2]	3/13/78 - 1123
78-6	3/16/78 - 1703	[2]	3/16/78 - 1705
78-7	3/21/78 - 2035		3/22/78 - 0804
78-8	3/31/78 - 0915		3/31/78 - 1315
78-9	4/4/78 - 0532		4/4/78 - 1138
78-10	4/10/78 - 0330		4/10/78 - 0730
78-11	4/12/78 - 0600		4/12/78 - 1442
78-12	4/19/78 - 0600		4/21/78 - 0930
78-13	5/4/78 - 1130	[2]	5/4/78 - 1135
78-14	5/15/78 - 0905	[2]	5/15/78 - 0907
78-15	5/19/78 - 2145		5/20/78 - 0745

---

[1] Data for measurement program period only.

[2] Short-term purge.

TABLE 7.14

TURKEY POINT UNIT #4
CONTAINMENT PURGES AND VENTS [1]

Purge #	Start Time	Stop Time
77-19	11/5/77 - 0520	11/5/77 - 1512
77-20	11/10/77 - 1145	11/10/77 - 1515
77-21	12/15/77 - 0645	12/16/77 - 0840
78-1	1/20/78 - 1025	1/21/78 - 1350
78-2	1/25/78 - 0620	1/25/78 - 1732
78-3	2/14/78 - 1610	[2]
78-4	3/29/78 - 0655	3/29/78 - 1105
78-5	4/11/78 - 0540	4/11/78 - 0940
78-6	4/14/78 - 0600	4/14/78 - 1125
78-7	5/15/78 - 0600	5/15/78 - 1350
78-8	5/26/78 - 1150	5/26/78 - 2010

---

[1] Data for measurement program period only.

[2] Approximately 20 days during outage.

Using data for the first five months of 1978 (Tables 7.13 and 7.14) the extrapolated annual purge frequencies for Units #3 and #4 are 40 and 19 times, respectively. The total of 40 for Unit #3 includes 16 short-term purges. The durations of the purges are discussed in the next section.

7.2.3.3 Extrapolated Annual Radionuclide Release

The extrapolated annual releases for ^3H, ^{131}I, and ^{14}C and particulates are shown in Table 7.15. The release rates (μCi/sec) for the different radionuclides during the different modes of plant operation (refueling and non-refueling) are presented in section 2. The intent of this section is to present the calculational methods employed and the data used in the calculations.

The method used for calculating ^{131}I and ^3H releases from a given containment building was identical; however, the method for calculating ^3H and ^{131}I released from the two containment buildings was different. The differences were to include a factor for continuous venting (2-inch line) of Unit #4 containment and not include it for Unit #3; and to include short-term purging for Unit #3 and not include it for Unit #4. In calculating the release from both containments, the leakage of ^{131}I and ^3H into the containment during a long-term purge (>4.0 hrs) was considered. In addition, all airborne activity was assumed to be removed from the containment during a long-term purge (>4.0 hrs). This is reasonable if we represent the concentration in containment during purge by the following relationship:

$$\frac{A_t}{A_o} = e^{-Qt/V}$$

where

A_t = Activity remaining at time t

A_o = Activity present at start of purge

Q = Containment purge rate (cfm)

t = Purge duration (minutes)

V = Containment volume (ft^3)

Using this relationship, A_t is equal to one percent of A_o after a 3.3 hour (197 minute) purge.

The following are the equations (with respective containment unit denoted) used to calculate the ^3H and ^{131}I annual releases:

TABLE 7.15

EXTRAPOLATED ANNUAL CONTAINMENT BUILDING RADIONUCLIDE RELEASES (Ci/year)

Nuclide	Unit #3	Unit #4	Total
^{131}I	4.1(-3)	2.0(-3)	6.1(-3)
^{3}H	5.2(0)	3.9(0)	9.1(0)
^{14}C	9.7(-2)	4.6(-2)	1.5(-1)
^{134}Cs	2.1(-5)	4.7(-5)	7.7(-5)
^{137}Cs	8.4(-5)	9.2(-5)	1.9(-4)
^{58}Co	3.2(-6)	[1]	3.2(-6)
^{60}Co	1.4(-5)	1.3(-5)	3.0(-5)
^{54}Mn	[1]	[1]	
^{55}Fe	[1]	[1]	

---

[1] Insufficient data

Equation	Unit
(1) $R_v R_c \left(\frac{LR}{100}\right) \frac{P_{dh}}{24} + C_c C_v = R_p$	3, 4
(2) $C_c V_F V_{dm} = R_{stp}$	3
(3) $C_c V_c D_v = R_{cv}$	4
(4) $R_{cv} + (R_p F_p) = R_a$	4
(5) $R_{stp} F_v + R_p F_p = R_a$	3

where:

R_v - Reactor coolant volume (3.8(8) cc)

R_c - Radionuclide concentration in reactor coolant (µCi/cc)

(LR)- Effective radionuclide reactor coolant to containment leak rate (%/day)

P_{dh} - Long-term purge duration (hrs)

C_c - Containment radionuclide airborne concentration (µCi/cc)

C_v - Containment free volume (4.4(10) cc)

R_p - Average release for long-term purge (µCi)

V_F - Short term purge flow (7.1(8) cc/min).

V_{dm} - Short term purge duration (2.7 min)

R_{stp} - Release for short-term purge (µCi)

V_c - Continuous vent flow (1.0(9) cc/day)

D_v - Continuous vent duration (250 days)

R_{cv} - Release for continuous vent (µCi)

F_p - Long-term purge frequency (yr^{-1})

F_v - Short-term purging frequency (yr^{-1})

R_a - Radionuclide extrapolated annual release (µCi)

Tables 7.16 and 7.17 list the appropriate values used in the calculations for ^{131}I. For all release calculations a reactor coolant volume of 3.8(8) cc was used for both Units #3 and #4 together with a containment free volume of 4.4(10) cc. Specific to Unit #3 for a short-term purge, a flow of 25,000 cfm (7.1(8) cc/min) and an average duration of 2.7 minutes was used. The short-term and long-term purging frequencies were 16 and 24 times per year, respectively. Specific to Unit #4, the continuous vent flow was 1.0(9) cc/day (25 cfm) and the continuous vent duration was assumed to be for 250 days/year. The long-term purge frequency used for Unit #4 was 19 times per year. The long-term purge durations used were 7.2 hours for Unit #3 and 8.9 hours for Unit #4. Iodine-131 effective leak rates are from Table 7.7.

The average long-term purge flows, durations, and frequencies described above for the respective units were used to obtain the ^3H results shown in Table 7.18. In addition, the same flows, durations, and frequencies were used for the continuous vent and short-term purges of Unit #3 and Unit #4. Tritium effective leak rates were taken from Table 7.7. The ^3H containment airborne concentrations were taken from Appendix B, Tables B.62 and B.65.

The extrapolated annual release of ^{14}C and particulates from Unit #3 was calculated using the following relation. No corrections for leakage of reactor coolant into containment during a purge were made in the calculation of ^{14}C and particulate releases.

$$[(C_V \times F_V) + (C_P \times F_P)] \times C_{Ave} \times K = R_C$$

where

C_V = Average volume of a vent short-term purge (cc)

F_V = Short-term frequency (year^{-1})

C_P = Free volume containment (cc)

F_P = Long-term purge frequency (year^{-1})

C_{Ave} = Average concentration of nuclide in containment (µCi/cc)

K = Conversion factor (10^{-6} Ci/µCi)

R_C = Extrapolated annual release from containment (Ci/yr)

For Unit #4 calculations, the first term in the equation, $(C_V \times F_V)$, is replaced by $(C_{CP} \times F_{CP})$. C_{CP} is equal to the average volume released per

TABLE 7.16

DATA FOR UNIT #3 CONTAINMENT ANNUAL ^{131}I RELEASES

Purge #	Purge Start Date	Purge Duration (hrs)	Days Since Previous Purge	Containment Atmosphere Concentration (μCi/cc)	Leak Rate (%/day)	Reactor Coolant Concentration (μCi/cc)	Release (μCi)
3-1				During shutdown (no data)			
3-2	2/25/78	4.0	8	8.9(-10)	3.3(-4)	5.4(-3)	40.0
3-3	2/28/78	3 (min.)	3	1.4(-9)	7.8(-4)	8.0(-3)	4.2
3-4	3/9/78	1 (min.)	12	3.4(-9)	5.3(-4)	1.0(-3)	3.4
3-5	3/13/78	3 (min.)	16	2.5(-9)	2.3(-4)	1.5(-2)	7.4
3-6	3/16/78	2 (min.)	19	5(-9)	4.2(-4)	1.5(-2)	9.9
3-7	3/21/78	11.5	24	3.4(-9)	3.6(-4)	1.1(-2)	154.3
3-8	3/31/78	4.0	10	4.0(-9)	7.0(-4)	1.0(-2)	179.5
3-9	4/4/78	3.1	4	3.8(-9)	1.7(-3)	8(-3)	171.9
3-10	4/10/78	4.0	6	3.5(-9)	1.1(-3)	8(-3)	158.3
3-11	4/12/78	21	2	1.8(-9)	1.6(-3)	7(-3)	92.8
3-12	4/19/78	3.5	7	3.6(-9)	1.2(-3)	7(-3)	184.9
3-13	5/4/78	5 (min.)	14	4.3(-9)	8.3(-4)	7.5(-3)	21.5
3-14	5/15/78	2 (min.)	25	7.7(-9)	1.2(-3)	7.5(-3)	15.3
3-15	5/19/78	6.8	30	7.5(-9)	1.0(-3)	8(-3)	337.7
Averages		[1] 7.2 hr [2] 2.7 min		[3] 3.8(-9)	[4] 8.5(-4)	8.5(-3)	[5] 165 [6] 10.2

---

[1] Long term purge average duration.

[2] Short term purge average duration.

[3] Average containment airborne concentration from FPL analyses at time of purge.

[4] Calculated by same method in section 7.2.3.1 from FPL ^{131}I measurements and reactor coolant ^{131}I concentrations for day nearest to purge. Data included in combined average for Section 7.2.3.1.

[5] Average release rate for long-term purge (μCi/purge).

[6] Average release rate for short-term purge (μCi/purge).

TABLE 7.17

DATA FOR UNIT #4 CONTAINMENT ANNUAL ^{131}I RELEASES

P #	Purge Start Date	Purge Duration (hrs)	Days Since Previous Purge	Containment Atmosphere Concentration (μCi/cc)	Leak Rate (%/day)	Reactor Coolant Concentration (μCi/cc)	Release (μCi)
8-4-1	1/20/78	3.4	26	2.6(-9)	3.2(-4)	7(-3)	123.3
8-4-2	1/25/78	11.2	5	2.1(-9)	8.7(-4)	7(-3)	96.3
8-4-3	2/14/78	24	30	2.0(-9)	3.1(-4)	7(-3)	98.0
8-4-4	8/29/78	4.2	20	3.1(-10)	6.4(-5)	6(-3)	14.8
8-4-5	4/11/78	6.5	13	1.8(-9)	3.0(-5)	9(-2)	84.4
8-4-6	4/14/78	5.4	3	2.1(-9)	1.0(-4)	9(-2)	95.3
8-4-6	5/16/78	7.8	32	9.3(-10)	1.3(-4)	7.5(-3)	45.7
8-4-8	5/26/78	8.4	10	2.3(-9)	5.8(-4)	7(-3)	107.0
Averages		[1] 8.9 hours		[2] 1.8(-9)	[3] 3(-4)	2.8(-2)	[4] 83.0

---

[1] Long-Term purge duration.

[2] Average containment airborne concentration from FPL analyses at time of purge.

[3] Calculated by same method in Section 7.2.3.1 from FPL ^{131}I analyses and reactor coolant ^{131}I concentrations for day nearest to purge. Data included in combined average for Section 7.2.3.1.

[4] Average release rate for long-term purge (μCi/purge).

TABLE 7.18

DATA FOR ANNUAL ^{3}H RELEASES FROM CONTAINMENT PURGES

Sample Date	Unit	Prior Purge (days)	Containment Atmosphere Concentration (μCi/cc)	Reactor Coolant Concentration (μCi/cc)	Release (μCi)
11/10/77	3	2.7	9.9(-7)	1.7(-1)	
2/23/78	3	4.3	1.9(-7)	4.2(-2)	
3/15/78	3	19.3	7.6(-6)	1.9(-1)	
5/3/78	3	12.5	9.6(-6)	3.0(-1)	
Average			4.4(-6)	1.8(-1)	[3] 1.7(5)
1/23/78	4	27	3.4(-6)	1.6(-1)	
4/11/78	4	0.7	1.2(-6)	2.1(-1)	
5/10/78	4	26.5	7.4(-6)	2.0(-1)	
Average			[1] 4.0(-6)	[2] 1.9(-1)	[3] 1.8(5)

---

[1] Based on Source Term Program measurements. (Appendix B Tables B.62 and B.65).

[2] Average reactor coolant concentrations based on samples on day nearest to purge.

[3] Average released due to long-term purge based on average long-term purge duration of 7.2 hours for Unit #3 and 8.9 hours for Unit #4 (Tables 7.16 and 7.17). Uses leak rates of 3.4(-2) and 1.3(-2) percent per day for Units #3 and #4 respectively (Table 7.5).

day for a continuous venting (1.0(9) cc/day) and F_{CP} is equal to the continuous vent duration (250 days/year). All other parameters are described in the ^3H and ^{131}I annual release discussion.

The radionuclide averages used in the calculations are in Table 7.19.

TABLE 7.19

^{14}C AND PARTICULATE RADIONUCLIDE AVERAGES

Nuclide	Unit #3 (μCi/cc)	Unit #4 (μCi/cc)
^{134}Cs	1.9(-11)	4.3(-11)
^{137}Cs	7.6(-11)	8.3(-11)
^{58}Co	2.9(-12)	[1]
^{60}Co	1.3(-11)	1.2(-11)
^{14}C [2]	8.9(-8)	4.2(-8)

[1] Radionuclide not detected.

[2] Includes total ^{14}C.

8. AUXILIARY BUILDING VENTILATION SYSTEM

8.1 System Description and Sampling Methods

Figure 1.2 presents a schematic diagram of the overall gas waste disposal system at Turkey Point. Figures 2.9 and 8.1 show the auxiliary building ventilation system in more detail. The auxiliary building ventilation system exhausts air from both Unit #3 and Unit #4 equipment rooms and the open areas of the auxiliary building. The exhaust system includes a bank of high efficiency particulate air (HEPA) filters, consisting of twenty individual filters each 24" x 24" x 11-1/2". Air is moved through the filter bank by two exhaust fans rated at 40,000 cfm each, discharging to the atmosphere via the plant vent. The system is designed to provide a minimum of five air exchanges per hour for each of the equipment rooms and open areas of the building. Supply air to the auxiliary building enters via two fans (each rated at 13,500 cfm). The balance of supply air is from inleakage. This system is designed to assure proper direction of air flow for removal of potential airborne radioactivity and adequate heat removal from operating equipment.

Additional buildings and systems exhausting to the plant stack include Unit #3 and Unit #4 containment buildings, Unit #4 fuel pit area, the new radwaste building, and the waste gas processing system. The secondary system off-gas system and the Unit #3 spent fuel pit area discharge to the atmosphere via their own individual vents.

The containment buildings and the Unit #3 fuel pool area exhaust systems as well as the secondary system associated off-gas and the waste gas processing systems are described and discussed in other sections of this report. The Unit #4 fuel pit area exhaust system consists of prefilters, HEPA filters, and a 20,000 cfm rated exhaust fan. The supply air to the Unit #4 spent fuel pit area enters via two fans with a combined rated capacity of 3000 cfm. The balance of the supply air is supplied by inleakage. The new radwaste building ventilation exhaust system is rated at 15,000 cfm via two exhaust fans. The supply air to this building is provided entirely by inleakage.

Figure 8.1 also shows sample points and types of samplers employed at each location. Specific plant areas whose ventilation exhaust feeds each sample point are listed in Table 8.1. Also, included in Table 8.1 are the design duct flows at the sampler locations. Design flows were taken from Figure B.16 in Appendix B.

As expected, the plant vent and auxiliary building duct flow rates changed with different fan alignments, i.e., with the number and/or with particular fans feeding the plant vent. To assess the significance of changes due to different fan alignments, two sets of flow rate measurements were made at each long-term sampling location using a multiple-injection,

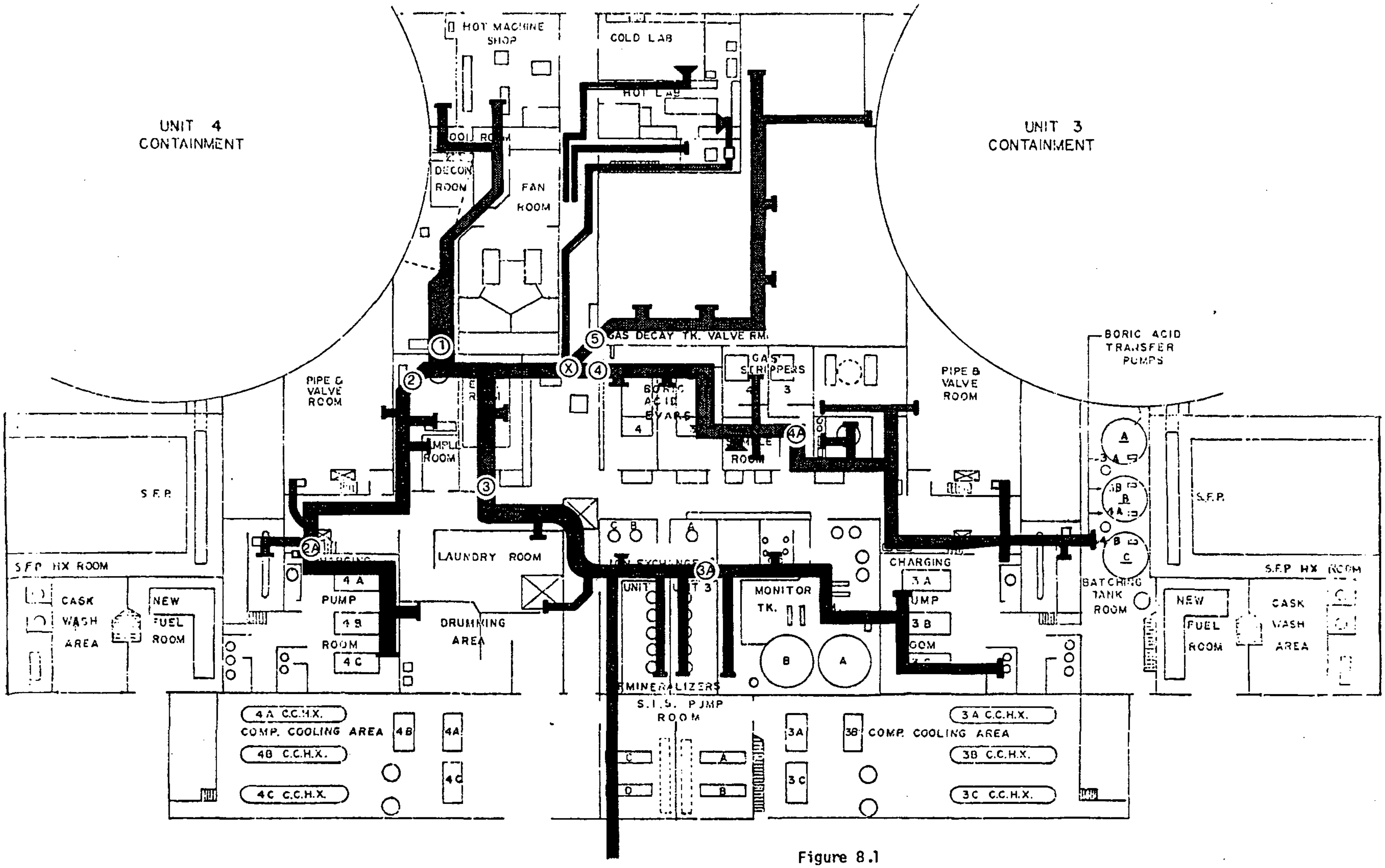

Figure 8.1

Auxiliary Building Ventilation System

TABLE 8.1

AUXILIARY BUILDING SAMPLING STATION FEEDS WITH DESIGN DUCT FLOWS

Main Stack - 85,000 cfm

1. Auxiliary building ventilation system
2. Containment source
3. Unit #4 fuel pit area
4. New radwaste building
5. Waste gas decay tanks (Units #3 and #4)

Station 1 - 4,570 cfm

1. Hot machine shop
2. Unit #4 electrical penetration room

Station 2 - 5,375 cfm

1. Unit #4 residual heat exchanger room
2. Unit #4 pipeways
3. Unit #4 non-regenerative heat exchanger room
4. Unit #4 seal water heat exchanger room
5. Unit #4 charging pump room
6. Unit #4 sample room
7. Unit #4 pipe and valve room
8. Unit #4 containment spray pump room

Station 3 - 7,550 cfm

1. Unit #3 charging pump room
2. Monitor tank room
3. Ion exchange room (Units #3 and #4)
4. Unit #4 residual heat removal pump rooms
5. Safety injection pump room
6. Deborating demineralizer room (Units #3 and #4)
7. Solid waste drumming room

Station 4 - 10,855 cfm

1. Boric acid tank room
2. Unit #3 residual heat exchanger room
3. Unit #3 non-regenerative heat exchanger room
4. Unit #3 seal heat exchanger room
5. Unit #3 pipe and valve room
6. Unit #3 containment spray pump room
7. Concentrate holding tank room
8. Residual heat exchanger rooms
9. Gas stripper rooms (Units #3 and #4)
10. Unit #3 sample room
11. Unit #3 Pipeways
12. Basement tank room
13. Basement pump room
14. Boric acid evaporator package rooms (Units #3 and #4)

TABLE 8.1 (cont'd)

AUXILIARY BUILDING SAMPLING STATION FEEDS WITH DESIGN DUCT FLOWS

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*Station 4A - 5505 cfm includes items 1-8

Station 5 - 14,310 cfm

1. Unit #3 electrical penetration room
2. Holdup tank rooms
3. Waste gas decay tank rooms

Unit #3 fuel pit area - 20,000 cfm

1. Unit #3 spent fuel pit heat exchanger pump room
2. New fuel storage room
3. Spent fuel pit room

---

helium dilution technique (4). Table 8.2 lists the alignments considered and the results of these measurements. Also, included in Table 8.2 are plant stack flow rate measurements obtained by the standard pitot tube traverse method. At locations where both helium and pitot tube measurements were made, the results agree within two percent. Ths is excellent agreement and indicates valid sampling locations. Duct flows used for short-term samplers (see Figure 2.9) were calculated from the ratio between design and measured duct flow rates at downstream sample locations. The flows employed were 205 cfm for the gas stripper and 150 cfm for the Unit #3 sampling room.

As indicated in Figure 2.9, the sampling system installed at each sample point was a low volume iodine species sampler and/or a ^{14}C and ^{3}H sampler. The samplers are described in reference 4.

8.2 Measurement Data

The radionuclide release rates (μCi/sec) for the auxiliary building ventilation system and Unit #3 spent fuel pit are presented in Appendix B Tables B.66-B.74. These tables contain the following information:

Sample Location	Measurement Period	Isotopic Concentration Data Presented for
Stations 1-5	11/10/77-6/1/78	Particulate, ^{131}I species
Station 4A	1/20/78-6/1/78	Particulate, ^{131}I species
Unit #3 fuel pit area	12/8/78-6/1/78	Particulate, ^{131}I species ^{14}C and ^{3}H
Unit #3 primary sample room	4/3/78-5/18/78	Particulate, ^{131}I species
Boric acid evaporator gas stripper room	5/18-6/1/78	Particulate, ^{131}I species
Main Stack	11/10/77-6/1/78	Particulate, ^{131}I species, ^{14}C, ^{3}H.

The stack sampler release data are presented in Appendix B, Table B.75. Particulate, ^{14}C-^{3}H, and ^{131}I release rates are given. Gaseous iodine species data are presented in Appendix B, Tables B.76-B.85. In addition to radionuclide release rates, upper limit values, based on experimental limits of detection are presented for a selected list of nuclides. Table B.86 in Appendix B presents a summary of sample station data for ^{131}I.

8.3 Results and Discussion

It is the intent of this section to present the basis for the major conclusions based upon studies of gas systems at Turkey Point as well as

TABLE 8.2

VENTILATION DUCT FLOW MEASUREMENTS

Exhaust Fans in Use[1]			Measured Flows (cfm)						
Auxiliary Building (40,000 cfm each)	Containment Purge (35,000 cfm each)	Main Stack[2] Pitot Tube Measurement	Main Stack	Station #1	Station #2	Station #3	Station #4	Station #4A	Station #5
1		58,000	[3]	5900	9900	7200	16,200	13,300	5900
2		68,500	69.300	6800	12,800	8300	21,300	17,800	6500
1	1	90,100	88,500	6000	10,300	7300	16,800	14,000	5700
1	2	[ ]	95,500	5200	7800	6300	12,200	10,000	5000

[1] All measurements made with #4 fuel pit exhaust fan and both "new" radwaste building exhaust fans operating.

[2] Plant measured flow rate.

[3] No plant measurement made.

Note: Unit 3 spent fuel pit area duct flow is 20,000 cfm.

to present the results of additional measurements. The following topics, which are pertinent to the analysis of the auxiliary building sampler data, are presented:

(1) Normalized ^{131}I and ^{3}H Release Rates.

(2) ^{131}I Source Term and Annual Releases.

(3) Particulate Source Term and Annual Releases

(4) Tritium and ^{14}C Annual Releases

(5) Decontamination Factors for HEPA Filters

(6) Effective Reactor Coolant Leakage Rates, Partition Factors and ^{131}I Species.

(7) Stack Release Rates of Selected Beta-Emitting Radionuclides.

(8) Stack Release Rates of ^{133}Xe.

8.3.1 Normalized ^{131}I and ^{3}H Release Rates

As a means of comparing radioactive effluents between different PWR's, it is advantageous to normalize the radionuclide release rates to their respective reactor coolant concentrations (5). The normalization formula is:

$$N = \frac{I_G}{I_W}$$

where

N = normalized release rate (μCi/sec)/(μCi/gm)

I_G = radionuclide gaseous release rate (μCi/sec).

I_W = average radionuclide concentration in reactor coolant (μCi/gm).

During a reactor power transient the ^{131}I reactor coolant concentration becomes elevated (i.e., spikes). The ^{3}H concentration is unaffected by the power level change. Tables 8.3 and 8.4 present the ^{131}I reactor coolant concentrations, excluding and including spikes. Also in Table 8.4 are the ^{3}H and ^{131}I (including spikes) normalized release rates from the main stack. Table 8.5 presents the corresponding ^{131}I normalized release rates (excluding spikes) for the main stack and the auxiliary building. Since the ^{131}I normalized release rates including spikes were calculated using higher ^{131}I reactor coolant concentrations, the ^{131}I normalized release rates including spikes were lower. The average ^{131}I normalized main stack release rates

TABLE 8.3

AVERAGE ^{131}I REACTOR COOLANT CONCENTRATIONS
(μCi/gm)
(Excluding Spikes)

Date	Unit #3 ^{131}I[1]	Unit #4 ^{131}I[1]	Average[2]
11/10-11/21	1.4(-2)	6.0(-3)	1.0(-2)
11/21-12/4	7.6(-3)	7.4(-3)	7.5(-3)
12/4-12/14	[3]	8.0(-3)	8.0(-3)
12/14-12/28	[3]	6.6(-3)	6.6(-3)
12/28-1/11	[3]	8.2(-3)	8.16(-3)
1/11-1/25	[3]	6.2(-3)	6.5(-3)
1/25-2/8	[3]	7.2(-3)	7.2(-3)
2/8-2/22	2.8(-3) [4]	6.7(-3) [4]	4.8(-3) [4]
2/22-3/9	1.0(-2)	[3]	1.0(-2)
3/9-3/21	1.8(-2)	6.2(-3)	1.2(-2)
3/21-4/3	1.3(-2)	1.0(-2)	1.2(-2)
4/3-4/20	7.3(-3)	5.7(-2)	3.2(-2)
4/20-5/4	7.2(-3)	1.0(-2)	8.8(-3)
5/4-5/18	7.4(-3)	7.9(-3)	7.6(-3)
5/18-6/1	7.3(-3)	7.1(-3)	7.2(-3)

---

[1] Reactor coolant average based on average of plant and source term measurements. Spikes are not included.

[2] Average of Unit #3 and Unit #4 reactor coolant ^{131}I concentrations. Spikes are not included.

[3] Refueling Outage

[4] Based on analyses during period of Unit #3 startup and Unit #4 shutdown.

TABLE 8.4

MAIN STACK ^{3}H AND ^{131}I NORMALIZED RELEASE RATES[10] AND EFFECTIVE PARTITION COEFFICIENTS

Date	Reactor Coolant Average ^{3}H (μCi/ml)[9]	Normalized ^{3}H Release Rate $\left(\frac{\mu Ci/sec}{\mu Ci/gm}\right)$[6,7]	Reactor Coolant Average ^{131}I (μCi/ml)[3]	Normalized ^{131}I Release[8] Rate $\left(\frac{\mu Ci/sec}{\mu Ci/gm}\right)$	EPF[5,7
11/10-11/21	7.1(-2)	0.44	1.3(-2)	3.08	7.0
11/21-12/4	1.9(-1)	0.83	1.4(-2)	0.74	0.89
12/4-12/14	1.1(-1)[1]	4.4	1.3(-2)[1]	1.34	0.30
12/14-12/28	1.5(-1)[1]	4.5	1.2(-2)[1]	5.64	1.25
12/28-1/11	1.6(-1)[1]	0.94	8.3(-3)[1]	5.29	5.62
1/11-1/25	2.3(-1)[1]	0.83	6.5(-3)[1]	0.52	0.62
1/25-2/8	1.6(-1)[1]	1.5	1.4(-2)[1]	5.47	3.65
2/8-2/22	8.0(-2)	3.0	[4]	[4]	
2/22-3/9	1.3(-1)[2]	3.5	1.1(-2)[2]	1.75	0.50
3/9-3/21	1.4(-1)	1.6	1.2(-2)	1.19	0.74
3/21-4/3	1.5(-1)	1.8	1.2(-2)	0.21	0.12
4/3-4/20	2.2(-1)	7.7	3.2(-2)	0.15	1.9(-2)
4/20-5/4	2.3(-1)	1.4	1.2(-2)	2.13	1.52
5/4-5/18	1.85(-1)	0.11	1.0(-2)	0.11	1.0
5/18-6/1	2.0(-1)	5.0	8.6(-3)	0.21	4.2(-2)

---

[1] Unit #4 shutdown; Unit #3 reactor coolant concentrations used.

[2] Unit #3 shutdown; Unit #4 reactor coolant concentrations used.

[3] Reactor coolant average ^{131}I concentration includes spike concentrations. Also includes plant analyses.

[4] Insufficient reactor coolant analyses to calculate average reactor coolant concentration of release rate.

[5] Effective Partition Factor (EPF) is the ratio of normalized ^{131}I release rate to the normalized tritium release rate.

[6] The ^{3}H releases from the Unit #3 spent fuel pit (SFP) are not included in the above normalized ^{3}H release rates. Including the Unit #3 SFP area would increase the total plant normalized rates by approximately 17 percent. Therefore, the corrected normalized total plant release rate is 2.95 (μCi/sec)/(μCi/gm).

[7] One ml of reactor coolant sample weighs one gram, i.e., gram and ml are essentially interchangeable.

[8] The ^{131}I releases from the Unit #3 spent fuel area are not included in the above normalized ^{131}I release rates. However, since ^{131}I releases from the Unit #3 are less than 2 percent of the total plant ^{131}I releases the main stack ^{131}I normalized release rates represent total plant normalized rates.

[9] Average Unit #3 and #4 ^{3}H reactor coolant concentrations except as noted.

[10] Normalized release rates are for both Units #3 and #4.

TABLE 8.5

NORMALIZED ^{131}I RELEASE RATES [1]
($\mu Ci/sec$)/($\mu Ci/gm$)

Date	Main Stack	Auxiliary Building Sum
11/10-11/21	4.0	4.6
11/21-12/4	1.4	0.6
12/4-12/14	2.2	0.3
12/14-12/28	9.5	5.8
12/28-1/11	5.4	4.4
1/11-1/25	0.5	0.3
1/25-2/8	10.6	9.9
2/8-2/22	[2]	[B]
2/22-3/9	1.9	1.2
3/9-3/21	1.2	1.6
3/21-4/3	0.2	0.1
4/3-4/20	0.15	0.1
4/20-5/4	2.9	3.2
5/4-5/18	0.15	0.14
5/18-6/1	0.25	0.05

---

[1] Average reactor coolant concentrations do not include ^{131}I values due to reactor power transients (spiking).

[2] Few analyses taken during period of Unit #3 startup and Unit #4 shutdown.

including spikes was 2.0 (μCi/sec)/(μCi/gm) while the average ^{131}I normalized main stack release rates excluding spikes was 2.9 (μCi/sec)/(μCi/gm). It should be noted that since the Unit #3 SFP ^{131}I release rates are less than two percent of the total plant ^{131}I releases, the main stack ^{131}I normalized release rates represent total plant ^{131}I normalized release rates from both Units #3 and #4. The average auxiliary building ^{131}I normalized release rate excluding spikes was 2.3 (μCi/sec)/(μCi/gm).

The average ^{3}H normalized release rate from the main stack was 2.5 (μCi/sec)/(μCi/gm). Since the Unit #3 spent fuel area contributes approximately 17% of the ^{3}H releases from the total plant (both Units #3 and #4), the total plant ^{3}H normalized release rate is 2.95 (μCi/sec)/(μCi/gm).

Comparison of these normalized release rates to those observed in another study (7) indicate that the ^{3}H release rates from Turkey Point are nominally 1.5 times lower and the ^{131}I release rates are nominally a factor of 40 higher than those at the other PWR's studied.

8.3.2 Iodine-131 Sources and Annual Release Rates

Table 2.6 shows the auxiliary building ^{131}I release rates in μCi/sec from each sample location as percentages of the sum of the auxiliary building ^{131}I activity (data for each sampling location may be found in Table B.86 of Appendix B). Sample station 4A is not included in the sum as it is a component of station 4, but the percentage of ^{131}I activity contributed to the auxiliary building total activity by station 4A is shown. Consequently, the sum of the six sample stations is greater than 100 percent. In addition, the stack release rate for ^{131}I is also presented. The difference between the auxiliary building total release rates and the stack release rates can be attributed in part to waste gas decay tank (WGDT) and containment purge releases which occurred during the measurement periods. The dates and times of these releases are listed in Tables 7.3, 7.13 and 7.14. An estimated 20% uncertainty should be applied to the release data due to variations in duct flows, sampler flows, and unknown effects of plant operations, e.g., maintenance on steam generators.

As is apparent from the data presented in Table 2.6, the major part of the auxiliary building release of ^{131}I originates between stations 4 and 4A (see Figure 2.9 and Table 8.1). Based on previous experience (2), a particulate-iodine species sampler was installed in the Unit #3 primary sample room. After determining that the Unit #3 primary sample room was not the major source of ^{131}I activity (see Table 8.6), the sampler was moved to the BAE's gas stripper room. The data indicated that neither the Unit #3 primary sample nor the gas stripper room are the major source of activity in the system. Discussions with FPL personnel indicated that the boric acid evaporator rooms might be the primary source of activity; but the BAE rooms could not be sampled due to room access limitations. For the same reason the Unit #3 pipeways could not be sampled.

TABLE 8.6

STATION #4 ^{131}I AIRBORNE ACTIVITY RELEASE RATES (μCi/sec)

Sample Period	Sample Station #4	Unit #3 Primary Sample Room	Unit #3 Gas Stripper Room	Sample Station #4A
4/3-4/20/78	2.84 ± 0.04(-3)	6.6 ± 0.3(-6)[1]		6.5 ± 0.2(-4)
4/20-5/4/78	2.72 ± 0.01(-2)	3.25 ± 0.03(-5)		9.61 ± 0.06(-3)
5/4-5/18/78	2.92 ± 0.07(-4)[2]	1.34 ± 0.07(-6)		1.04 ± 0.02(-3)
5/18-6/1/78	2.9 ± 0.1(-4)[2]		8.6 ± 0.8(-7)	3.5 ± 0.1(-4)

---

[1] Short sample period 4/14-4/20/78.

[2] Air flow to sampler off for a portion of the sample period.

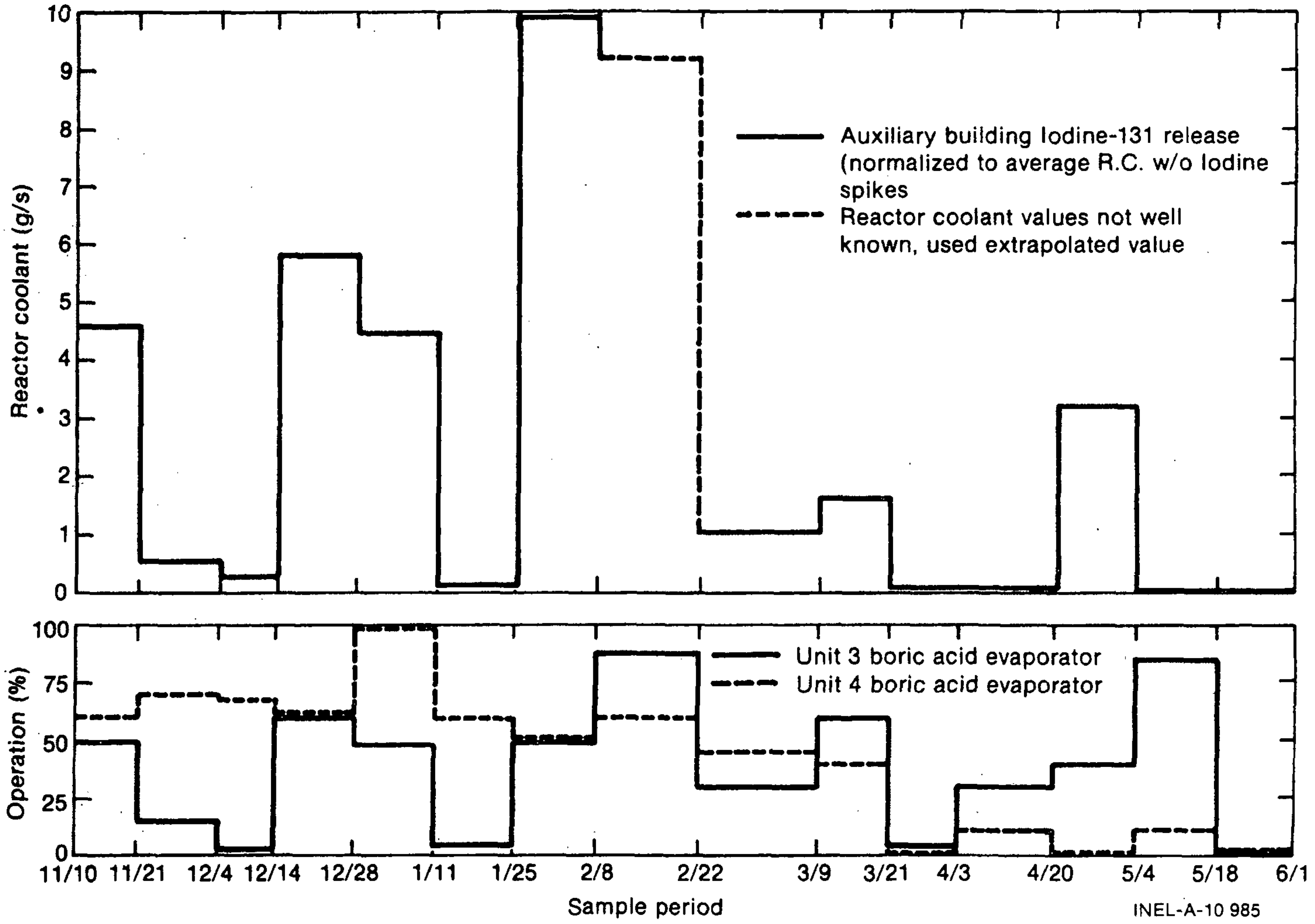
Figure 8.2 presents correlation between the percent operation of the boric acid evaporators during each sample period and the normalized ^{131}I release rate for the auxiliary building. The auxiliary building sum was used for comparison purposes, as station #4 accounts for an average of 87% (excluding last two sampling periods) of the auxiliary building release. These data indicate a correlation between operation of the #3 boric acid evaporator and changes in the ^{131}I release rate from the auxiliary building. This correlation was observed in all measurements except two (the periods 4/3-20/78 and 5/4-18/78). It is not known why the release did not increase with the increased usage of the BAE during the 4/3-20/78 sampling period. The lack of correlation during the 5/4-18/78 period, however, can be explained by the lower level of iodine (factors of 10^2-10^3 lower) in the feed processed by the BAE. No correlation is indicated between the #4 BAE (i.e., radwaste evaporator) operation and the auxiliary building release. These data support the conclusions that the #3 BAE was the primary ^{131}I source term at Turkey Point.

In addition to the above, the values of the effective partition factors (see Table 8.4) support the conclusion that the BAE is the primary ^{131}I source. The effective partition factor (EPF) is defined as the ratio of the normalized ^{131}I release rate to the normalized ^3H release rate, where a normalized release rate for a radionuclide is the absolute release divided by the radionuclide concentration in the source of the radionuclide. The source is normally the reactor coolant. The EPF should not be greater than 1.0. An EPF value greater than 1.0 indicates that the source to which the absolute release rates were normalized (reactor coolant in this case) was not the true total source. When the ^{131}I release rate is normalized to the ^{131}I concentration in the BAE bottoms for the period 1/25-2/8/78 (the only period for which data exist to make a comparison), the EPF value obtained is lowered from 3.65 to 0.46. An EPF of 0.46 is more reasonable and implies that the BAE is the primary ^{131}I source at Turkey Point.

The average ^{131}I release rate for different systems or buildings at Turkey Point during the combined refueling-non-refueling interval, the non-refueling interval, and the refueling interval are presented in Tables 2.5, 2.7, and 2.8. For the combined refueling-non-refueling interval the data indicate that the annual stack release is 0.80 Ci/year, and the auxiliary building annual release is 0.74 Ci/year. This indicates that approximately 92% of the ^{131}I released by Units #3 and #4 via the air pathway come from the auxiliary building, since the release from the Unit #3 spent fuel area is insignificant (0.02 Ci/year). Within the auxiliary building, station #4 (BAE) contributes 0.65 curies per year (Table 2.6). These releases were obtained by converting the μCi/sec release rates in Tables 2.5 and 2.6 to Ci/year. Only sample periods where no sampler malfunctions occurred were used in the calculations. For the refueling and non-refueling intervals (Tables 2.7 and 2.8) similar calculations could be performed, however, the μCi/sec release rates should be weighted for the refueling and non-refueling durations.

Figure 8.2

Auxiliary Building ^{131}I Release Rates



8.3.3 Particulate Source Terms and Annual Releases for Gaseous Effluents

Table 8.7 presents the extrapolated average and annual releases of radioactive particulates in the gaseous effluents from the auxiliary building and stack. Data used in the calculation of releases from the auxiliary building were obtained by summing contributions from sampling stations #1-#5. Only data obtained when all samplers were operational were used. Also, only measured values (i.e., no detection limit estimates) were used. For the auxiliary building the average release rate was then multiplied by the number of seconds per year, corrected for filtration, and converted to curies to obtain annual releases. Release rates from the stack were handled in a similar manner except no filtration correction was made. The annual release of particulate nuclides from the auxiliary building is one percent, or less, of the total stack release for the nuclides shown in Table 8.7. Release paths to the stack that were not monitored in this study were the Unit #3 and Unit #4 containment purge exhaust ducts, the Unit #4 fuel pit area duct, the new radwaste building duct, and the waste gas decay tanks release duct.

Using the release rates in Table 2.5, Table 8.8 presents a mass balance of particulate releases for an arbitrary two-week period. In the mass balance it was assumed one containment purge and one waste gas decay tank release occurred during the sample period. From the data in this table, it is apparent that none of the measured releases is the major source of plant particulate release. Therefore, the major release point for particulate radionuclides is either the new radwaste building, which has no exhaust HEPA's, or the Unit #4 fuel handling area, which has HEPA filters on the exhaust vent. For this reason (also see Unit #3 SFP particulate releases, Table 2.5), it appears that the new radwaste building is the likely primary source for the release of particulates. The new radwaste building system consists of a radwaste evaporator and associated storage tanks area, the test demineralizer (see section 4.1.2), as well as the solid waste drumming area. The radwaste area of the building was not used during the measurement period except to house the test demineralizer system used during the latter stages of the study (April-June, 1978). However, the particulate releases thought to be due to the new radwaste building vent were not correlated with the times the test demineralizer system was in use. Particulate releases were observed throughout the measurement period. Consequently, the primary source of particulates at Turkey Point is believed to be the solids drumming area in the new radwaste building.

8.3.4 Stack Gaseous ^{3}H and ^{14}C Release Rates

The annual ^{3}H and ^{14}C release (including both oxidized and non-oxidized species) via the vapor pathway from all plant areas exhausting to the main stack is presented in Table 8.9. The extrapolated annual releases do not include releases from the Unit #3 fuel pit area because this area exhausts separately (see Table 2.5). The average total release

TABLE 8.7

EXTRAPOLATED ANNUAL STACK AND AXULIARY BUILDING PARTICULATE RELEASES FOR GASEOUS EFFLUENTS

	Auxiliary Building		Stack	
Nuclide	Average Release Rate Sum of Stations 1-5 Before Filters (μCi/sec)	Extrapolated [1] Annual Releases After Filters (Ci/year)	Average Release Rate (μCi/sec)	Extrapolated Annual Releases (Ci/year)
^{134}Cs	2.5(-5)	7.9(-6)	2.6(-4)	8.2(-3)
^{137}Cs	4.4(-5)	1.4(-5)	4.2(-4)	1.3(-2)
^{58}Co	3.5(-5)	1.1(-5)	3.4(-3)	1.1(-1)
^{60}Co	1.9(-5)	6.0(-6)	1.4(-3)	4.4(-2)
^{54}Mn	2.0(-6)	6.3(-7)	2.0(-4)	6.3(-3)
^{59}Fe	[2]	[2]	[2]	[2]

---

[1] Annual and average releases are for the auxiliary building only, decontamination factor assumed to be 100.

[2] Not sufficient data to make extrapolation of annual release.

TABLE 8.8

AVERAGE PARTICULATE RELEASE MASS BALANCE

Nuclide	Stack[1] (μCi)	Auxiliary[1] Building (μCi)	Containment[2] Purge (μCi)	Waste Gas[3] Decay Tanks (μCi)
^{134}Cs	3.1(2)	3.0 (-1)	3.0	1.4(-5)
^{137}Cs	5.1(2)	5.3 (-1)	7.3	3.4(-5)
^{58}Co	4.1(3)	4.2 (-1)	1.2(-1)	3.4(-4)
^{60}Co	1.7(3)	2.3 (-1)	1.2(-1)	1.1(-4)
^{54}Mn	7.6(3)	2.0(-2)	[4]	[4]

---

[1] Average stack and auxiliary building releases are calculated for a two-week sample period [1.21(6) seconds]. Decontamination factor of 100 assumed for auxiliary building HEPA filter banks.

[2] Calculated average releases for one containment purge (see Section 2.3.3).

[3] Calculated average releases for one waste gas decay tank release. Decontamination factor of 100 assumed for HEPA filter banks (see Section 2.3.1).

[4] Insufficient data to calculated average release of this nuclide.

TABLE 8.9

EXTRAPOLATED ANNUAL STACK RELEASES OF GASEOUS ^{3}H AND ^{14}C

Nuclide	Average Release Rate (μCi/sec)	Extrapolated Annual Release (Ci/year)
^{3}H	4.3(-1)	13.5
^{14}C	2.2(-1)	6.9

TABLE 8.10

CONTAINMENT PURGE AND WGDT[1] CONTRIBUTIONS TO ANNUAL STACK RELEASE OF ^{14}C AND ^{3}H

	Fractional contribution to annual stack release (%)	
Nuclide	Unit 3 & 4 Containment Purge Exhaust	Waste Gas Decay Tanks
^{3}H	67.4	0.2
^{14}C	2.1	23.6

[1] Waste gas decay tank release

rate was multiplied by the number of seconds in a year to obtain annual release. Based on calculations described in sections 8.3.1 and 8.3.3, the contribution of ^{14}C and ^{3}H in waste gas decay tank releases and containment purges to the stack release may be obtained. Values are presented in Table 8.10.

The distribution of oxidized and oxidizable ^{3}H and ^{14}C species is presented in Table 8.11. The average release was found to be predominantly oxidized ^{3}H (91% HTO) and oxidizable ^{14}C (82% $R^{14}C$, etc.).

An estimation of the auxiliary building radionuclide source term was included in Table 2.5. It was assumed that the contribution of ^{3}H and ^{14}C to the annual release from the Unit #3 and Unit #4 spent fuel pit areas was the same. In addition, it was assumed that the new radwaste building contribution to the ^{3}H and ^{14}C source term was insignificant. With these assumptions, the auxiliary building is the predominant source of ^{14}C, accounting for 64%, of the total plant release. The fuel pit areas combined contribute 10% to the total plant release of ^{14}C. The balance of the ^{14}C release is via the waste gas processing system. The estimated contribution to the total plant release of ^{3}H from the auxiliary building is approximately 10%. The predominant source of ^{14}C was the containment buildings (56% of plant total), however, a very significant source of ^{14}C was the two spent fuel areas, which contributed approximately 34% of the total ^{14}C plant releases.

8.3.5 Decontamination Factor for HEPA Filters

Figure 1.2 presents a schematic drawing showing the filter banks in the plant gaseous waste system. The only systems which incorporate HEPA filter banks are the Unit #4 and Unit #3 fuel pit area exhaust ducts and the auxiliary building ventilation duct. Due to a lack of sample locations, the fuel pit area ducts were not sampled. Therefore, no decontamination factor measurements could be made for the HEPA filters in these systems.

Continuous measurements were made of all exhaust streams entering the auxiliary building HEPA filter banks, except the waste gas decay tank releases which were sampled periodically. The stack was sampled on the exhaust side of the auxiliary building HEPA filter banks. In addition to the auxiliary building exhaust, the new radwaste building duct, the Unit #4 fuel pit area duct, and the containment purge exhaust duct also vent to the stack sampling point (see Figure 1.2). No samplers existed on these ducts. No decontamination factor could be calculated for the auxiliary building HEPA filters as the stack releases for the radionuclides listed in Table 8.8 are approximately 100 times greater than the releases from the auxiliary building.

8.3.6 Effective Reactor Coolant Leakage Rates, Partition Factors, and ^{131}I Species

The distribution of iodine chemical species measured for the auxiliary building and stack species samplers is given in Tables B.76-B.85 of Appendix B. Table 8.12 shows the average iodine species distribution

TABLE 8.11

STACK GASEOUS ^3H AND ^{14}C SPECIES

Sample Period	HTO (%)[A]	CO_2 (%)[B]
11/10-11/21/77	--	--
11/21-12/4/77	87	6
12/4-12/14/77	98	24
12/14-12/28/77	96	23
12/28-1/11/78	90	18
1/11-1/25/78	--	--
1/25-2/8/78	94	7
2/8-2/22/78	96	9
2/22-3/9/78	99.6	47
3/9-3/21/78	100	22
3/21-4/3/78	98	5
4/3-4/20/78	88	35
4/20-5/4/78	90	7
5/4-5/18/78	62	16
5/18-6/1/78	92	9

[A] Oxidized fraction (%) of total tritium in sample. Balance is oxidizable.

[B] Oxidized fraction (%) of total ^{14}C in sample. Balance is oxidizable.

TABLE 8.12

AVERAGE FRACTIONAL PERCENTAGE FOR ^{131}I SPECIES

		Particulate Filter		I_2		HOI		Organic	
Station	Number of Samples	Ave (%)	Range (%)	Ave (%)	Range (%)	Ave (%)	Range (%)	Ave (%)	Range (%)
Stack	15	1.3	(.05-6.3)	5.9	(.7-17.2)	27.9	(5.6-54.1)	64.3	(29.8-93.8)
Station #1	15	2.0	(0-13.3)	8.8	(0-19.7)	27.2	(7.6-46.9)	61.8	(37.2-86.3)
Station #2	15	4.0	(.1-9.3)	22.3	(2.6-51.3)	33.1	(0-49.2)	40.6	(20.5-91.7)
Station #3	13 [1]	0.4	(.1-.9)	4.1	(1.4-10.0)	27.0	(8.3-65.3)	68.0	(27.2-90.1)
Station #4	13 [2]	1.2	(.2-5.1)	4.7	(.6-15.1)	19.7	(3.3-50.7)	74.5	(34.5-96.0)
Station #4A	10	2.1	(.4-7.7)	6.3	(.04-13.6)	57.8	(12.6-74.4)	33.0	(14.5-85.1)
Station #5	15	2.0	(0-14.8)	6.2	(0-40.4)	14.7	(0-31.6)	77.1	(25-100)
#3 Fuel pit duct	12 [3]	1.8	(0-3.9)	11.8	(0-25.0)	57.9	(0-89.3)	28.5	(12.7-100)
Auxiliary Building Avg	[4]	2.5		9.2		24.3		64.0	

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[1] Sample periods 5/4-5/18/78 and 5/18-6.1/78 not included due to possible partial sample line blockage.

[2] Sample periods 5/4-5/18/78 and 5/18-6/1/78 not included due to closed sample line for part of sample period.

[3] Sample period 12/8-12/12/77 not included due to possible broken sample line for part of the sample period.

[4] Auxiliary Building Average is average of stations 1-5.

and the measured range for each sampling location and average values for the entire sampling program. As indicated, the predominant chemical form of iodine for both the stack and the auxiliary building is organic. This was the case for all sampling stations except sampling stations #2, #4A, and the Unit #3 spent fuel pit area duct. The latter two stations were enriched in HOI while station #2 analyses indicated iodine in the elemental form.

The reason for the presence of HOI in station #4A is unknown. The presence of HOI as the predominant species in the spent fuel storage area is consistent with measurements in another PWR measurement program (7). In that study, ^{131}I of unknown origin was observed in gaseous effluent prior to the plant's first refueling. In this study, similar observations were recorded - the presence of ^{131}I was detected in the fuel pit area effluent prior to movement of fuel into the fuel pit. Samples of both the spent fuel pit (SFP) and refueling water storage tank (RWST) waters indicated that the source of ^{131}I prior to fuel movement was the RWST water as ^{131}I was detected in the RWST water and not in the SFP water. The RWST water is processed through a mixed-bed demineralizer which is common to the SFP and is located adjacent to the SFP. Subsequent to fuel movement, the SFP was the source of ^{131}I, as both the ^{131}I in the SFP water and the gaseous effluent increased. Tritium concentration in the fuel pit water and fuel pit exhaust was relatively constant until the SFP water was removed for SFP liner repairs (see section 5). After the water was removed from the SFP, ^{3}H showed a gradual decrease, and a drastic drop in ^{131}I concentrations was observed, but the predominant species was still HOI. During the latter interval, RWST water was still being processed through the demineralizer.

The presence of significant quantities of elemental iodine in sampling station #2 is believed to be due to a source in the Unit #4 sampling room. This conclusion is consistent with data from other plants (2,7) where ^{131}I was detected in the primary system sampling rooms. It is an indication that the source is due to an active leak, i.e., reactor coolant. However, the predominant iodine species in the Unit #3 sampling room were organic (60%) and HOI (29%). This indicates a source further removed in time from the reactor coolant. It further indicates that the Unit #3 sampling room was not the primary source of ^{131}I, since the primary source was principally organic.

Values for effective reactor coolant leakage based on stack release and reactor coolant concentrations are given in Table 8.13. To obtain a leakage rate of reactor coolant into the auxiliary building, the average stack leakage rate (475 lbs/year) must be multiplied by 0.12. This is based on extrapolated annual ^{3}H release data, where the auxiliary building contributes twelve percent of the total ^{3}H stack release. Also included in Table 8.13 are the effective partition factors (EPF's) calculated from the ratio of the ^{131}I and ^{3}H normalized release rates (Table 8.4). Because unrealistic EPF values (>1.0) are often obtained, it is felt that effective reactor coolant leak rates should be determined from ^{3}H measurements only (see section 8.3.2).

TABLE 8.13

MAIN STACK EFFECTIVE REACTOR COOLANT LEAK RATES

Date	Leak Rate Based on Tritium (lbs/day) [1]	EPF [2]	Stack ^3H Release Rate (μCi/sec)
11/10-11/21	83	7.0	3.1(-2) [3]
11/21-12/4	158	0.89	9(-2)
12/4-12/14	848	0.30	4.9(-1)
12/14-12/28	863	1.25	6.8(-1)
12/28-1/11	178	5.62	1.5(-1)
1/11-1/25	157	0.62	1.9(-1) [3]
1/25-2/8	286	3.65	2.4(-1)
2/8-2/22	567	----	2.4(-1)
2/22-3/9	658	0.50	4.6(-1)
3/9-3/21	299	0.74	2.2(-1)
3/21-4/3	338	0.12	2.7(-1)
4/3-4/20	1462	1.9(-2)	1.7(0)
4/20-5/4	256	1.52	3.1(-1)
5/4-5/18	22	1.0	2.1(-2)
5/18-6/1	952	4.2(-2)	1.0(0)

---

[1] Leak rates tabulated are calculated from the reactor coolant and stack concentrations. To obtain an average value for leakage of reactor coolant into the auxiliary building the average of the values above must be multiplied by 0.12.

[2] EPF is the effective partition factor calculated from the ratio of the normalized ^{131}I to ^3H release rate values.

[3] Oxidized tritium only.

Effective leak rates based on ^{3}H listed in Table 8.13 were calculated using the following relations. The ^{3}H values gaseous and reactor coolant concentrations used are from Tables 8.13 and 8.4.

$$C_g \times 60 \text{ sec/min} \times 1440 \text{ min/day} = M$$

$$\frac{M}{C \times 454 \text{ gm/lb}} = L$$

where:

C_g = airborne nuclide activity per unit time (µCi/sec)

M = airborne nuclide activity per day (µCi/day)

C = nuclide activity per unit mass in reactor coolant (µCi/gm)

L = primary coolant leakage rate (lbs/day)

The utility of the effective leak rates is discussed in more detail in sections 2 and 7.2.3.1.

8.3.7 Stack Release Rates for Selected Beta-Emitting Nuclides

Table 8.14 lists results of beta analysis including data from several sample periods. The samples analyzed were particulate filters from the particulate-iodine sampler installed on the stack sample point. Two sample periods indicated increased activity levels for ^{63}Ni and ^{55}Fe. During the first sample period (12/14-28/78) repairs were being made on a Unit #3 steam generator and during the second time period (2/22-3/9/78) repairs were being made on Unit #4 steam generator.

8.3.8 Stack Release Rates for ^{133}Xe

Table 8.15 tabulates stack release rate (µCi/sec) for ^{133}Xe. Samples were taken using a cryogenic air sampler (14), which produces a concentrated noble gas sample which was subsequently analyzed by gamma-ray spectrometry and gas chromatography. The release rate for ^{133}Xe was calculated using the relation:

$$\left(\frac{M}{Q}\right) \times A \times D = R$$

M = activity of ^{133}Xe in sample (µCi)

Q = quantity of xenon per can (cm^3)

TABLE 8.14

STACK RELEASE RATES FOR SELECTED BETA-EMITTING NUCLIDES

	(μCi/sec)			
Sample Date	^{90}Sr	^{89}Sr	^{63}Ni	^{55}Fe
12/4-12/28/77	1.4 ± 0.3(-6)	3 ± 1(-5)	3.9 ± 0.1(-4)	5.49 ± 0.06(-3)
1/25-2/8/78	1.7 ± 0.3(-6)	<3.5(-6)	1.0 ± 0.1(-5)	1.6 ± 0.1(-4)
2/22-3/9/78	1.1 ± 0.2(-6)	3.0 ± 0.3(-5)	3.05 ± 0.03(-3)	1.50 ± 0.02(-2)
5/18-6/1/78	2.3 ± 0.3(-6)	8 ± 1(-6)	1.2 ± 0.1(-5)	1.0 ± 0.1(-4)

TABLE 8.15

STACK ^{133}Xe RELEASES (4/29-6/7/78)

Date	^{133}Xe (μCi/sec)	Date	^{133}Xe (μCi/sec)
4/29/78	2.4 ± 0.5(2)	5/19/78	[1]
4/30/78	[1]	5/20/78	8 ± 2(1)
5/1/78	[1]	5/21/78	[1]
5/2/78	3.0 ± 0.4(2)	5/22/78	[1]
5/3/78	2.0 ± 0.4(2)	5/23/78	[1]
5/4/78	2.1 ± 0.3(2)	5/24/78	[1]
5/5/78	5.6 ± 0.8(1)	5/25/78	4.9 ± 0.6(1)
5/6/78	1.3 ± 0.2(2)	5/26/78	1.0 ± 0.1(3)
5/7/78	[1]	5/27/78	[1]
5/8/78	[1]	5/28/78	2.97 ± 0.04(1)
5/9/78	3.1 ± 0.5(1)	5/29/78	1.22 ± 0.01(2)
5/10/78	[1]	5/30/78	2.6 ± 0.3(2)
5/11/78	[1]	5/31/78	1.7 ± 0.2(1)
5/12/78	6.4 ± 0.6(1)	6/1/78	[1]
5/13/78	6.8 ± 0.9(1)	6/2/78	2.6 ± 0.5(2)
5/14/78	[1]	6/3/78	1.4 ± 0.2(2)
5/15/78	[1]	6/4/78	3.3 ± 0.5(2)
5/16/78	4.7 ± 0.5(1)	6/5/78	1.8 ± 0.3(0)
5/17/78	[1]	6/6/78	6 ± 1(0)
5/18/78	[1]		

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[1] No detectable xenon concentration.

A = abundance of xenon in air (0.084×10^{-6} cc Xe/cc Air)

D = duct flow rate (cc/sec)

R = release rate of stack ^{133}Xe (μCi/sec)

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*Available for purchase from the NRC/GPO Sales Program, U.S. Nuclear Regulatory Commission, Washington, DC 20555, and the National Technical Information Service, Springfield, VA 22161.

APPENDIX A. SAMPLE AND DATA HANDLING

A.1 Sample Handling

A.1.1 Sample Volumes and General Sampling Procedures

The general sampling procedures that were followed have been described in the report "Procedures, Source Term Measurement Program" (4). Brief descriptions that include details specific to Turkey Point (e.g., sample points, purge times, sample volumes, etc.) are included in the appropriate sections of this report.

A.1.2 Sample Validation

Although it is impossible to prove that a given sample is an actual representation of the liquid or gas under study, some confidence can be placed on the quality of the sample by showing how reproducible the results are for replicate samples or for samples from a given system taken under different conditions. Validation of liquid and gaseous samples at Turkey Point was handled as described below.

A.1.2.1 Liquid Samples

During the initial phase of the measurements at Turkey Point, each sample point was investigated to determine whether or not a valid sample could be obtained. This was done by first discussing the sample point with plant personnel and determining the sampling procedures they recommend (e.g., recirculation times for tanks). The sample line was then purged for a time at least as long as recommended by plant personnel, a sample was taken, and the results were compared with expected activities (e.g., with earlier measurements made by the plant) and with other associated samples. Replicate samples obtained under identical conditions over a period of time were compared in order to give final verification of sample validity.

During the course of sampling at Turkey Point, two problem areas were identified. The first involved the measurement of crud radionuclides (e.g., radioisotopes of Co, Mn, Fe, etc.) in reactor coolant. The range in the measured concentrations for the cruds was found to be much larger than that for soluble radionuclides (e.g., ^{24}Na, iodines, rubidiums, cesiums). Measurements made by FPL also indicated this large range in crud concentrations. In order to investigate this variation in crud concentrations in more detail and determine if it was due to sampling procedures, series of replicate samples were obtained under identical conditions. The sample lines were purged for longer than normal durations (about one-half to one hour). Then without altering any valve settings, samples were obtained separated in time by 1 to 19 minutes (depending on the series).

Six replicate series were taken: (1) two samples from Unit #3 at 0805 and 0806 on 4/9/78; (2) two samples from Unit #3 at 1000 and 1004 on 4/17/78; (3) four samples from Unit #3 at 1006, 1007, 1008, 1009 on 4/25/78; (4) two samples from Unit #4 at 1916 and 1935 on 3/25/78; (5) two samples from Unit #4 at 0903 and 0904 on 4/9/78; and (6) two samples from Unit #4 at 1045 and 1046 on 4/17/78. Results of analyses of these samples are given in Appendix B Tables B.3 and B.4. Comparisons of the replicate samples indicated that the results for the soluble radionuclides (e.g., Na, iodines, rubidiums, cesiums) did not change from sample to sample in a given series. The measured crud concentrations for a series, however, varied from factors of 2 to 10, depending upon the series. These variations were not always in the same direction - sometimes the earlier samples had higher crud concentrations (replicate series 1, 2, and 6) while in other series (replicate series 3, 4, and 5) the later samples showed higher crud concentrations. The conclusion was that nothing could be done to eliminate the wide variation in measured crud concentrations. The best estimate of the average crud concentrations in the reactor coolant could be obtained by taking many samples and averaging the results.

The second problem area was sampling the outlet of the radwaste evaporator (i.e., old boric acid evaporator #4). This sample point was at the bottom of a U-tube that was valved off on one end. Liquid, therefore, did not normally flow through this U-tube and large amounts of crud had built up on the sample valve. Replicate samples taken over a period of time indicated that the sampling procedure should include a 15-minute purge at a high flow rate to purge the U-tube and then another 15-minute purge after the sample valve had been adjusted to the lower flow required for sampling. This second purge was required to insure that crud loosened when the sample valve setting was changed was removed and did not get into the sample.

A.1.2.2 Gaseous Samples

Verification of the validity of gaseous samples was determined by two methods. The first involved pitot tube and helium dilution measurements (see sections 2.2 and 2.3 in reference (4)). Ventilation duct flows were calculated based on the results of each of the two types of measurements. The two results agreed (to within ± 10%), indicating that representative samples had been obtained.

The second verification method involved taking replicate samples under identical conditions over a time interval. Analyses of these replicate samples agreed (to within $\pm 2\sigma$), indicating that representative samples had been obtained.

A.1.3 Validation of Sample Analyses

In order to insure accuracy of analyses, efficiency tables for all systems, both those in the NRC Mobile Laboratory and those at INEL, were established through the use of NBS standards or standards traceable to NBS. These efficiency tables were obtained under all geometric conditions which the samples were analyzed. During the measurement period at Turkey Point the efficiencies were checked using standards on a routine basis.

In addition to checks with standards, intercomparisons were made with the Source Term group and the DOE Radiological and Environmental Sciences Laboratory (DOE-RESL) at the INEL and with the FPL radiation chemistry group at Turkey Point. Tables A.1 and A.2 show the results of these intercomparisons. Table A.1 shows the results of two sets of reactor coolant samples obtained by FPL and INEL. In general, agreement is very good (within $\pm 2\sigma$) for ^{24}Na and iodines. Cesiums show slightly higher differences. The differences seen in the cruds in the samples of 5/1/78 are similar to the differences observed in the replicate samples discussed in section A.1.2.1 and are due to actual differences in crud concentrations in the pairs of samples.

A.2 Data Handling

Analysis of each gamma-ray spectrum was performed either in the NRC Mobile Laboratory or at INEL using a program that searches the spectrum for gamma-ray peaks, identifies the isotopes producing the detected gamma rays, decay corrects activities to the sample collection time, and provides radionuclide concentrations together with error estimates. For radionuclides of interest that were not detected, the program determines lower limits of detection. A discussion of this program can be found in reference 4.

Uncertainties quoted for radionuclide concentrations in this report are 1σ errors due to counting statistics only. An additional uncertainty of approximately 10% should be added to the quoted errors to account for calibration and volume measurement errors. Indeterminate sampling errors have not been treated, however, the total errors due to sampling, calibration, and volume measurement are estimated to be approximately 20%.

In the determination of mean concentrations, both individual measured concentrations and lower limits of detection (when a nuclide was not detected) were included. The lower limits of detection were included so that the means would not be biased high. The procedure used to do this was as follows. Since a lower limit of detection indicates that the true concentration is somewhere between zero and the lower limit of detection; two mean concentrations were obtained - one assuming the concentration of the undetected radionuclide to be zero and the second assuming the concentration to be equal to the lower limit of detection. The quoted mean was then obtained by averaging the two results.

In the determination of radionuclide concentrations in reactor coolant, the sample was gamma counted 3-4 times over a period of 2 weeks in order to obtain data on both long- and short-lived isotopes. When a radionuclide was detected in more than one spectrum, the quoted concentration for that sample was obtained from the average of the individual results.

TABLE A.1

COMPARISONS OF RESULTS FROM REPLICATE SAMPLES OF REACTOR COOLANT ANALYZED BY FPL AND INEL

Nuclide	INEL Sample Unit #3 12:00 12/2/77 (µCi/ml)	FPL Sample Unit #3 11:55 12/2/77 (µCi/ml)	INEL Sample Unit #4 09:09 5/1/78 (µCi/ml)	FPL Sample Unit #4 09:00 5/1/78 (µCi/ml)
^{131}I	6.4 ± 0.1(-2)	6.4 ± 0.2(-2)	1.06 ± 0.01(-2)	9.6 ± 0.2(-3)
^{132}I	1.55 ± 0.05(-2)	1.4 ± 0.1(-2)	1.94 ± 0.02(-2)	1.73 ± 0.05(-2)
^{133}I	4.7 ± 0.1(-2)	4.2 ± 0.1(-2)	1.73 ± 0.03(-2)	1.5 ± 0.1(-2)
^{134}I	1.21 ± 0.08(-2)	1.17 ± 0.08(-2)	2.18 ± 0.06(-2)	2.14 ± 0.05(-2)
^{135}I	2.4 ± 0.1(-2)	2.0 ± 0.2(-2)	1.89 ± 0.05(-2)	1.46 ± 0.07(-2)
^{134}Cs	1.11 ± 0.09(-3)	**	1.61 ± 0.05(-3)	1.2 ± 0.1(-3)
^{136}Cs	9.4 ± 0.9(-5)	**	2.4 ± 0.5(-3)	*
^{137}Cs	2.19 ± 0.08(-3)	**	3.0 ± 0.1(-3)	2.4 ± 0.1(-3)
^{24}Na	1.28 ± 0.07(-2)	1.37 ± 0.05(-2)	8.6 ± 0.3(-3)	8.5 ± 0.4(-3)
^{58}Co	1.85 ± 0.09(-4)	**	8.5 ± 0.4(-3)	9.5 ± 0.8(-4)
^{60}Co	1.4 ± 0.1(-5)	**	4.6 ± 0.9(-4)	2.0 ± 0.2(-4)
^{99}Mo	1.1 ± 0.1(-4)	**	7.1 ± 0.6(-5)	1.3 ± 0.3(-4)
^{139}Ba	3.3 ± 0.4(-3)	6 ± 1(-3)***	6.3 ± 0.1(-3)	5.8 ± 0.8(-3)

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* Radionuclide not detected
** Radionuclide not measured
*** Parent-daughter correction not made

TABLE A.2

RESULTS OF SPLIT AND REPLICATE SAMPLES ANALYZED BY DOE-RESL AND INEL

	Unit #3 Reactor Coolant		Waste Holdup Tank #2			
	09:38; 6/1/78		12:50; 5/23/78	12:48; 5/23/78	08:58; 5/25/78	08:56; 5/25/78
	INEL	DOE-RESL	INEL	DOE-RESL	INEL	DOE-RESL
Nuclide	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)
^{131}I	7.2 ± 0.5(-3)	6.1 ± 0.2(-3)	2.14 ± 0.02(-4)	2.1 ± 0.3(-4)	1.31 ± 0.06(-4)	1.1 ± 0.4(-4)
^{134}Cs	3.95 ± 0.07(-4)	3.6 ± 0.1(-4)	1.98 ± 0.02(-4)	2.06 ± 0.08(-4)	1.5 ± 0.03(-4)	1.93 ± 0.08(-4)
^{137}Cs	5.7 ± 0.1(-4)	6.0 ± 0.2(-4)	3.10 ± 0.05(-4)	3.2 ± 0.1(-4)	2.6 ± 0.1(-4)	2.8 ± 0.2(-4)
^{54}Mn			2.13 ± 0.09(-5)	2.9 ± 0.3(-5)	7.3 ± 0.3(-5)	8.0 ± 0.5(-5)
^{57}Co					7.7 ± 0.9(-6)	1.4 ± 0.2(-5)
^{58}Co			1.64 ± 0.07(-4)	2.20 ± 0.08(-4)	7.8 ± 0.3(-4)	8.5 ± 0.3(-4)
^{60}Co			3.16 ± 0.03(-4)	3.14 ± 0.11(-4)	1.6 ± 0.06(-3)	1.85 ± 0.06(-3)
^{65}Zn					1.3 ± 0.3(-5)	6.7 ± 1.0(-5)
^{99}Mo	1.02 ± 0.04(-3)	1.8 ± 0.4(-3)				
^{110m}Ag					9.6 ± 0.3(-5)	1.12 ± 0.08(-4)
^{125}Sb			1.5 ± 0.2(-5)	2.2 ± 0.8(-5)		

	Monitor Tank A		Monitor Tank C	
	15:45; 5/25/78	15:45; 5/25/78	10:20; 5/25/78	10:22; 5/25/78
	INEL	DOE-RESL	INEL	DOE-RESL
Nuclide	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)
^{54}Mn	4.9 ± 1.5(-7)	5.0 ± 1.1(-7)	7.9 ± 1.3(-7)	7.7 ± 1.5(-7)
^{58}Co	9.5 ± 1.0(-7)	1.16 ± 0.15(-6)	2.7 ± 0.2(-6)	3.0 ± 0.3(-6)
^{60}Co	2.6 ± 0.1(-6)	2.7 ± 0.2(-6)	6.1 ± 1.5(-6)	7.7 ± 0.4(-6)
^{110m}Ag			9 ± 2(-7)	1.1 ± 0.2(-6)

On occasion, several samples were taken from a tank or a system for the purpose of validating a sample point (e.g., see section A.1.2.1). When average radionuclide concentrations were later obtained for this tank or system, the results of the closely spaced samples were averaged to obtain a single value for that time period. This was done to prevent the final average from containing a bias.

APPENDIX B

The data obtained during the in-plant measurement studies at Turkey Point Units #3 and #4 are presented in this Appendix. The Piping and Instrument Diagrams (P&ID) for the systems studied are also presented.

TABLE B.1

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS PRIOR TO REFUELING

Nuclide	11/9/77; 15:20 (μCi/ml)	11/14/77; 10:37 (μCi/ml)	11/16/77; 16:23 (μCi/ml)	11/17/77; 11:58 (μCi/ml)	11/18/77; 17:35 (μCi/ml)	11/21/77; 17:10 (μCi/ml)
^{131}I	6.0 ± 0.1(-2)	1.52 ± 0.05(-2)	1.4 ± 0.1(-2)	1.33 ± 0.04(-2)	1.67 ± 0.03(-2)	1.8 ± 0.1(-2)
^{132}I	1.94 ± 0.07(-1)	1.71 ± 0.06(-1)	1.90 ± 0.04(-1)	1.86 ± 0.03(-1)	2.00 ± 0.04(-1)	2.16 ± 0.07(-1)
^{133}I	1.04 ± 0.03(-1)	1.12 ± 0.03(-1)	1.13 ± 0.03(-1)	1.10 ± 0.02(-1)	1.28 ± 0.03(-1)	1.2 ± 0.1(-1)
^{134}I	1.68 ± 0.06(-1)	3.4 ± 0.3(-1)	3.5 ± 0.1(-1)	3.4 ± 0.1(-1)	3.4 ± 0.1(-1)	3.3 ± 0.1(-1)
^{135}I	1.16 ± 0.05(-1)	2.12 ± 0.06(-1)	2.00 ± 0.04(-1)	2.00 ± 0.05(-1)	2.16 ± 0.05(-1)	2.01 ± 0.04(-1)
^{88}Rb	4.3 ± 0.3(-2)	1.3 ± 0.2(-1)	1.1 ± 0.1(-1)	1.1 ± 0.1(-1)	8.2 ± 0.5(-2)	8.2 ± 0.6(-2)
^{89}Rb	4.9 ± 0.1(-2)	1.1 ± 0.1(-1)	1.0 ± 0.1(-1)	1.0 ± 0.1(-1)	9.1 ± 0.2(-2)	1.0 ± 0.1(-1)
^{134}Cs	1.10 ± 0.05(-3)	3.1 ± 0.3(-4)	1.41 ± 0.04(-3)	1.43 ± 0.03(-3)	1.47 ± 0.03(-3)	1.58 ± 0.04(-3)
^{136}Cs	1.5 ± 0.1(-4)	1.1 ± 0.2(-4)	1.4 ± 0.1(-4)	1.3 ± 0.2(-4)	2.2 ± 0.5(-4)	1.4 ± 0.1(-4)
^{137}Cs	1.77 ± 0.08(-3)	5.3 ± 0.3(-4)	2.39 ± 0.08(-3)	2.38 ± 0.07(-3)	2.46 ± 0.06(-3)	2.75 ± 0.05(-3)
^{138}Cs	1.5 ± 0.1(-1)	3.3 ± 0.1(-1)	3.1 ± 0.1(-1)	3.1 ± 0.1(-1)	2.9 ± 0.1(-1)	2.8 ± 0.1(-1)
^{139}Cs	1.4 ± 0.1(-1)	3.3 ± 0.5(-1)	3.0 ± 0.3(-1)	2.7 ± 0.2(-1)	2.2 ± 0.2(-1)	3.0 ± 0.3(-1)
^{24}Na	2.6 ± 0.3(-3)	3.0 ± 0.2(-3)	6.1 ± 0.3(-3)	6.2 ± 0.3(-3)	7.0 ± 0.4(-3)	6.8 ± 0.3(-3)
^{51}Cr	<6(-5)	1.7 ± 1.2(-5)	<2(-5)	<3(-5)	<4(-5)	1.7 ± 0.3(-4)
^{54}Mn	1.2 ± 0.3(-5)	1.0 ± 0.3(-5)	1.0 ± 0.4(-5)	<4(-5)	<2(-5)	1.9 ± 0.2(-5)
^{56}Mn	<5(-4)	<9(-4)	<5(-3)	<8(-4)	<7(-3)	<7(-3)
^{59}Fe	<8(-6)	<2(-5)	1.1 ± 0.7(-5)	<2(-5)	<2(-5)	9 ± 5(-6)
^{57}Co	<4(-5)	<2(-5)	1 ± 1(-5)	<2(-5)	<2(-5)	6 ± 4(-6)
^{58}Co	5.6 ± 0.5(-5)	1.30 ± 0.08(-4)	1.10 ± 0.07(-4)	4.7 ± 0.1(-4)	1.3 ± 0.2(-4)	1.51 ± 0.07(-3)
^{60}Co	1.8 ± 0.5(-5)	6 ± 1(-5)	6.7 ± 0.8(-5)	1.2 ± 0.1(-4)	4.5 ± 0.8(-5)	3.3 ± 0.3(-4)
^{65}Zn	<9(-6)	<2(-5)	<9(-6)	1.9 ± 0.7(-5)	2 ± 2(-5)	1.3 ± 0.3(-5)
^{91}Sr	6 ± 3(-4)	1.0 ± 0.3(-3)	6 ± 6(-4)	8 ± 2(-4)	1.3 ± 0.3(-3)	3 ± 3(-4)
^{91m}Y	†	†	†	†	†	
^{93}Y	3 ± 1(-3)	<5(-4)	<3(-3)	2 ± 1(-3)	5 ± 2(-3)	3 ± 1(-3)
^{95}Zr	1.6 ± 0.6(-5)	6.5 ± 0.6(-5)	1.4 ± 1.0(-5)	1.9 ± 0.6(-5)	<2(-5)	1.5 ± 0.4(-5)
^{95}Nb	<2(-5)	6.9 ± 0.6(-5)	<2(-5)	<8(-5)	<6(-5)	2.4 ± 0.3(-5)
^{99}Mo	3.2 ± 0.1(-3)	2.2 ± 0.4(-4)	1.28 ± 0.05(-3)	1.4 ± 0.3(-3)	1.56 ± 0.06(-3)	1.36 ± 0.09(-3)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	<3(-5)	<2(-5)	<2(-5)	1.6 ± 1.0(-5)	<3(-5)	2.4 ± 0.4(-5)

TABLE B.1 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS PRIOR TO REFUELING

Nuclide	11/9/77; 15:20 (μCi/ml)	11/14/77; 10:37 (μCi/ml)	11/16/77; 16:23 (μCi/ml)	11/17/77; 11:58 (μCi/ml)	11/18/77; 17:35 (μCi/ml)	11/21/77; 17:10 (μCi/ml)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	<3(-5)	<2(-5)	<3(-5)	<8(-5)	<6(-5)	6 ± 2(-5)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	<5(-4)	<2(-4)	<6(-4)	<8(-4)	<7(-4)	<6(-4)
^{124}Sb	4 ± 1(-6)	<9(-6)	<4(-6)	<8(-6)	6 ± 5(-6)	2.0 ± 0.3(-5)
^{125}Sb	1 ± 1(-5)	<2(-5)	1.5 ± 1.4(-5)	<2(-5)	<4(-5)	<2(-5)
^{129m}Te	<2(-5)	<2(-5)	<2(-5)	<2(-5)	<2(-5)	5 ± 5(-6)
^{129}Te	<5(-3)	<2(-2)	<5(-3)	<7(-3)	<7(-2)	<6(-2)
^{131m}Te	<3(-4)	<4(-4)	<4(-4)	<5(-4)	<5(-4)	3 ± 2(-4)
^{131}Te	**	**	**	**	**	**
^{132}Te	<9(-5)	<6(-5)	4 ± 2(-5)	<5(-5)	<5(-6)	3 ± 1(-6)
^{139}Ba	4 ± 1(-3)	<2(-2)	6 ± 3(-3)	1.6 ± 0.2(-2)	1.7 ± 0.2(-2)	<7(-3)
^{140}Ba	9 ± 3(-5)	1.9 ± 0.3(-4)	4 ± 2(-5)	5 ± 3(-5)	4 ± 2(-5)	1.2 ± 0.2(-4)
^{140}La	<2(-4)	3 ± 7(-4)	7 ± 4(-4)	<9(-5)	2 ± 2(-5)	4 ± 7(-5)
^{141}Ce	<6(-5)	<2(-5)	<2(-5)	<2(-5)	2 ± 1(-5)	1.4 ± 0.4(-5)
^{143}Ce	<2(-4)	<1(-5)	<8(-5)	<7(-5)	<1(-4)	<3(-4)
^{144}Ce	<4(-5)	<3(-5)	<2(-5)	<3(-5)	<3(-5)	<9(-6)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<5(-5)	<4(-5)	<2(-5)	<3(-5)	<4(-5)	<3(-5)
^{154}Eu	<7(-6)	<9(-6)	<5(-6)	<9(-6)	<2(-5)	<5(-6)
^{155}Eu	**	**	**	**	**	**
^{187}W	<8(-4)	<2(-4)	<2(-4)	<1(-4)	<7(-5)	<5(-4)
^{239}Np	<2(-4)	1.1 ± 0.9(-4)	1.0 ± 0.6(-4)	6 ± 3(-5)	<4(-5)	<7(-5)

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† Radionuclide not measured directly. Concentration can be inferred from parent or daughter.
** Radionuclide not measured.

TABLE B.2

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3 DURING REFUELING

Nuclide	12/2/77; 11:45 (μCi/ml)††	12/30/77; 11:34 (μCi/ml)††	1/3/78; 11:10 (μCi/ml)††	1/3/78; 14:40 (μCi/ml)†††	1/11/78; 11:36 (μCi/ml)††
^{131}I	2.7 ± 0.4(-4)	1.0 ± 0.1(-6)	4.7 ± 0.3(-5)	6.8 ± 0.2(-5)	2.6 ± 0.2(-5)
^{132}I	5.8 ± 0.1(-3)	<5(-6)	*	*	*
^{133}I	<1(-4)	<8(-6)	*	*	*
^{134}I	<4(-4)	<8(-5)	*	*	*
^{135}I	<4(-5)	<4(-5)	*	*	*
^{88}Rb	<7(-5)	<5(-6)	*	*	*
^{89}Rb	<4(-4)	<3(-5)	*	*	*
^{134}Cs	4.6 ± 0.7(-5)	3.1 ± 0.3(-5)	9.0 ± 0.9(-6)	5.2 ± 0.7(-6)	5.4 ± 0.3(-5)
^{136}Cs	1.7 ± 0.5(-5)	5.3 ± 0.9(-6)	6 ± 1(-6)	<3(-6)	1.2 ± 0.2(-5)
^{137}Cs	7.5 ± 0.9(-5)	3.9 ± 0.2(-5)	1.0 ± 0.2(-5)	1.04 ± 0.08(-5)	5.4 ± 0.4(-5)
^{138}Cs	<7(-5)	<3(-6)	*	*	*
^{139}Cs	<4(-4)	<5(-5)	*	*	*
^{24}Na	<2(-5)	<2(-6)	<2(-6)	*	*
^{51}Cr	1.1 ± 0.1(-3)	5.9 ± 0.1(-4)	1.8 ± 0.2(-4)	1.9 ± 0.1(-4)	4.3 ± 0.2(-4)
^{54}Mn	1.3 ± 0.2(-4)	2.4 ± 0.1(-5)	1.9 ± 0.1(-5)	4.5 ± 0.1(-5)	3.9 ± 0.2(-5)
^{56}Mn	2 ± 1(-5)	<1(-6)	<2(-6)	*	*
^{59}Fe	2.0 ± 1.5(-5)	1.8 ± 0.2(-5)	7 ± 2(-5)	1.4 ± 0.1(-5)	7 ± 5(-6)
^{57}Co	4.6 ± 0.5(-5)	9.1 ± 0.7(-6)	8.0 ± 0.8(-6)	9.3 ± 0.5(-6)	1.4 ± 0.1(-5)
^{58}Co	3.05 ± 0.06(-2)	5.3 ± 0.2(-3)	4.3 ± 0.1(-3)	4.3 ± 0.1(-3)	7.5 ± 0.1(-3)
^{60}Co	3.3 ± 0.1(-3)	7.3 ± 0.3(-4)	5.9 ± 0.3(-4)	7.7 ± 0.2(-4)	1.58 ± 0.02(-3)
^{65}Zn	5 ± 2(-5)	1.4 ± 0.5(-5)	8 ± 1(-6)	1.1 ± 0.2(-5)	4.6 ± 0.9(-5)
^{91}Sr	<9(-5)	<7(-6)	*	*	*
^{91m}Y	†	†	†	†	†
^{93}Y	<7(-5)	<7(-6)	*	*	*
^{95}Zr	3 ± 2(-5)	2.6 ± 0.2(-5)	1.2 ± 0.4(-5)	2.9 ± 0.1(-5)	3.3 ± 0.4(-5)
^{95}Nb	6 ± 3(-5)	5.0 ± 0.7(-5)	4.3 ± 0.9(-5)	5.4 ± 0.3(-5)	6.5 ± 0.9(-5)
^{99}Mo	<9(-4)	<4(-6)	<4(-6)	<3(-5)	<9(-6)
^{99m}Tc	†	†	†	†	†
^{103}Ru	3 ± 1(-5)	3.5 ± 0.2(-5)	1.2 ± 0.2(-5)	3.8 ± 0.1(-5)	2.2 ± 0.3(-5)
^{103m}Rh	†	†	†	†	†
^{106}Ru	1.0 ± 0.7(-4)	<3(-6)	<1(-5)	2.2 ± 0.6(-5)	<2(-5)
^{106}Rh	†	†	†	†	†

TABLE B.2 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3 DURING REFUELING

Nuclide	12/2/77; 11:45 (μCi/ml)	12/30/77; 11:34 (μCi/ml)	1/3/78; 11:10 (μCi/ml)	1/3/78; 14:40 (μCi/ml)	1/11/78; 11:36 (μCi/ml)
^{110m}Ag	2.0 ± 0.1(-4)	4.9 ± 0.5(-5)	7.6 ± 0.6(-5)	1.88 ± 0.08(-5)	7.7 ± 0.4(-5)
^{124}Sb	5.8 ± 0.2(-4)	6.5 ± 0.3(-5)	8.0 ± 0.2(-5)	7.2 ± 0.2(-5)	1.16 ± 0.04(-4)
^{125}Sb	3.4 ± 0.9(-4)	3.0 ± 0.3(-5)	3.7 ± 0.3(-5)	3.6 ± 0.2(-5)	5.8 ± 0.8(-5)
^{129m}Te	7 ± 4(-5)	2.8 ± 0.9(-4)	4 ± 2(-5)	8 ± 2(-5)	6 ± 5(-6)
^{129}Te	<2(-4)	<8(-5)	*	*	*
^{131m}Te	4 ± 3(-5)	<5(-6)	<6(-6)	<2(-5)	6 ± 6(-6)
^{131}Te	**	**	**	**	**
^{132}Te	5.8 ± 0.2(-4)	<7(-6)	<4(-6)	2 ± 2(-6)	5 ± 4(-6)
^{139}Ba	<5(-5)	<4(-6)	*	*	*
^{140}Ba	1.0 ± 0.2(-4)	3 ± 2(-6)	3 ± 2(-6)	1 ± 2(-6)	<2(-5)
^{140}La	4 ± 1(-5)	1.1 ± 0.6(-6)	2.1 ± 0.4(-6)	7 ± 6(-6)	3.0 ± 0.7(-6)
^{141}Ce	1.8 ± 0.8(-5)	1.9 ± 0.1(-5)	1.18 ± 0.08(-5)	1.26 ± 0.06(-5)	2.3 ± 0.3(-5)
^{143}Ce	<5(-5)	<7(-6)	<6(-6)	<2(-5)	<9(-6)
^{144}Ce	<2(-5)	2.1 ± 0.4(-5)	1.4 ± 0.2(-5)	1.5 ± 0.3(-5)	5 ± 3(-6)
^{144}Pr	†	†	†	†	†
^{152}Eu	<3(-5)	<3(-6)	<2(-6)	<2(-6)	<1(-5)
^{154}Eu	<2(-5)	<1(-6)	<2(-6)	<1(-6)	<5(-6)
^{155}Eu	**	**	**	**	**
^{187}W	<8(-5)	<9(-6)	<5(-5)	<4(-5)	*
^{239}Np	<3(-4)	<4(-6)	<4(-6)	<4(-6)	*

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† Radionuclide not measured directly. Concentration can be inferred from parent or daughter.
* Radionuclide not detected.
** Radionuclide not measured.
†† Sample obtained from RHR system.
††† Dip sample obtained from reactor cavity.

TABLE B.3

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS AFTER REFUELING

Nuclide	2/21/78; 13:16 (µCi/ml)	2/23/78; 11:33 (µCi/ml)	3/17/78; 09:35 (µCi/ml)	3/25/78; 18:10 (µCi/ml)	3/25/78; 18:41 (µCi/ml)	4/9/78; 08:05 (µCi/ml)
^{85m}Kr	2.1 ± 0.2(-2)	2.3 ± 0.3(-2)	2.7 ± 0.3(-2)	**	**	**
^{85}Kr	<1(-4)	<4(-5)	<2(-1)	**	**	**
^{87}Kr	3.9 ± 0.3(-2)	4.1 ± 0.3(-2)	4.4 ± 0.4(-2)	**	**	**
^{88}Kr	5.5 ± 0.4(-2)	6.3 ± 0.5(-2)	6.1 ± 0.1(-2)	**	**	**
^{89}Kr	*	*	*	**	**	**
^{131m}Xe	<5(-5)	<9(-5)	<7(-3)	**	**	**
^{133m}Xe	2.9 ± 0.1(-3)	5.4 ± 0.2(-3)	<4(-3)	**	**	**
^{133}Xe	5.3 ± 0.4(-2)	1.01 ± 0.04(-1)	**	**	**	**
^{135m}Xe	<1(-1)	7 ± 7(-2)	<2(-1)	**	**	**
^{135}Xe	1.75 ± 0.03(-1)	1.94 ± 0.07(-1)	1.96 ± 0.03(-1)	**	**	**
^{137}Xe	*	*	*	**	**	**
^{138}Xe	1.13 ± 0.02(-1)	1.17 ± 0.02(-1)	1.56 ± 0.02(-1)	**	**	**
^{84}Br	**	**	**	**	**	1.6 ± 0.2(-2)
^{131}I	4.3 ± 0.2(-3)	5.4 ± 0.3(-3)	2.4 ± 0.1(-2)	1.49 ± 0.03(-2)	1.62 ± 0.04(-2)	7.9 ± 0.5(-3)
^{132}I	4.3 ± 0.1(-2)	6.5 ± 0.2(-2)	1.02 ± 0.01(-1)	*	*	1.04 ± 0.02(-1)
^{133}I	5.6 ± 0.1(-2)	6.1 ± 0.2(-2)	6.0 ± 0.2(-2)	3.8 ± 0.1(-2)	4.1 ± 0.1(-2)	5.4 ± 0.2(-2)
^{134}I	1.7 ± 0.1(-1)	1.8 ± 0.1(-1)	1.65 ± 0.07(-1)	*	*	1.79 ± 0.04(-1)
^{135}I	9.8 ± 0.3(-2)	1.05 ± 0.02(-1)	8.9 ± 0.2(-2)	*	*	9.8 ± 0.3(-2)
^{88}Rb	7.7 ± 0.3(-2)	7.9 ± 0.4(-2)	8.7 ± 0.5(-2)	*	*	5.8 ± 0.2(-2)
^{89}Rb	5.7 ± 0.1(-2)	5.6 ± 0.2(-2)	7.1 ± 0.1(-2)	*	*	6.4 ± 0.1(-2)
^{134}Cs	2.8 ± 0.1(-4)	5 ± 1(-5)	<7(-4)	2.01 ± 0.03(-3)	2.16 ± 0.03(-3)	4.4 ± 0.3(-4)
^{136}Cs	6 ± 3(-5)	5.8 ± 0.9(-5)	<2(-3)	4.0 ± 0.2(-4)	4.6 ± 0.3(-4)	3.9 ± 0.3(-5)
^{137}Cs	6 ± 1(-4)	6.1 ± 0.7(-5)	<1(-2)	2.3 ± 0.1(-3)	2.5 ± 0.1(-3)	5.8 ± 0.3(-4)
^{138}Cs	1.6 ± 0.1(-1)	1.8 ± 0.1(-1)	2.02 ± 0.02(-1)	*	*	1.70 ± 0.04(-1)
^{139}Cs	1.1 ± 0.1(-1)	1.3 ± 0.1(-1)	2.0 ± 0.2(-1)	*	*	1.6 ± 0.1(-1)
^{24}Na	2.38 ± 0.09(-3)	2.7 ± 0.1(-3)	4.3 ± 0.2(-3)	4.3 ± 0.4(-3)	4.9 ± 0.4(-3)	7.1 ± 0.5(-3)
^{41}Ar	2.3 ± 0.1(-2)	1.7 ± 0.1(-2)	1.6 ± 0.9(-3)	**	**	**
^{51}Cr	3.0 ± 0.3(-4)	1.6 ± 0.2(-4)	<8(-3)	<2(-2)	1.09 ± 0.04(-4)	3.0 ± 0.9(-4)
^{54}Mn	1.08 ± 0.04(-4)	2.8 ± 0.4(-5)	**	5.6 ± 0.2(-4)	2.5 ± 0.1(-4)	2.6 ± 0.2(-5)
^{56}Mn	<4(-3)	<4(-3)	<5(-3)	*	*	<3(-3)
^{59}Fe	<2(-5)	1.4 ± 0.5(-5)	<2(-3)	6.6 ± 0.5(-4)	2.6 ± 0.3(-4)	1.2 ± 0.2(-5)
^{57}Co	4 ± 1(-6)	2.9 ± 0.9(-6)	<5(-4)	4 ± 3(-5)	3.1 ± 0.9(-5)	<2(-6)
^{58}Co	1.16 ± 0.04(-3)	3.4 ± 0.2(-4)	<7(-3)	1.95 ± 0.03(-2)	1.01 ± 0.02(-2)	3.4 ± 0.3(-4)
^{60}Co	5.5 ± 0.2(-4)	1.7 ± 0.2(-4)	4 ± 3(-4)	5.6 ± 0.1(-3)	2.9 ± 0.1(-3)	1.7 ± 0.3(-4)

TABLE B.3 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS AFTER REFUELING

Nuclide	2/21/78; 13:16 (μCi/ml)	2/23/78; 11:33 (μCi/ml)	3/17/78; 09:35 (μCi/ml)	3/25/78; 18:10 (μCi/ml)	3/25/78; 18:41 (μCi/ml)	4/9/78; 08:05 (μCi/ml)
^{65}Zn	7 ± 6(-6)	9 ± 4(-6)	<2(-3)	8 ± 3(-5)	1.2 ± 0.3(-4)	<3(-6)
^{91}Sr	1.0 ± 0.1(-3)	3 ± 2(-4)	<2(-3)	<2(-3)	<1(-2)	<4(-4)
^{91m}Y	†	†	†	†	†	<3(-4)
^{93}Y	1.0 ± 0.3(-3)	2.0 ± 0.6(-3)	<2(-3)	<6(-3)	<6(-3)	<3(-3)
^{95}Zr	6.1 ± 0.6(-5)	3.8 ± 0.4(-5)	<7(-4)	4.8 ± 0.1(-3)	1.27 ± 0.03(-3)	7.5 ± 0.9(-5)
^{95}Nb	1.2 ± 0.1(-4)	5.6 ± 0.6(-5)	**	3.6 ± 0.1(-3)	1.18 ± 0.03(-3)	7.7 ± 0.9(-5)
^{99}Mo	1.3 ± 0.1(-4)	1.6 ± 0.2(-4)	<3(-3)	3.8 ± 0.1(-3)	4.1 ± 0.1(-3)	1.48 ± 0.05(-3)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	3.1 ± 0.4(-5)	2.1 ± 0.3(-5)	<8(-4)	1.56 ± 0.03(-3)	1.03 ± 0.03(-3)	2.4 ± 0.3(-5)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	1.0 ± 0.2(-4)	5 ± 3(-6)	**	1.2 ± 0.2(-3)	5 ± 2(-4)	<2(-5)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	<3(-4)	<5(-5)	**	5 ± 1(-4)	<2(-3)	4.3 ± 0.8(-6)
^{124}Sb	9 ± 4(-6)	4 ± 3(-6)	<7(-4)	8.4 ± 0.4(-4)	6.5 ± 0.3(-4)	1.4 ± 0.2(-5)
^{125}Sb	1.1 ± 0.7(-5)	4 ± 3(-6)	<8(-4)	5.3 ± 0.5(-4)	3.4 ± 0.5(-4)	6 ± 2(-6)
^{129m}Te	<2(-5)	<8(-6)	5 ± 4(-4)	<6(-5)	<5(-5)	<5(-5)
^{129}Te	2.1 ± 0.2(-2)	<3(-2)	<5(-2)	*	*	<2(-2)
^{131m}Te	<4(-4)	<4(-4)	<3(-2)	1.3 ± 0.3(-3)	<3(-4)	<4(-5)
^{131}Te	**	**	**	**	**	<9(-3)
^{132}Te	1.3 ± 0.1(-4)	1.3 ± 0.3(-4)	*	4.1 ± 0.1(-3)	2.6 ± 0.1(-3)	<9(-6)
^{139}Ba	1.4 ± 0.1(-2)	1.3 ± 0.1(-2)	5 ± 2(-3)	*	*	3.0 ± 0.7(-3)
^{140}Ba	4.2 ± 0.3(-4)	1.8 ± 0.6(-4)	<9(-3)	4.8 ± 0.8(-4)	6.9 ± 0.9(-4)	1.1 ± 0.1(-4)
^{140}La	3 ± 1(-5)	<8(-5)	<7(-4)	3 ± 2(-4)	<4(-4)	<9(-5)
^{141}Ce	3 ± 1(-5)	4 ± 2(-6)	<8(-4)	2.0 ± 0.3(-4)	1.1 ± 0.1(-4)	<3(-6)
^{143}Ce	<7(-5)	<2(-4)	<1(-3)	2 ± 1(-4)	1.6 ± 0.9(-4)	<2(-4)
^{144}Ce	2.0 ± 1.5(-5)	3 ± 3(-5)	<6(-3)	5.4 ± 0.9(-4)	2.3 ± 0.6(-4)	<7(-6)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<8(-6)	<2(-5)	<6(-4)	<2(-4)	<2(-4)	<2(-5)
^{154}Eu	<6(-6)	<4(-6)	<9(-4)	<5(-5)	<3(-5)	<2(-6)
^{155}Eu	**	**	**	**	**	<4(-6)
^{187}W	<7(-5)	8 ± 5(-5)	<7(-4)	<8(-4)	1.1 ± 0.3(-3)	<5(-4)
^{239}Np	9 ± 5(-5)	1.8 ± 0.6(-4)	<5(-4)	5.0 ± 0.7(-3)	2.1 ± 0.4(-3)	<8(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.
* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.3 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS AFTER REFUELING

Nuclide	4/9/78; 08:06 (μCi/ml)	4/12/78; 18:24 (μCi/ml)	4/13/78; 11:26 (μCi/ml)	4/15/78; 11:23 (μCi/ml)	4/17/78; 10:00 (μCi/ml)	4/17/78; 10:04 (μCi/ml)
^{85m}Kr	**	**	**	**	**	1.9 ± 0.1(-2)
^{85}Kr	**	**	**	**	**	<4(-2)
^{87}Kr	**	**	**	**	**	4 ± 2(-2)
^{88}Kr	**	**	**	**	**	4.8 ± 0.1(-2)
^{89}Kr	**	**	**	**	**	<3(-2)
^{131m}Xe	**	**	**	**	**	<3(-3)
^{133m}Xe	**	**	**	**	**	7.4 ± 0.2(-3)
^{133}Xe	**	**	**	**	**	2.4 ± 0.2(-1)
^{135m}Xe	**	**	**	**	**	<1(-1)
^{135}Xe	**	**	**	**	**	1.5 ± 0.1(-1)
^{137}Xe	**	**	**	**	**	2 ± 2(-2)
^{138}Xe	**	**	**	**	**	1.1 ± 0.1(-1)
^{84}Br	*	*	1.4 ± 0.2(-2)	1.5 ± 0.2(-2)	1.5 ± 0.2(-2)	1.6 ± 0.1(-2)
^{131}I	7.2 ± 0.3(-3)	7.3 ± 0.2(-3)	6.9 ± 0.8(-3)	6.6 ± 0.4(-3)	5.8 ± 0.2(-3)	6.3 ± 0.3(-3)
^{132}I	1.02 ± 0.02(-1)	1.07 ± 0.02(-1)	1.15 ± 0.09(-1)	1.07 ± 0.02(-1)	1.00 ± 0.02(-1)	1.01 ± 0.03(-1)
^{133}I	5.4 ± 0.2(-2)	5.3 ± 0.2(-2)	5.0 ± 0.4(-2)	5.5 ± 0.2(-2)	5.2 ± 0.2(-2)	5.5 ± 0.1(-2)
^{134}I	*	*	1.83 ± 0.04(-1)	1.83 ± 0.02(-1)	1.62 ± 0.04(-1)	1.64 ± 0.06(-1)
^{135}I	1.00 ± 0.02(-1)	9.9 ± 0.1(-2)	9 ± 1(-2)	9.8 ± 0.2(-2)	9.7 ± 0.2(-2)	9.8 ± 0.2(-2)
^{88}Rb	*	*	7.3 ± 0.6(-2)	7.2 ± 0.5(-2)	6.2 ± 0.2(-2)	5.7 ± 0.2(-2)
^{89}Rb	*	*	6.5 ± 0.2(-2)	6.5 ± 0.2(-2)	4.6 ± 0.2(-2)	5.1 ± 0.2(-2)
^{134}Cs	4.1 ± 0.1(-4)	3.43 ± 0.06(-4)	3.19 ± 0.05(-4)	3.0 ± 0.1(-4)	3.0 ± 0.2(-4)	4.5 ± 0.2(-4)
^{136}Cs	3.1 ± 0.5(-5)	4.7 ± 0.1(-5)	6 ± 1(-5)	5.5 ± 0.4(-5)	5.2 ± 0.1(-5)	6.4 ± 0.3(-5)
^{137}Cs	5.4 ± 0.8(-4)	5.1 ± 0.1(-4)	4.5 ± 0.2(-4)	4.3 ± 0.1(-4)	4.2 ± 0.1(-4)	6.5 ± 0.3(-4)
^{138}Cs	*	*	1.83 ± 0.05(-1)	1.79 ± 0.04(-1)	1.61 ± 0.04(-1)	1.72 ± 0.05(-1)
^{139}Cs	*	*	1.3 ± 0.2(-1)	2.4 ± 0.3(-1)	1.0 ± 0.1(-1)	9.0 ± 0.7(-2)
^{24}Na	7.5 ± 0.4(-3)	7.1 ± 0.3(-3)	7.3 ± 0.8(-3)	7.6 ± 0.4(-3)	7.9 ± 0.4(-3)	8.4 ± 0.2(-3)
^{41}Ar	**	**	**	**	**	<7(-4)
^{51}Cr	7.7 ± 0.2(-4)	6 ± 1(-5)	1.1 ± 0.2(-4)	6 ± 2(-5)	<3(-5)	1.1 ± 0.4(-4)
^{54}Mn	1.04 ± 0.02(-4)	1.7 ± 0.4(-6)	7.1 ± 0.5(-6)	1.8 ± 0.2(-5)	1.5 ± 0.1(-5)	2.1 ± 0.2(-5)
^{56}Mn	<3(-3)	<4(-3)	<8(-3)	<6(-3)	<6(-3)	<8(-3)
^{59}Fe	5.1 ± 0.3(-5)	<2(-6)	5 ± 1(-6)	4.7 ± 0.9(-6)	<3(-6)	<7(-6)
^{57}Co	5.3 ± 0.6(-6)	<2(-6)	<2(-6)	<9(-7)	<2(-6)	<3(-6)
^{58}Co	1.65 ± 0.03(-3)	9.1 ± 0.5(-5)	1.17 ± 0.05(-4)	1.16 ± 0.08(-4)	1.1 ± 0.4(-4)	3.4 ± 0.2(-4)

TABLE B.3 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS AFTER REFUELING

Nuclide	4/9/78; 08:06 (μCi/ml)	4/12/78; 18:24 (μCi/ml)	4/13/78; 11:26 (μCi/ml)	4/15/78; 11:23 (μCi/ml)	4/17/78; 10:00 (μCi/ml)	4/17/78; 10:04 (μCi/ml)
^{60}Co	1.2 ± 0.2(-3)	1.5 ± 0.2(-5)	5.5 ± 0.4(-5)	9.1 ± 0.5(-5)	6.4 ± 0.9(-5)	2.3 ± 0.2(-4)
^{65}Zn	7 ± 3(-6)	<2(-6)	<2(-6)	<2(-6)	<3(-6)	<7(-6)
^{91}Sr	<4(-4)	<4(-4)	<3(-4)	<2(-3)	<6(-4)	<5(-4)
^{91m}Y	<1(-3)	*	<5(-4)	<3(-4)	<4(-4)	<4(-4)
^{93}Y	<3(-3)	<2(-3)	9 ± 4(-4)	<2(-2)	<2(-3)	<2(-3)
^{95}Zr	1.7 ± 0.1(-4)	9 ± 2(-6)	2.1 ± 0.2(-5)	1.9 ± 0.2(-5)	4.2 ± 0.8(-6)	2.5 ± 0.4(-5)
^{95}Nb	1.8 ± 0.1(-4)	9 ± 2(-6)	1.9 ± 0.1(-5)	2.2 ± 0.3(-5)	2.8 ± 0.9(-6)	2.7 ± 0.4(-5)
^{99}Mo	1.15 ± 0.02(-3)	1.19 ± 0.04(-3)	7.6 ± 0.6(-4)	1.52 ± 0.08(-3)	2.4 ± 0.1(-4)	6.2 ± 0.3(-4)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	9.1 ± 0.2(-5)	1.09 ± 0.09(-5)	9.4 ± 0.8(-6)	5.9 ± 0.7(-6)	2 ± 1(-6)	7 ± 3(-6)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	6 ± 1(-5)	<1(-5)	<1(-5)	<1(-5)	<2(-5)	<4(-5)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	1.7 ± 0.2(-5)	1.8 ± 0.4(-6)	<1(-6)	<2(-6)	<2(-6)	5 ± 3(-6)
^{124}Sb	6.3 ± 0.2(-5)	8.5 ± 0.8(-6)	3.9 ± 0.6(-6)	2.9 ± 0.6(-6)	<2(-6)	<4(-6)
^{125}Sb	3.7 ± 0.3(-5)	1.0 ± 0.2(-5)	<4(-6)	<4(-6)	<5(-6)	1.6 ± 0.6(-5)
^{129m}Te	<7(-5)	<3(-5)	<3(-5)	<3(-5)	<4(-5)	<1(-4)
^{129}Te	<2(-2)	*	<2(-1)	<7(-2)	<2(-1)	<1(-1)
^{131m}Te	<3(-3)	<2(-4)	<3(-4)	<4(-4)	<3(-4)	<5(-4)
^{131}Te	*	*	<5(-3)	<6(-3)	<3(-3)	<3(-3)
^{132}Te	1.9 ± 0.6(-5)	<9(-6)	1.6 ± 0.4(-5)	<8(-6)	4 ± 2(-6)	1.7 ± 0.7(-5)
^{139}Ba	*	<3(-1)	9 ± 3(-3)	<3(-2)	1.1 ± 0.1(-2)	1.26 ± 0.08(-2)
^{140}Ba	1.7 ± 0.1(-4)	1.9 ± 0.4(-5)	6 ± 2(-5)	1.6 ± 0.3(-5)	7.5 ± 0.5(-4)	2.1 ± 0.2(-4)
^{140}La	<9(-5)	<3(-5)	2 ± 1(-5)	1 ± 1(-5)	4.1 ± 0.5(-4)	1.2 ± 0.2(-4)
^{141}Ce	8 ± 4(-6)	<3(-6)	<2(-5)	2 ± 1(-6)	<3(-6)	<5(-6)
^{143}Ce	<4(-4)	<5(-5)	<6(-5)	<7(-5)	<8(-5)	<5(-5)
^{144}Ce	2.1 ± 0.4(-5)	1.3 ± 0.5(-5)	<9(-6)	<1(-5)	<2(-5)	<2(-5)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<2(-5)	<2(-5)	<4(-6)	<3(-5)	<4(-5)	<3(-5)
^{154}Eu	<4(-6)	<2(-6)	<2(-6)	<2(-6)	<5(-6)	<6(-6)
^{155}Eu	<5(-6)	<4(-6)	<6(-6)	<4(-6)	<5(-6)	<2(-5)
^{187}W	<1(-5)	<6(-4)	<1(-5)	<2(-4)	<2(-4)	<1(-4)
^{239}Np	<8(-5)	<3(-5)	<4(-5)	<4(-5)	<3(-5)	<6(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.
* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.3 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS AFTER REFUELING

Nuclide	4/25/78; 10:06 (μCi/ml)	4/25/78; 10:07 (μCi/ml)	4/25/78; 10:08 (μCi/ml)	4/25/78; 10:09 (μCi/ml)	5/1/78; 09:18 (μCi/ml)	5/9/78; 10:13 (μCi/ml)
^{85m}Kr	1.7 ± 0.1(-2)	**	**	**	1.7 ± 0.1(-2)	1.57 ± 0.03(-2)
^{85}Kr	<2(-2)	**	**	**	<4(-2)	<3(-3)
^{87}Kr	3 ± 1(-2)	**	**	**	2.7 ± 0.2(-2)	2.6 ± 0.3(-2)
^{88}Kr	4.24 ± 0.07(-2)	**	**	**	4.10 ± 0.08(-2)	4.00 ± 0.05(-2)
^{89}Kr	*	**	**	**	*	*
^{131m}Xe	1.6 ± 0.4(-3)	**	**	**	<3(-3)	<2(-3)
^{133m}Xe	1.23 ± 0.04(-3)	**	**	**	<2(-3)	5 ± 1(-3)
^{133}Xe	2.9 ± 0.4(-1)	**	**	**	2.5 ± 0.5(-1)	2.3 ± 0.1(-1)
^{135m}Xe	<3(-1)	**	**	**	<2(-1)	3 ± 3(-1)
^{135}Xe	1.50 ± 0.07(-1)	**	**	**	1.5 ± 0.1(-1)	1.4 ± 0.1(-1)
^{137}Xe	*	**	**	**	*	*
^{138}Xe	1.13 ± 0.02(-1)	**	**	**	1.17 ± 0.03(-1)	9.2 ± 0.6(-2)
^{84}Br	2.0 ± 0.3(-2)	9 ± 2(-3)	1.3 ± 0.3(-2)	1.3 ± 0.3(-2)	2.0 ± 0.2(-2)	1.6 ± 0.2(-2)
^{131}I	7.2 ± 0.3(-3)	7.1 ± 0.5(-3)	7.1 ± 0.4(-3)	7.0 ± 0.4(-3)	7.5 ± 0.2(-3)	7.9 ± 0.2(-3)
^{132}I	1.02 ± 0.02(-1)	1.00 ± 0.01(-2)	1.05 ± 0.05(-1)	1.04 ± 0.02(-1)	1.01 ± 0.03(-1)	1.07 ± 0.02(-1)
^{133}I	5.81 ± 0.07(-2)	5.62 ± 0.07(-2)	5.72 ± 0.09(-2)	5.75 ± 0.08(-2)	5.45 ± 0.08(-2)	5.9 ± 0.1(-2)
^{134}I	1.72 ± 0.03(-1)	1.80 ± 0.02(-1)	1.77 ± 0.02(-1)	1.84 ± 0.03(-1)	1.81 ± 0.03(-1)	1.72 ± 0.02(-1)
^{135}I	1.00 ± 0.03(-1)	9.9 ± 0.3(-2)	1.02 ± 0.03(-1)	1.02 ± 0.05(-1)	1.02 ± 0.02(-1)	1.03 ± 0.02(-1)
^{88}Rb	7.1 ± 0.5(-2)	6.0 ± 0.4(-2)	7 ± 1(-2)	6 ± 3(-2)	7.3 ± 0.7(-2)	8 ± 2(-2)
^{89}Rb	6.4 ± 0.3(-2)	6.4 ± 0.4(-2)	6.4 ± 0.7(-2)	7 ± 1(-2)	5.8 ± 0.2(-2)	5.1 ± 0.3(-2)
^{134}Cs	6.2 ± 0.3(-4)	4.9 ± 0.2(-4)	5.7 ± 0.3(-4)	4.6 ± 0.2(-4)	7.9 ± 0.3(-4)	1.59 ± 0.03(-3)
^{136}Cs	1.0 ± 0.1(-4)	8.3 ± 0.6(-5)	1.7 ± 0.6(-4)	7.8 ± 0.6(-5)	8.4 ± 0.3(-5)	1.30 ± 0.09(-4)
^{137}Cs	4.2 ± 0.2(-4)	6.3 ± 0.2(-4)	6.8 ± 0.2(-4)	6.36 ± 0.07(-4)	1.05 ± 0.03(-3)	2.0 ± 0.1(-3)
^{138}Cs	2.00 ± 0.06(-1)	1.7 ± 0.1(-1)	1.70 ± 0.04(-1)	1.85 ± 0.05(-1)	1.72 ± 0.07(-1)	1.98 ± 0.08(-1)
^{139}Cs	2.0 ± 0.5(-1)	2.0 ± 0.2(-1)	<2(-1)	<4(-1)	2.6 ± 0.4(-1)	3 ± 3(-2)
^{24}Na	7.8 ± 0.4(-3)	7.0 ± 0.3(-3)	7.2 ± 0.6(-3)	7.0 ± 0.3(-3)	8.0 ± 0.3(-3)	1.26 ± 0.05(-2)
^{41}Ar	<7(-4)	**	**	**	<7(-4)	*
^{51}Cr	<9(-5)	8 ± 2(-5)	<4(-4)	1.8 ± 0.8(-5)	1.8 ± 0.3(-4)	9 ± 4(-5)
^{54}Mn	2.6 ± 0.3(-5)	2.1 ± 0.5(-6)	<2(-4)	1.7 ± 0.2(-6)	2.8 ± 0.2(-5)	2.8 ± 0.3(-5)
^{56}Mn	<5(-3)	<7(-3)	<6(-3)	<6(-3)	<3(-3)	<3(-3)
^{59}Fe	<1(-5)	3 ± 2(-6)	<7(-5)	2.1 ± 0.8(-6)	1.0 ± 0.3(-5)	<8(-6)
^{57}Co	<4(-6)	<9(-7)	<3(-5)	<7(-7)	3.6 ± 0.9(-6)	<3(-6)
^{58}Co	1.73 ± 0.09(-4)	1.5 ± 0.2(-4)	1.0 ± 0.2(-4)	3.1 ± 0.1(-5)	5.9 ± 0.1(-4)	2.14 ± 0.06(-4)

TABLE B.3 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS AFTER REFUELING

Nuclide	4/25/78; 10:06 (μCi/ml)	4/25/78; 10:07 (μCi/ml)	4/25/78; 10:08 (μCi/ml)	4/25/78; 10:09 (μCi/ml)	5/1/78; 09:18 (μCi/ml)	5/9/78; 10:13 (μCi/ml)
^{60}Co	1.34 ± 0.09(-4)	2.0 ± 0.3(-5)	6 ± 2(-5)	9 ± 1(-6)	2.59 ± 0.03(-4)	2.1 ± 0.2(-4)
^{65}Zn	<8(-6)	<4(-6)	<6(-5)	<1(-6)	<4(-6)	<8(-6)
^{91}Sr	<7(-4)	<2(-3)	<5(-4)	<1(-3)	<2(-4)	<3(-4)
^{91m}Y	<3(-4)	<6(-4)	<9(-4)	<7(-4)	*	*
^{93}Y	<4(-3)	<8(-3)	2.4 ± 0.8(-3)	<6(-3)	<2(-4)	<5(-4)
^{95}Zr	<2(-5)	8.0 ± 0.8(-6)	<4(-5)	1.1 ± 0.4(-5)	6.6 ± 0.4(-5)	3.6 ± 0.5(-5)
^{95}Nb	2.7 ± 0.6(-5)	1.2 ± 0.5(-5)	<3(-5)	7.2 ± 0.4(-6)	8.4 ± 0.4(-5)	3.9 ± 0.6(-5)
^{99}Mo	1.64 ± 0.03(-3)	1.4 ± 0.2(-3)	1.11 ± 0.05(-3)	1.5 ± 0.2(-3)	1.20 ± 0.02(-3)	7.4 ± 0.3(-4)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	1.1 ± 0.5(-5)	1.0 ± 0.4(-5)	<3(-5)	2.4 ± 0.5(-6)	1.9 ± 0.2(-5)	1.1 ± 0.4(-5)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	<5(-5)	1.3 ± 0.6(-5)	<7(-4)	<7(-6)	<3(-5)	<7(-5)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	<7(-6)	6 ± 1(-6)	<4(-5)	7 ± 3(-7)	1.1 ± 0.2(-5)	<5(-6)
^{124}Sb	<4(-6)	1.12 ± 0.08(-5)	<5(-5)	1.5 ± 0.6(-6)	1.2 ± 0.2(-5)	<4(-6)
^{125}Sb	<2(-5)	<4(-6)	<7(-5)	<3(-6)	1.9 ± 0.7(-5)	1.7 ± 0.8(-5)
^{129m}Te	<2(-4)	<6(-5)	<6(-4)	<2(-5)	<6(-5)	<2(-4)
^{129}Te	<6(-2)	<2(-1)	<2(-1)	*	*	<2(-2)
^{131m}Te	<3(-4)	<5(-4)	<7(-4)	<4(-4)	<3(-4)	<4(-4)
^{131}Te	7 ± 1(-3)	<4(-3)	<6(-3)	<2(-2)	*	<2(-3)
^{132}Te	<3(-6)	<3(-5)	<4(-5)	<2(-5)	<3(-5)	<2(-5)
^{139}Ba	2 ± 1(-3)	1.2 ± 0.1(-2)	3 ± 2(-2)	<7(-2)	1.77 ± 0.05(-2)	1.81 ± 0.02(-2)
^{140}Ba	7.1 ± 0.3(-4)	2.0 ± 0.1(-4)	1.6 ± 0.4(-4)	1.8 ± 0.4(-4)	7.9 ± 0.6(-5)	6.0 ± 0.3(-4)
^{140}La	<2(-4)	9 ± 2(-3)	<3(-4)	<3(-4)	1.2 ± 0.9(-4)	3.0 ± 0.6(-4)
^{141}Ce	<7(-6)	<3(-6)	<5(-5)	<2(-6)	<4(-6)	<7(-6)
^{143}Ce	<8(-5)	<1(-4)	<2(-4)	<2(-4)	<5(-5)	<2(-4)
^{144}Ce	<3(-5)	<7(-6)	<2(-4)	<4(-6)	<2(-5)	<3(-5)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<7(-5)	<2(-5)	<9(-5)	<6(-6)	<6(-5)	<8(-5)
^{154}Eu	<1(-5)	<3(-6)	<7(-5)	<2(-6)	<4(-6)	<2(-5)
^{155}Eu	<2(-5)	<4(-6)	<1(-4)	2 ± 1(-6)	<7(-6)	<2(-5)
^{187}W	<3(-4)	<4(-4)	<2(-4)	<3(-4)	3 ± 2(-4)	<1(-3)
^{239}Np	1.2 ± 0.3(-4)	<9(-5)	<2(-4)	<9(-5)	<4(-5)	<7(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.
* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.3 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS AFTER REFUELING

Nuclide	5/16/78; 09:51 (µCi/ml)	5/22/78; 12:00 (µCi/ml)	5/25/78; 09:23 (µCi/ml)	6/1/78; 09:38 (µCi/ml)
^{85m}Kr	2.0 ± 0.1(-2)	7 ± 2(-3)	1.5 ± 0.3(-2)	**
^{85}Kr	*	*	<1(-2)	**
^{87}Kr	4 ± 1(-2)	1.7 ± 0.9(-2)	3 ± 1(-2)	**
^{88}Kr	4.98 ± 0.08(-2)	2.10 ± 0.04(-2)	3.9 ± 0.1(-2)	**
^{89}Kr	*	<5(-2)	3 ± 1(-2)	**
^{131m}Xe	<2(-3)	<4(-3)	<2(-3)	**
^{133m}Xe	8.7 ± 0.6(-3)	6.3 ± 0.5(-3)	3 ± 1(-3)	**
^{133}Xe	3.1 ± 0.3(-1)	2.6 ± 0.4(-1)	1.6 ± 0.2(-1)	**
^{135m}Xe	<2(-1)	<3(-2)	5 ± 4(-2)	**
^{135}Xe	1.6 ± 0.1(-1)	3.05 ± 0.04(-2)	1.20 ± 0.06(-1)	**
^{137}Xe	*	5 ± 4(-2)	4.3 ± 0.3(-2)	**
^{138}Xe	1.33 ± 0.07(-1)	5.82 ± 0.07(-2)	1.03 ± 0.04(-1)	**
^{84}Br	2.2 ± 0.2(-2)	6.7 ± 0.8(-3)	1.4 ± 0.1(-2)	1.6 ± 0.1(-2)
^{131}I	7.8 ± 0.2(-3)	3.16 ± 0.08(-2)	8.1 ± 0.4(-3)	7.2 ± 0.5(-3)
^{132}I	1.02 ± 0.03(-1)	6.4 ± 0.1(-2)	7.7 ± 0.3(-2)	1.09 ± 0.02(-1)
^{133}I	6.0 ± 0.2(-2)	2.95 ± 0.06(-2)	6.0 ± 0.2(-2)	5.8 ± 0.2(-2)
^{134}I	1.86 ± 0.03(-1)	1.05 ± 0.01(-1)	1.69 ± 0.04(-1)	1.97 ± 0.05(-1)
^{135}I	1.06 ± 0.02(-1)	5.16 ± 0.05(-2)	1.03 ± 0.03(-1)	1.09 ± 0.02(-1)
^{88}Rb	8.0 ± 0.7(-2)	3.6 ± 0.1(-2)	5.9 ± 0.2(-2)	6.5 ± 0.3(-2)
^{89}Rb	7.6 ± 0.3(-2)	2.9 ± 0.1(-2)	5.4 ± 0.2(-2)	6.8 ± 0.2(-2)
^{134}Cs	7.9 ± 0.3(-4)	2.96 ± 0.03(-3)	1.85 ± 0.05(-3)	3.95 ± 0.07(-4)
^{136}Cs	1.0 ± 0.1(-4)	8.3 ± 0.3(-4)	5.6 ± 0.2(-4)	6.2 ± 0.4(-5)
^{137}Cs	1.12 ± 0.09(-3)	3.1 ± 0.1(-3)	2.6 ± 0.1(-3)	5.7 ± 0.1(-4)
^{138}Cs	2.48 ± 0.07(-1)	8.7 ± 0.3(-2)	1.68 ± 0.05(-1)	1.87 ± 0.05(-1)
^{139}Cs	1.2 ± 0.5(-1)	6.6 ± 0.9(-2)	1.12 ± 0.08(-1)	1.8 ± 0.1(-1)
^{24}Na	8.5 ± 0.3(-3)	4.6 ± 0.2(-3)	8.2 ± 0.3(-3)	9.8 ± 0.9(-3)
^{41}Ar	<6(-4)	<4(-4)	<5(-4)	**
^{51}Cr	<4(-5)	1.7 ± 0.1(-3)	3.8 ± 0.4(-4)	<3(-5)
^{54}Mn	1.7 ± 0.2(-5)	7.6 ± 0.7(-5)	4.7 ± 0.3(-5)	2 ± 1(-6)
^{56}Mn	<6(-3)	<5(-3)	<7(-3)	<5(-3)
^{59}Fe	<4(-6)	8 ± 1(-5)	2.6 ± 0.4(-5)	<3(-6)
^{57}Co	<1(-6)	1.0 ± 0.5(-5)	<2(-6)	3 ± 1(-6)
^{58}Co	2.1 ± 0.1(-4)	3.5 ± 0.1(-3)	8.0 ± 0.2(-4)	1.3 ± 0.1(-5)

TABLE B.3 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #3
POWER OPERATIONS AFTER REFUELING

Nuclide	5/16/78; 09:51 (μCi/ml)	5/22/78; 12:00 (μCi/ml)	5/25/78; 09:23 (μCi/ml)	6/1/78; 09:38 (μCi/ml)
^{60}Co	1.88 ± 0.08(-4)	7 ± 1(-4)	2.8 ± 0.5(-4)	4 ± 2(-6)
^{65}Zn	<4(-6)	7 ± 2(-5)	9 ± 3(-6)	<4(-6)
^{91}Sr	<5(-4)	<5(-4)	<5(-4)	<4(-4)
^{91m}Y	<3(-4)	<3(-4)	<3(-4)	<4(-4)
^{93}Y	<2(-3)	<2(-3)	<3(-3)	5 ± 3(-3)
^{95}Zr	1.9 ± 0.3(-5)	5.8 ± 0.3(-4)	1.05 ± 0.05(-4)	<3(-6)
^{95}Nb	2.8 ± 0.3(-5)	4.6 ± 0.3(-4)	1.16 ± 0.05(-4)	5 ± 1(-6)
^{99}Mo	1.00 ± 0.04(-3)	5.4 ± 0.7(-3)	1.2 ± 0.1(-2)	1.02 ± 0.04(-3)
^{99m}Tc	†	†	†	†
^{103}Ru	4 ± 1(-6)	1.6 ± 0.1(-4)	2.5 ± 0.2(-5)	<2(-6)
^{103m}Rh	†	†	†	†
^{106}Ru	3.6 ± 0.8(-5)	<2(-4)	4 ± 1(-5)	<4(-5)
^{106}Rh	†	†	†	†
^{110m}Ag	5 ± 1(-6)	2.6 ± 0.8(-5)	7 ± 2(-6)	<3(-6)
^{124}Sb	6 ± 1(-6)	1.55 ± 0.09(-4)	2.0 ± 0.2(-5)	1.9 ± 0.6(-6)
^{125}Sb	1.2 ± 0.3(-5)	7 ± 3(-5)	<2(-5)	<5(-6)
^{129m}Te	<8(-5)	<5(-4)	<9(-5)	5 ± 3(-5)
^{129}Te	<2(-1)	<6(-2)	<9(-2)	*
^{131m}Te	<2(-3)	<4(-4)	<2(-4)	<2(-4)
^{131}Te	<5(-3)	<3(-3)	<3(-3)	<4(-3)
^{132}Te	3 ± 1(-5)	2.9 ± 0.7(-4)	1.9 ± 0.4(-5)	<3(-6)
^{139}Ba	1.9 ± 0.6(-2)	4 ± 1(-3)	9 ± 1(-3)	4 ± 1(-3)
^{140}Ba	8.4 ± 0.6(-5)	1.81 ± 0.08(-3)	2.8 ± 0.1(-4)	4 ± 1(-5)
^{141}La	<2(-4)	5.2 ± 0.7(-4)	2.2 ± 0.6(-4)	5 ± 3(-5)
^{141}Ce	<3(-6)	3 ± 2(-5)	<3(-6)	<3(-6)
^{143}Ce	<5(-4)	<2(-4)	<1(-4)	<2(-5)
^{144}Ce	<8(-6)	<8(-5)	<2(-5)	<2(-5)
^{144}Pr	†	†	†	†
^{152}Eu	<4(-5)	<3(-4)	<8(-5)	<3(-5)
^{154}Eu	<4(-6)	<3(-5)	<4(-6)	<3(-6)
^{155}Eu	<4(-6)	<5(-5)	<6(-6)	<6(-6)
^{187}W	<8(-4)	<8(-4)	<5(-4)	<4(-5)
^{239}Np	<2(-4)	<3(-4)	<6(-5)	<2(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.
* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.4

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	12/2/77; 12:00 (μCi/ml)	12/6/77; 15:06 (μCi/ml)	12/8/77; 09:45 (μCi/ml)	12/9/77; 09:47 (μCi/ml)	12/10/77; 09:16 (μCi/ml)	12/11/77; 10:52 (μCi/ml)
^{85m}Kr	**	**	**	2.0 ± 0.1(-2)	2.5 ± 0.1(-2)	1.9 ± 0.1(-2)
^{85}Kr	**	**	**	<7(-4)	<3(-4)	<2(-4)
^{87}Kr	**	**	**	2.7 ± 0.1(-2)	3.1 ± 0.1(-2)	2.4 ± 0.1(-2)
^{88}Kr	**	**	**	4.2 ± 0.1(-2)	5.0 ± 0.1(-2)	3.5 ± 0.5(-2)
^{89}Kr	**	**	**	*	*	*
^{131m}Xe	**	**	**	<2(-3)	9 ± 5(-4)	<5(-4)
^{133m}Xe	**	**	**	1.3 ± 0.1(-2)	1.05 ± 0.04(-2)	7.9 ± 0.4(-3)
^{133}Xe	**	**	**	5.1 ± 0.5(-1)	3.5 ± 0.3(-1)	2.7 ± 0.1(-1)
^{135m}Xe	**	**	**	<6(-1)	<2(0)	2 ± 2(-2)
^{135}Xe	**	**	**	1.8 ± 0.1(-1)	1.51 ± 0.05(-1)	1.27 ± 0.03(-1)
^{137}Xe	**	**	**	*	*	*
^{138}Xe	**	**	**	3.2 ± 0.2(-2)	8 ± 2(-2)	3.1 ± 0.1(-2)
^{84}Br	**	**	**	**	**	**
^{131}I	6.4 ± 0.1(-2)	3.7 ± 0.1(-2)	7.2 ± 0.1(-3)	9.8 ± 0.3(-2)	2.08 ± 0.09(-2)	8.6 ± 0.2(-3)
^{132}I	1.55 ± 0.05(-2)	**	9.9 ± 0.2(-3)	3.36 ± 0.04(-2)	1.21 ± 0.02(-2)	1.18 ± 0.03(-2)
^{133}I	4.7 ± 0.1(-2)	1.59 ± 0.03(-2)	1.07 ± 0.02(-2)	**	2.08 ± 0.03(-2)	1.29 ± 0.03(-2)
^{134}I	1.21 ± 0.08(-2)	**	1.09 ± 0.03(-2)	1.08 ± 0.04(-2)	1.36 ± 0.05(-2)	1.10 ± 0.03(-2)
^{135}I	2.4 ± 0.1(-2)	9.9 ± 0.2(-3)	1.10 ± 0.08(-2)	5.2 ± 0.1(-2)	1.4 ± 0.1(-2)	1.17 ± 0.07(-2)
^{88}Rb	5.8 ± 0.3(-2)	**	7.4 ± 0.6(-2)	6.3 ± 0.8(-2)	2.2 ± 0.5(-1)	5.6 ± 0.3(-2)
^{89}Rb	1.1 ± 0.1(-2)	**	8.0 ± 0.8(-3)	7.5 ± 0.9(-3)	<2(-2)	7.2 ± 0.6(-3)
^{134}Cs	1.11 ± 0.09(-3)	9.8 ± 0.2(-4)	1.13 ± 0.03(-3)	5.1 ± 0.1(-3)	1.51 ± 0.05(-3)	1.1 ± 0.1(-3)
^{136}Cs	9.4 ± 0.9(-5)	7.9 ± 0.7(-5)	5.7 ± 0.6(-5)	2.8 ± 0.1(-3)	4.5 ± 0.3(-4)	9 ± 3(-5)
^{137}Cs	2.19 ± 0.08(-3)	1.99 ± 0.04(-3)	2.11 ± 0.04(-3)	8.5 ± 0.2(-3)	2.55 ± 0.06(-3)	1.74 ± 0.03(-3)
^{138}Cs	4.7 ± 0.1(-2)	**	4.2 ± 0.1(-2)	5.2 ± 0.2(-2)	1.6 ± 1.5(-2)	3.8 ± 0.1(-2)
^{139}Cs	2.1 ± 0.4(-2)	**	<2(-2)	<2(-2)		1 ± 1(-3)
^{24}Na	1.28 ± 0.07(-2)	8.6 ± 0.3(-3)	7.5 ± 0.2(-3)	4.5 ± 0.1(-4)	5.4 ± 0.3(-3)	5.1 ± 0.3(-3)
^{41}Ar	**	**	**	6 ± 2(-4)	1.6 ± 0.2(-3)	5 ± 3(-4)
^{51}Cr	<4(-5)	<4(-5)	<3(-5)	2.4 ± 0.3(-3)	2.2 ± 0.1(-3)	4.5 ± 0.6(-4)
^{54}Mn	5.0 ± 0.5(-6)	<5(-5)	<5(-5)	2.9 ± 0.1(-4)	3.7 ± 0.1(-4)	1.9 ± 0.5(-4)
^{56}Mn	<4(-4)	<5(-3)	<3(-4)	3.5 ± 0.4(-3)	<5(-4)	<5(-4)
^{59}Fe	5.4 ± 0.8(-6)	1.0 ± 0.8(-5)	<3(-5)	2.8 ± 0.1(-4)	2.7 ± 0.1(-4)	5.8 ± 0.7(-5)
^{57}Co	2 ± 2(-6)	1.1 ± 0.2(-5)	<3(-5)	2.0 ± 0.3(-5)	9.2 ± 0.7(-6)	9 ± 2(-6)
^{58}Co	1.85 ± 0.09(-4)	2.5 ± 0.1(-4)	2.0 ± 0.1(-4)	1.1 ± 0.1(-2)	6.7 ± 0.2(-3)	2.49 ± 0.05(-3)

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	12/2/77; 12:00 (μCi/ml)	12/6/77; 15:06 (μCi/ml)	12/8/77; 09:45 (μCi/ml)	12/9/77; 09:47 (μCi/ml)	12/10/77; 09:16 (μCi/ml)	12/11/77; 10:52 (μCi/ml)
^{60}Co	1.4 ± 0.1(-5)	2.6 ± 0.3(-5)	<2(-5)	9.3 ± 0.7(-4)	5.1 ± 0.2(-4)	3.6 ± 0.3(-4)
^{65}Zn	1.7 ± 1.0(-6)	<1(-5)	<2(-5)	2.9 ± 0.3(-5)	2.3 ± 0.2(-5)	4 ± 4(-5)
^{91}Sr	<3(-4)	6 ± 3(-5)	<1(-4)	<2(-4)	<6(-4)	2 ± 2(-4)
^{91m}Y	**	**	**	**	**	**
^{93}Y	<3(-4)	6 ± 2(-4)	<1(-4)	1.4 ± 0.4(-3)	<4(-4)	3.0 ± 0.2(-5)
^{95}Zr	9 ± 2(-6)	7 ± 3(-6)	<2(-5)	3.7 ± 0.1(-4)	3.2 ± 0.2(-4)	2.7 ± 0.4(-5)
^{95}Nb	9 ± 4(-6)	<3(-5)	<4(-5)	3.5 ± 0.2(-4)	2.9 ± 0.1(-4)	2.2 ± 0.4(-5)
^{99}Mo	1.1 ± 0.1(-4)	9.0 ± 0.3(-5)	1.28 ± 0.07(-4)	1.9 ± 0.2(-3)	1.85 ± 0.05(-3)	3.6 ± 0.4(-4)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	1.0 ± 0.8(-6)	<8(-6)	<3(-5)	2.1 ± 0.4(-5)	1.4 ± 0.2(-5)	<2(-5)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	<7(-6)	<8(-5)	<2(-5)	<2(-5)	<9(-6)	<2(-5)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	<4(-4)	<5(-4)	<8(-4)	<3(-3)	3.3 ± 0.8(-5)	<7(-4)
^{124}Sb	2.0 ± 0.4(-6)	<8(-6)	<2(-5)	1.4 ± 0.1(-4)	7.3 ± 0.9(-5)	1.5 ± 0.3(-5)
^{125}Sb	<4(-6)	<8(-6)	<3(-5)	4.7 ± 0.8(-5)	1.4 ± 0.4(-5)	<2(-5)
^{129m}Te	<5(-6)	<6(-5)	<3(-5)	<2(-5)	8 ± 4(-5)	<2(-5)
^{129}Te	<9(-3)	**	<7(-3)	<8(-3)	<6(-3)	<9(-3)
^{131m}Te	<1(-4)	<1(-4)	<9(-5)	<2(-3)	<2(-4)	<2(-4)
^{131}Te	**	**	**	**	**	**
^{132}Te	<7(-6)	<2(-5)	<2(-4)	<5(-4)	<2(-4)	<2(-4)
^{139}Ba	3.3 ± 0.4(-3)	**	4 ± 2(-3)	5 ± 1(-3)	6 ± 1(-3)	5.6 ± 0.4(-3)
^{140}Ba	8 ± 4(-6)	<2(-5)	<3(-5)	<4(-5)	5 ± 4(-5)	4.0 ± 0.4(-4)
^{140}La	1.0 ± 0.6(-5)	<1(-5)	<1(-4)	<2(-4)	<2(-5)	<8(-5)
^{141}Ce	<6(-6)	<8(-6)	<3(-5)	<2(-5)	4 ± 2(-6)	<2(-5)
^{143}Ce	1.2 ± 0.8(-4)	<2(-5)	<4(-5)	<3(-4)	<1(-4)	<1(-4)
^{144}Ce	<4(-6)	<8(-6)	<3(-5)	3 ± 3(-6)	<6(-5)	<1(-5)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<2(-5)	<2(-5)	<6(-5)	<5(-4)	<4(-5)	<3(-5)
^{154}Eu	<2(-6)	5 ± 4(-6)	<2(-5)	<3(-6)	<2(-6)	<7(-6)
^{155}Eu	**	**	**	**	**	**
^{187}W	<2(-4)	<2(-5)	<7(-5)	<2(-4)	<2(-4)	<2(-4)
^{239}Np	<3(-5)	<2(-5)	7 ± 2(-5)	8 ± 8(-4)	5 ± 5(-5)	<2(-4)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.

* Radionuclide not detected.

** Radionuclide not measured.

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	12/12/77; 09:27 (μCi/ml)	1/7/78; 16:18 (μCi/ml)	1/11/78; 20:30 (μCi/ml)	1/18/78; 11:27 (μCi/ml)	1/19/78; 11:27 (μCi/ml)	1/20/78; 13:05 (μCi/ml)
^{85m}Kr	**	1.6 ± 0.1(-2)	1.75 ± 0.03(-2)	**	**	**
^{85}Kr	**	<3(-5)	<6(-2)	**	**	**
^{87}Kr	**	2.1 ± 0.1(-2)	2.3 ± 0.1(-2)	**	**	**
^{88}Kr	**	3.2 ± 0.1(-2)	3.8 ± 0.1(-2)	**	**	**
^{89}Kr	**	*	*	**	**	**
^{131m}Xe	**	<3(-5)	<2(-3)	**	**	**
^{133m}Xe	**	5.3 ± 0.1(-3)	7.1 ± 0.9(-3)	**	**	**
^{133}Xe	**	1.8 ± 0.1(-1)	2.4 ± 0.1(-1)	**	**	**
^{135m}Xe	**	<4(-2)	1.7 ± 0.3(-2)	**	**	**
^{135}Xe	**	1.02 ± 0.02(-1)	1.15 ± 0.02(-1)	**	**	**
^{137}Xe	**	*	*	**	**	**
^{138}Xe	**	3.3 ± 0.1(-2)	2.3 ± 0.1(-2)	**	**	**
^{84}Br	**	**	**	**	**	**
^{131}I	7.3 ± 0.3(-3)	5.79 ± 0.06(-3)	6.1 ± 0.1(-3)	7.2 ± 0.5(-3)	6.8 ± 0.1(-3)	6.7 ± 0.3(-3)
^{132}I	1.06 ± 0.02(-2)	1.25 ± 0.02(-2)	1.20 ± 0.02(-2)	1.32 ± 0.02(-2)	1.36 ± 0.02(-2)	1.24 ± 0.02(-2)
^{133}I	1.19 ± 0.02(-2)	1.13 ± 0.04(-2)	1.20 ± 0.04(-2)	1.19 ± 0.04(-2)	1.12 ± 0.02(-2)	1.10 ± 0.02(-2)
^{134}I	1.13 ± 0.04(-2)	1.24 ± 0.04(-2)	1.19 ± 0.03(-2)	1.4 ± 0.1(-2)	1.53 ± 0.06(-2)	1.32 ± 0.05(-2)
^{135}I	1.15 ± 0.07(-2)	1.1 ± 0.1(-2)	1.20 ± 0.03(-2)	1.33 ± 0.06(-2)	1.21 ± 0.04(-2)	1.19 ± 0.04(-2)
^{88}Rb	5.9 ± 0.3(-2)	5.0 ± 0.4(-2)	5.1 ± 0.4(-2)	5.4 ± 0.3(-2)	6.2 ± 0.5(-2)	5.1 ± 0.1(-2)
^{89}Rb	7.3 ± 0.8(-3)	9 ± 1(-3)	6.8 ± 0.3(-3)	1.0 ± 0.1(-2)	1.4 ± 0.1(-2)	9.3 ± 0.3(-3)
^{134}Cs	7.6 ± 0.7(-4)	6.2 ± 0.1(-4)	4.4 ± 0.4(-4)	7.5 ± 0.8(-4)	7.2 ± 1.0(-4)	8.3 ± 0.6(-4)
^{136}Cs	6 ± 2(-5)	1.5 ± 0.3(-5)	<2(-4)	4 ± 2(-5)	2.9 ± 0.8(-5)	3.0 ± 0.4(-5)
^{137}Cs	1.43 ± 0.07(-3)	1.24 ± 0.02(-3)	1.2 ± 0.1(-3)	1.46 ± 0.08(-3)	1.5 ± 0.1(-3)	1.62 ± 0.06(-3)
^{138}Cs	3.7 ± 0.1(-2)	3.6 ± 0.1(-2)	3.8 ± 0.1(-2)	4.1 ± 0.1(-2)	4.0 ± 0.2(-2)	4.0 ± 0.1(-2)
^{139}Cs	<5(-3)	<3(-3)	<2(-3)	1.4 ± 0.2(-2)	<2(-3)	1.4 ± 0.3(-2)
^{24}Na	5.2 ± 0.2(-3)	4.8 ± 0.2(-3)	4.9 ± 0.2(-3)	5.5 ± 0.3(-3)	5.6 ± 0.2(-3)	5.5 ± 0.2(-3)
^{41}Ar	**	<6(-4)	1.05 ± 0.07(-3)	**	**	**
^{51}Cr	4.0 ± 0.5(-3)	2 ± 1(-5)	<2(-4)	4 ± 1(-5)	3 ± 1(-5)	4 ± 3(-6)
^{54}Mn	6.0 ± 0.6(-4)	9 ± 1(-6)	<1(-3)	1.0 ± 0.2(-5)	2.0 ± 0.5(-5)	2.0 ± 0.4(-6)
^{56}Mn	<3(-4)	<6(-4)	<4(-4)	<6(-4)	<6(-4)	<5(-4)
^{59}Fe	5.3 ± 0.7(-4)	2.0 ± 0.7(-5)	<2(-4)	<4(-6)	5 ± 2(-6)	1.6 ± 1.1(-6)
^{57}Co	1.3 ± 0.1(-5)	4 ± 2(-6)	8 ± 3(-5)	2 ± 1(-6)	<2(-6)	<4(-6)
^{58}Co	1.2 ± 0.1(-2)	3.0 ± 0.1(-4)	1.0 ± 0.3(-4)	2.1 ± 0.2(-4)	2.7 ± 0.4(-4)	1.13 ± 0.09(-4)

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	12/12/77; 09:27 (μCi/ml)	1/7/78; 16:18 (μCi/ml)	1/11/78; 20:30 (μCi/ml)	1/18/78; 11:27 (μCi/ml)	1/19/78; 11:27 (μCi/ml)	1/20/78; 13:05 (μCi/ml)
^{60}Co	1.0 ± 0.2(-3)	4 ± 1(-5)	7 ± 3(-5)	3.1 ± 0.3(-5)	6.3 ± 0.8(-5)	1.05 ± 0.08(-5)
^{65}Zn	2.5 ± 0.4(-5)	<3(-6)	<2(-4)	<3(-6)	<4(-6)	<2(-6)
^{91}Sr	<2(-4)	<5(-5)	<2(-4)	<2(-4)	<2(-4)	<4(-4)
^{91m}Y	**	**	**	**	**	**
^{93}Y	2.2 ± 0.6(-3)	5 ± 1(-4)	<2(-4)	<2(-4)	<2(-4)	<5(-4)
^{95}Zr	4.6 ± 0.3(-4)	5 ± 1(-6)	<2(-4)	8 ± 2(-6)	4 ± 1(-6)	1.0 ± 0.5(-5)
^{95}Nb	4.4 ± 0.2(-4)	6 ± 2(-6)	<4(-4)	5 ± 1(-6)	4.9 ± 0.9(-6)	5 ± 1(-6)
^{99}Mo	1.08 ± 0.02(-3)	9.6 ± 0.2(-5)	<3(-4)	2.6 ± 0.6(-5)	3 ± 1(-5)	1.3 ± 0.1(-4)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	3.5 ± 1.0(-5)	4 ± 2(-6)	<2(-4)	3 ± 3(-6)	3 ± 3(-6)	<5(-6)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	<2(-5)	<4(-6)	*	<4(-6)	<5(-6)	<4(-6)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	3.4 ± 0.8(-5)	<3(-4)	*	<3(-4)	<3(-4)	<3(-4)
^{124}Sb	1.5 ± 0.1(-4)	4.4 ± 0.9(-6)	<2(-4)	1.3 ± 0.5(-6)	4 ± 3(-6)	1.9 ± 0.6(-6)
^{125}Sb	3.0 ± 0.6(-5)	<4(-6)	<1(-4)	<5(-6)	8 ± 6(-6)	<4(-6)
^{129m}Te	<3(-5)	<3(-6)	<2(-4)	<4(-6)	<4(-6)	<4(-6)
^{129}Te	<7(-3)	<9(-3)	<6(-3)	<9(-3)	<1(-2)	<8(-3)
^{131m}Te	<2(-4)	<5(-5)	<2(-3)	<9(-5)	<8(-5)	<8(-5)
^{131}Te	**	**	**	**	**	**
^{132}Te	5 ± 2(-5)	<7(-6)	*	<6(-5)	<5(-5)	<3(-5)
^{139}Ba	5.6 ± 0.6(-3)	4.8 ± 0.4(-3)	4.9 ± 0.2(-3)	4.1 ± 0.3(-3)	5.3 ± 0.4(-3)	3.4 ± 0.4(-3)
^{140}Ba	1.3 ± 1.0(-4)	5.0 ± 0.6(-5)	3 ± 2(-4)	1.0 ± 0.2(-4)	1.0 ± 0.3(-4)	<2(-5)
^{140}La	<5(-5)	<1(-5)	<2(-4)	<4(-5)	<5(-5)	<2(-5)
^{141}Ce	<2(-5)	<4(-6)	<2(-4)	<4(-6)	<3(-6)	<3(-6)
^{143}Ce	<7(-5)	<2(-5)	<2(-4)	<4(-5)	<3(-5)	<5(-5)
^{144}Ce	<7(-6)	<3(-6)	<4(-4)	3 ± 2(-5)	1.5 ± 1.0(-6)	<3(-6)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<8(-6)	<4(-6)	<2(-4)	<9(-6)	<1(-5)	<8(-6)
^{154}Eu	<4(-6)	<2(-6)	<2(-4)	<5(-6)	<6(-6)	<2(-6)
^{155}Eu	**	**	**	**	**	**
^{187}W	1.0 ± 0.2(-4)	<3(-5)	<2(-4)	<6(-5)	<6(-5)	<2(-4)
^{239}Np	1.6 ± 0.5(-4)	5 ± 4(-6)	<8(-5)	<4(-5)	<8(-5)	<3(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.

* Radionuclide not detected.

** Radionuclide not measured.

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	1/22/78; 11:16 (μCi/ml)	1/23/78; 11:14 (μCi/ml)	1/24/78; 10:31 (μCi/ml)	1/25/78; 04:14 (μCi/ml)	1/26/78; 12:55 (μCi/ml)	2/3/78; 09:43 (μCi/ml)
^{85m}Kr	**	**	**	**	**	**
^{85}Kr	**	**	**	**	**	**
^{87}Kr	**	**	**	**	**	**
^{88}Kr	**	**	**	**	**	**
^{89}Kr	**	**	**	**	**	**
^{131m}Xe	**	**	**	**	**	**
^{133m}Xe	**	**	**	**	**	**
^{133}Xe	**	**	**	**	**	**
^{135m}Xe	**	**	**	**	**	**
^{135}Xe	**	**	**	**	**	**
^{137}Xe	**	**	**	**	**	**
^{138}Xe	**	**	**	**	**	**
^{84}Br	**	**	**	**	**	**
^{131}I	5.8 ± 0.3(-3)	6.7 ± 0.2(-3)	6.0 ± 0.4(-3)	6.3 ± 0.3(-3)	4.7 ± 0.1(-2)	5.9 ± 0.2(-3)
^{132}I	1.26 ± 0.02(-2)	1.28 ± 0.02(-2)	1.23 ± 0.02(-2)	1.29 ± 0.03(-2)	1.43 ± 0.03(-2)	1.37 ± 0.02(-2)
^{133}I	9.9 ± 0.2(-3)	1.17 ± 0.02(-2)	1.02 ± 0.06(-2)	1.07 ± 0.06(-2)	2.86 ± 0.05(-2)	1.27 ± 0.04(-2)
^{134}I	1.42 ± 0.05(-2)	1.38 ± 0.05(-2)	1.38 ± 0.04(-2)	1.37 ± 0.03(-2)	1.40 ± 0.06(-2)	1.46 ± 0.06(-2)
^{135}I	1.09 ± 0.09(-2)	1.27 ± 0.04(-2)	1.23 ± 0.03(-2)	1.26 ± 0.03(-2)	1.54 ± 0.04(-2)	1.38 ± 0.03(-2)
^{88}Rb	5.1 ± 0.1(-2)	5.2 ± 0.3(-2)	5.3 ± 0.2(-2)	5.2 ± 0.3(-2)	4.7 ± 0.2(-2)	4.6 ± 0.2(-2)
^{89}Rb	9.4 ± 0.2(-3)	8.6 ± 0.3(-3)	1.0 ± 0.1(-2)	8.8 ± 0.3 (-3)	7.8 ± 0.3(-3)	8.8 ± 0.2(-3)
^{134}Cs	7.9 ± 0.3(-4)	9.7 ± 0.5(-4)	1.02 ± 0.09(-3)	9.6 ± 0.6(-4)	1.90 ± 0.07(-3)	7.7 ± 0.7(-4)
^{136}Cs	2.9 ± 0.1(-5)	5.2 ± 0.9(-5)	3.5 ± 0.2(-5)	3.3 ± 0.3(-5)	6.8 ± 0.5(-4)	2.5 ± 0.2(-5)
^{137}Cs	1.61 ± 0.06(-3)	1.78 ± 0.04(-3)	1.79 ± 0.08(-3)	1.85 ± 0.04(-3)	2.62 ± 0.09(-3)	1.41 ± 0.05(-3)
^{138}Cs	3.9 ± 0.1(-2)	4.0 ± 0.2(-2)	4.1 ± 0.1(-2)	3.9 ± 0.1(-2)	3.8 ± 0.1(-2)	3.6 ± 0.1(-2)
^{139}Cs	2.1 ± 0.6(-2)	1.6 ± 0.3(-2)	2.1 ± 0.4(-2)	1.0 ± 0.7(-4)	6 ± 5(-4)	1.2 ± 0.2(-2)
^{24}Na	5.3 ± 0.1(-3)	5.6 ± 0.2(-3)	6.3 ± 0.2(-3)	6.0 ± 0.2(-3)	3.6 ± 0.1(-3)	4.2 ± 0.3(-3)
^{41}Ar	**	**	**	**	**	**
^{51}Cr	7 ± 2(-5)	<3(-5)	4 ± 1(-5)	6 ± 3(-6)	*	<8(-6)
^{54}Mn	2.2 ± 0.4(-5)	8 ± 5(-5)	1.9 ± 0.5(-6)	1.5 ± 0.7(-6)	*	2.1 ± 0.2(-5)
^{56}Mn	<6(-4)	<5(-4)	<5(-4)	<5(-4)	6.9 ± 0.4(-3)	<4(-4)
^{59}Fe	5 ± 2(-6)	<4(-5)	<3(-6)	<3(-6)	2 ± 1(-4)	5 ± 3(-6)
^{57}Co	2.2 ± 0.4(-6)	<5(-5)	<3(-6)	2 ± 1(-6)	<2(-4)	<5(-6)
^{58}Co	3.9 ± 0.2(-4)	5.6 ± 0.3(-4)	1.22 ± 0.03(-4)	6 ± 4(-4)	6.5 ± 0.4(-3)	1.50 ± 0.06(-4)

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	1/22/78; 11:16 (μCi/ml)	1/23/78; 11:14 (μCi/ml)	1/24/78; 10:31 (μCi/ml)	1/25/78; 04:14 (μCi/ml)	1/26/78; 12:55 (μCi/ml)	2/3/78; 09:43 (μCi/ml)
^{60}Co	7.0 ± 0.3(-5)	3.0 ± 0.6(-5)	8.2 ± 0.9(-6)	3.2 ± 0.6(-6)	5.4 ± 0.8(-4)	2.0 ± 0.2(-5)
^{65}Zn	<5(-6)	2 ± 2(-5)	<3(-6)	1.6 ± 1.1(-6)	1.2 ± 1.0(-4)	<5(-6)
^{91}Sr	<3(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<1(-4)
^{91m}Y	**	**	**	**	**	**
^{93}Y	<2(-5)	<1(-4)	<3(-4)	<3(-4)	<2(-4)	<1(-4)
^{95}Zr	1.1 ± 0.1(-5)	4.1 ± 0.9(-5)	<3(-6)	3 ± 1(-6)	3.2 ± 0.8(-4)	7 ± 2(-6)
^{95}Nb	1.0 ± 0.3(-5)	4 ± 2(-5)	2 ± 1(-6)	4 ± 2(-6)	<6(-4)	5 ± 3(-6)
^{99}Mo	1.0 ± 0.2(-6)	1.60 ± 0.08(-4)	1.6 ± 0.1(-4)	1.23 ± 0.07(-4)	<5(-4)	4.2 ± 0.3(-5)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	<6(-6)	<3(-5)	2 ± 1(-6)	4 ± 3(-6)	<2(-4)	<9(-6)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	<5(-6)	<3(-5)	<5(-6)	<4(-6)	*	<9(-6)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	<3(-4)	<7(-4)	<4(-4)	<4(-4)	*	<3(-4)
^{124}Sb	5 ± 2(-6)	1.7 ± 1.0(-5)	1.1 ± 0.5(-6)	1.2 ± 0.6(-6)	<4(-4)	2 ± 2(-6)
^{125}Sb	4 ± 4(-6)	<3(-5)	<6(-6)	<4(-6)	<2(-4)	<6(-6)
^{129m}Te	<4(-6)	<2(-5)	<4(-6)	<3(-6)	<2(-4)	<6(-6)
^{129}Te	<8(-3)	*	<9(-3)	<7(-3)	<7(-3)	<7(-3)
^{131m}Te	<5(-5)	<2(-4)	<3(-3)	<2(-4)	<3(-3)	<6(-5)
^{131}Te	**	**	**	**	**	**
^{132}Te	<6(-6)	<2(-4)	<8(-6)	<3(-5)	*	<2(-5)
^{139}Ba	2.5 ± 0.6(-3)	2.9 ± 0.4(-3)	2.8 ± 0.4(-3)	3.9 ± 0.3(-3)	4.2 ± 0.2(-3)	7.6 ± 0.3(-3)
^{140}Ba	4.1 ± 0.5(-5)	<3(-5)	<8(-6)	1.5 ± 0.5(-5)	<6(-4)	3.5 ± 0.3(-4)
^{140}La	5 ± 5(-6)	<3(-5)	<3(-5)	<2(-4)	<2(-4)	<1(-4)
^{141}Ce	<4(-6)	<3(-5)	3 ± 2(-6)	<5(-6)	<2(-4)	<5(-6)
^{143}Ce	<2(-5)	<5(-5)	<3(-4)	<2(-4)	<2(-4)	<4(-5)
^{144}Ce	1.2 ± 0.4(-5)	<3(-5)	<3(-6)	<4(-6)	<5(-4)	<4(-6)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<4(-5)	<3(-5)	<3(-5)	<5(-5)	<6(-4)	<7(-6)
^{154}Eu	<4(-5)	<3(-5)	<3(-5)	<5(-5)	<3(-4)	<5(-6)
^{155}Eu	**	**	**	**	**	**
^{187}W	<2(-5)	<5(-5)	<3(-4)	<2(-4)	<2(-4)	<6(-5)
^{239}Np	<9(-6)	<5(-5)	<3(-5)	<9(-5)	<2(-4)	<2(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.
* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	2/7/78; 09:50 (μCi/ml)	2/8/78; 09:55 (μCi/ml)	2/9/78; 11:04 (μCi/ml)	3/17/78; 10:36 (μCi/ml)	3/25/78; 19:35 (μCi/ml)	3/25/78; 19:16 (μCi/ml)
^{85m}Kr	1.6 ± 0.1(-2)	**	**	**	**	**
^{85}Kr	<2(-4)	**	**	**	**	**
^{87}Kr	2.3 ± 0.2(-2)	**	**	**	**	**
^{88}Kr	3.3 ± 0.1(-2)	**	**	**	**	**
^{89}Kr	*	**	**	**	**	**
^{131m}Xe	<2(-3)	**	**	**	**	**
^{133m}Xe	7.3 ± 0.2(-3)	**	**	**	**	**
^{133}Xe	2.25 ± 0.05(-1)	**	**	**	**	**
^{135m}Xe	2 ± 2(-2)	**	**	**	**	**
^{135}Xe	1.08 ± 0.03(-1)	**	**	**	**	**
^{137}Xe	*	**	**	**	**	**
^{138}Xe	4.4 ± 0.1(-2)	**	**	**	**	**
^{84}Br	**	**	**	**	**	**
^{131}I	7.0 ± 0.2(-3)	6.4 ± 0.4(-3)	6.6 ± 0.1(-3)	3.9 ± 0.1(-3)	5.0 ± 0.1(-3)	5.2 ± 0.1(-3)
^{132}I	1.45 ± 0.03(-2)	1.46 ± 0.02(-2)	**	**	**	**
^{133}I	1.37 ± 0.05(-2)	1.16 ± 0.02(-2)	1.21 ± 0.02(-2)	1.66 ± 0.03(-2)	1.24 ± 0.03(-2)	1.22 ± 0.02(-2)
^{134}I	1.72 ± 0.04(-2)	1.66 ± 0.07(-2)	**	**	**	**
^{135}I	1.42 ± 0.06(-2)	1.44 ± 0.03(-2)	**	**	**	**
^{88}Rb	5.4 ± 0.4(-2)	5.4 ± 0.3(-2)	**	**	**	**
^{89}Rb	1.4 ± 0.1(-2)	1.1 ± 0.1(-2)	**	**	**	**
^{134}Cs	1.4 ± 0.1(-3)	8.7 ± 0.9(-4)	8.0 ± 0.2(-4)	1.42 ± 0.04(-3)	1.47 ± 0.03(-3)	1.52 ± 0.02(-3)
^{136}Cs	4.1 ± 0.8(-5)	2.4 ± 0.6(-5)	2.3 ± 0.6(-5)	4.2 ± 0.5(-5)	3.9 ± 0.6(-5)	3.3 ± 0.5(-5)
^{137}Cs	2.2 ± 0.1(-3)	1.53 ± 0.04(-3)	1.63 ± 0.04(-3)	2.66 ± 0.06(-3)	2.9 ± 0.1(-3)	2.91 ± 0.06(-3)
^{138}Cs	4.4 ± 0.1(-2)	4.0 ± 0.2(-2)	**	**	**	**
^{139}Cs	5 ± 1(-2)	2.6 ± 0.6(-2)	**	**	**	**
^{24}Na	5.6 ± 0.4(-3)	5.2 ± 0.6(-3)	5.0 ± 0.3(-3)	7.6 ± 0.4(-3)	6.0 ± 0.4(-3)	5.7 ± 0.6(-3)
^{41}Ar	<6(-4)	**	**	**	**	**
^{51}Cr	1.9 ± 0.4(-4)	<4(-6)	<6(-3)	1.7 ± 0.2(-4)	<2(-4)	<3(-5)
^{54}Mn	7.6 ± 0.3(-5)	7.3 ± 0.4(-6)	1.4 ± 0.1(-5)	1.7 ± 0.2(-6)	7.6 ± 0.6(-5)	1.3 ± 0.3(-5)
^{56}Mn	<7(-4)	<6(-4)	**	**	**	**
^{59}Fe	3.7 ± 0.4(-5)	6 ± 1(-6)	3.3 ± 0.6(-6)	2.1 ± 0.5(-5)	4 ± 1(-5)	<2(-5)
^{57}Co	1.1 ± 0.4(-5)	<2(-6)	1.3 ± 0.9(-6)	5 ± 3(-6)	1.4 ± 0.6(-5)	<2(-5)
^{58}Co	1.8 ± 0.6(-3)	7.3 ± 0.5(-5)	1.15 ± 0.04(-4)	1.62 ± 0.04(-3)	5.1 ± 0.1(-3)	7.4 ± 0.2(-4)

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	2/7/78; 09:50 (μCi/ml)	2/8/78; 09:55 (μCi/ml)	2/9/78; 11:04 (μCi/ml)	3/17/78; 10:36 (μCi/ml)	3/25/78; 19:35 (μCi/ml)	3/25/78; 19:16 (μCi/ml)
^{60}Co	1.7 ± 0.1(-4)	1.0 ± 0.1(-5)	1.8 ± 0.1(-5)	4.9 ± 0.7(-5)	1.6 ± 0.1(-4)	1.9 ± 0.4(-5)
^{65}Zn	<8(-6)	<2(-6)	<2(-5)	<1(-5)	<2(-5)	<2(-5)
^{91}Sr	<4(-4)	<2(-4)	**	<2(-3)	<4(-3)	<3(-3)
^{91m}Y	**	**	**	**	**	**
^{93}Y	<5(-4)	<2(-4)	**	<2(-3)	<4(-3)	<3(-3)
^{95}Zr	5.2 ± 0.5(-5)	1.3 ± 1.1(-6)	<2(-6)	3.2 ± 0.5(-5)	9 ± 1(-5)	4.1 ± 0.9(-5)
^{95}Nb	6.8 ± 0.3(-5)	2 ± 1(-6)	2.0 ± 0.4(-6)	2.2 ± 0.4(-5)	1.1 ± 0.1(-4)	1.7 ± 0.5(-5)
^{99}Mo	1.0 ± 0.1(-4)	4.9 ± 0.2(-5)	4.3 ± 0.2(-5)	2.02 ± 0.05(-4)	1.17 ± 0.09(-4)	1.11 ± 0.08(-4)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	1.1 ± 0.2(-5)	1.9 ± 0.7(-6)	<3(-6)	1.0 ± 0.3(-6)	2 ± 2(-5)	<3(-5)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	<2(-5)	<4(-6)	<5(-6)	<3(-5)	<4(-6)	<3(-5)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	<7(-4)	<3(-4)	<3(-4)	<8(-4)	<1(-3)	<7(-4)
^{124}Sb	1.0 ± 0.3(-5)	8 ± 5(-7)	1.0 ± 0.5(-6)	3.7 ± 0.7(-5)	1.0 ± 0.1(-4)	1.5 ± 0.7(-5)
^{125}Sb	<2(-5)	<3(-6)	<5(-6)	1.9 ± 0.7(-5)	<3(-5)	<3(-5)
^{129m}Te	<9(-6)	<3(-6)	<4(-6)	<2(-5)	<3(-5)	<2(-5)
^{129}Te	<9(-3)	<9(-3)	**	**	**	**
^{131m}Te	<2(-4)	<4(-5)	<4(-5)	<9(-5)	<1(-4)	<7(-5)
^{131}Te	**	**	**	**	**	**
^{132}Te	<4(-5)	4 ± 3(-6)	<6(-6)	<2(-5)	3.5 ± 0.9(-5)	<4(-5)
^{139}Ba	<5(-3)	2.5 ± 0.6(-3)	**	**	**	**
^{140}Ba	1.5 ± 0.1(-4)	8.3 ± 0.5(-5)	9.4 ± 0.6(-5)	<2(-5)	4 ± 2(-5)	<4(-5)
^{140}La	2 ± 2(-4)	<2(-4)	<3(-4)	<2(-5)	<4(-5)	<3(-5)
^{141}Ce	2.5 ± 0.4(-5)	<3(-6)	<3(-6)	<1(-5)	<4(-5)	<2(-5)
^{143}Ce	<2(-4)	<4(-5)	<3(-6)	<9(-5)	<2(-4)	4 ± 4(-5)
^{144}Ce	<2(-5)	<3(-6)	<2(-6)	<7(-6)	<2(-5)	<2(-5)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<3(-5)	<4(-6)	<6(-6)	<2(-5)	<4(-5)	<4(-5)
^{154}Eu	<5(-6)	<2(-6)	<2(-6)	<6(-6)	1.0 ± 0.7(-6)	9 ± 6(-6)
^{155}Eu	**	**	**	**	**	**
^{187}W	<4(-4)	<2(-4)	<8(-5)	<2(-4)	<3(-4)	5 ± 2(-4)
^{239}Np	5 ± 2(-5)	<2(-5)	<7(-6)	<2(-5)	7 ± 2(-5)	<3(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.
* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	4/9/78; 09:03 (μCi/ml)	4/9/78; 09:04 (μCi/ml)	4/12/78; 17:53 (μCi/ml)	4/13/78; 11:38 (μCi/ml)	4/14/78; 13:55 (μCi/ml)	4/17/78; 10:45 (μCi/ml)
^{85m}Kr	**	**	**	**	**	**
^{85}Kr	**	**	**	**	**	**
^{87}Kr	**	**	**	**	**	**
^{88}Kr	**	**	**	**	**	**
^{89}Kr	**	**	**	**	**	**
^{131m}Xe	**	**	**	**	**	**
^{133m}Xe	**	**	**	**	**	**
^{133}Xe	**	**	**	**	**	**
^{135m}Xe	**	**	**	**	**	**
^{135}Xe	**	**	**	**	**	**
^{137}Xe	**	**	**	**	**	**
^{138}Xe	**	**	**	**	**	**
^{84}Br	1.9 ± 0.5(-3)	<2(-3)	2 ± 1(-3)	<3(-3)	<2(-3)	<2(-2)
^{131}I	8.0 ± 0.1(-2)	7.8 ± 0.1(-2)	9.7 ± 0.6(-2)	1.01 ± 0.05(-1)	6.6 ± 0.4(-2)	1.04 ± 0.06(-2)
^{132}I	2.27 ± 0.03(-2)	2.25 ± 0.04(-2)	2.45 ± 0.05(-2)	2.17 ± 0.04(-2)	1.89 ± 0.05(-2)	1.88 ± 0.03(-2)
^{133}I	5.21 ± 0.08(-2)	5.07 ± 0.08(-2)	5.0 ± 0.2(-2)	5.2 ± 0.1(-2)	3.3 ± 0.2(-2)	1.78 ± 0.04(-2)
^{134}I	2.16 ± 0.05(-2)	2.21 ± 0.04(-2)	2.18 ± 0.04(-2)	2.12 ± 0.03(-2)	2.01 ± 0.03(-2)	2.00 ± 0.06(-2)
^{135}I	3.02 ± 0.08(-2)	2.95 ± 0.08(-2)	3.05 ± 0.06(-2)	2.84 ± 0.07(-2)	2.0 ± 0.2(-2)	1.76 ± 0.04(-2)
^{88}Rb	5.5 ± 0.2(-2)	5.5 ± 0.6(-2)	5.0 ± 0.2(-2)	8 ± 1(-2)	6.2 ± 0.4(-2)	5.0 ± 0.2(-2)
^{89}Rb	1.2 ± 0.1(-2)	1.1 ± 0.1(-2)	1.2 ± 0.1(-2)	8 ± 2(-3)	9.8 ± 0.6(-3)	1.14 ± 0.03(-2)
^{134}Cs	1.8 ± 0.1(-3)	1.7 ± 0.1(-3)	1.73 ± 0.08(-3)	1.73 ± 0.08(-3)	1.8 ± 0.2(-3)	1.8 ± 0.1(-3)
^{136}Cs	1.7 ± 0.2(-4)	2.0 ± 0.2(-4)	2.7 ± 0.5(-4)	2.4 ± 0.4(-4)	1.45 ± 0.05(-4)	2.5 ± 0.3(-5)
^{137}Cs	3.2 ± 0.1(-3)	3.15 ± 0.09(-3)	3.06 ± 0.08(-3)	3.16 ± 0.09(-3)	3.44 ± 0.08(-3)	3.37 ± 0.09(-3)
^{138}Cs	4.9 ± 0.1(-2)	4.6 ± 0.2(-2)	5.1 ± 0.2(-2)	7 ± 2(-2)	5.1 ± 0.2(-2)	4.5 ± 0.2(-2)
^{139}Cs	1.6 ± 0.3(-2)	3 ± 1(-2)	1.5 ± 0.4(-2)	<2(-1)	<3(-2)	8 ± 3(-3)
^{24}Na	2.45 ± 0.09(-2)	2.42 ± 0.08(-2)	2.4 ± 0.1(-2)	2.39 ± 0.08(-2)	1.64 ± 0.09(-2)	1.17 ± 0.03(-2)
^{41}Ar	**	**	**	**	**	**
^{51}Cr	1.7 ± 0.6(-4)	<2(-4)	<3(-4)	<2(-4)	<2(-4)	<4(-5)
^{54}Mn	1.56 ± 0.08(-5)	7.8 ± 0.6(-6)	1.4 ± 0.1(-5)	5.3 ± 0.7(-6)	2.1 ± 0.1(-5)	7.6 ± 0.6(-6)
^{56}Mn	<8(-4)	<8(-4)	<2(-3)	<2(-3)	<1(-3)	<2(-3)
^{59}Fe	8 ± 2(-6)	6 ± 1(-6)	7 ± 2(-6)	2 ± 2(-6)	1.6 ± 0.2(-5)	2.2 ± 0.9(-6)
^{57}Co	<4(-6)	<5(-6)	<3(-6)	<3(-6)	<3(-6)	<2(-6)
^{58}Co	1.4 ± 0.1(-3)	7.9 ± 0.6(-4)	3.7 ± 0.1(-4)	2.6 ± 0.2(-4)	1.14 ± 0.03(-3)	1.8 ± 0.3(-4)

TABLE B.4 (cont'd

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	4/9/78; 09:03 (μCi/ml)	4/9/78; 09:04 (μCi/ml)	4/12/78; 17:53 (μCi/ml)	4/13/78; 11:38 (μCi/ml)	4/14/78; 13:55 (μCi/ml)	4/17/78; 10:45 (μCi/ml)
^{60}Co	3.7 ± 0.3(-5)	2.5 ± 0.4(-5)	4.0 ± 0.2(-5)	1.4 ± 0.1(-5)	4.5 ± 0.4(-5)	1.4 ± 0.1(-5)
^{65}Zn	3 ± 1(-6)	<2(-6)	<4(-6)	2.9 ± 0.8(-6)	<3(-6)	<2(-6)
^{91}Sr	<3(-4)	<3(-4)	<4(-4)	<3(-4)	<2(-4)	<5(-4)
^{91m}Y	<4(-3)	<2(-3)	<2(-3)	<3(-3)	<2(-3)	<2(-4)
^{93}Y	<2(-3)	<2(-3)	<2(-3)	<2(-3)	9 ± 4(-4)	<2(-3)
^{95}Zr	3.7 ± 0.6(-5)	1.1 ± 0.1(-5)	5 ± 1(-6)	1.0 ± 0.2(-5)	1.8 ± 0.2(-5)	2 ± 1(-5)
^{95}Nb	2.8 ± 0.2(-5)	1.6 ± 0.1(-5)	8.4 ± 0.8(-6)	8.3 ± 0.9(-6)	2.3 ± 0.2(-5)	3.4 ± 0.7(-6)
^{99}Mo	1.3 ± 0.2(-4)	1.1 ± 0.2(-4)	1.2 ± 0.2(-4)	1.3 ± 0.2(-4)	1.5 ± 0.3(-4)	1.5 ± 0.2(-4)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	3 ± 2(-6)	4 ± 1(-6)	<4(-6)	<3(-6)	9 ± 2(-6)	<3(-6)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	<3(-5)	<2(-5)	<7(-5)	<1(-4)	<5(-5)	<2(-5)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	3.5 ± 0.8(-6)	2 ± 1(-6)	7 ± 1(-6)	3.5 ± 0.8(-6)	6 ± 1(-6)	<2(-6)
^{124}Sb	2.6 ± 0.2(-5)	2.6 ± 0.9(-5)	4.3 ± 0.7(-6)	5.2 ± 0.7(-6)	1.8 ± 0.2(-5)	2.5 ± 0.6(-6)
^{125}Sb	<2(-5)	<8(-6)	<9(-6)	<8(-6)	<1(-5)	<6(-6)
^{129m}Te	<6(-5)	<6(-5)	<9(-5)	<2(-4)	<9(-5)	<7(-5)
^{129}Te	<5(-3)	<4(-3)	<2(-2)	<3(-2)	<2(-2)	<7(-2)
^{131m}Te	1.6 ± 0.8(-3)	<3(-3)	<4(-4)	<3(-4)	<2(-4)	<3(-4)
^{131}Te	<9(-4)	<2(-3)	<2(-3)	<3(-3)	<2(-3)	<2(-3)
^{132}Te	<3(-5)	<3(-5)	<2(-5)	<3(-6)	1.9 ± 0.9(-5)	<7(-6)
^{139}Ba	4.6 ± 0.5(-3)	3 ± 2(-3)	4.3 ± 0.6(-3)	9 ± 2(-3)	7 ± 3(-3)	5.5 ± 0.4(-3)
^{140}Ba	<2(-5)	<2(-5)	<2(-5)	<2(-5)	<2(-5)	2.9 ± 0.6(-5)
^{140}La	<3(-5)	<3(-5)	<4(-5)	<2(-5)	<1(-5)	<3(-5)
^{141}Ce	<7(-6)	<6(-6)	<8(-6)	<8(-6)	<6(-6)	<3(-6)
^{143}Ce	<8(-5)	<2(-4)	<2(-4)	<5(-5)	<4(-5)	<6(-5)
^{144}Ce	<3(-5)	<3(-5)	<4(-5)	<3(-5)	<3(-5)	<2(-5)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<3(-5)	<9(-5)	<2(-4)	<2(-4)	<8(-5)	<2(-5)
^{154}Eu	<2(-6)	<2(-6)	<3(-6)	<2(-6)	<2(-6)	<2(-6)
^{155}Eu	<9(-6)	<2(-5)	<2(-5)	<2(-5)	<1(-5)	<6(-6)
^{187}W	<2(-4)	<2(-4)	<4(-4)	<2(-4)	<6(-4)	<2(-4)
^{239}Np	<1(-4)	<2(-4)	<2(-4)	<8(-5)	<5(-5)	<4(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.
* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	4/17/78; 10:46 (μCi/ml)	4/25/78; 10:15 (μCi/ml)	5/1/78; 09:09 (μCi/ml)	5/9/78; 09:21 (μCi/ml)	5/16/78; 10:12 (μCi/ml)	5/23/78; 10:30 (μCi/ml)
^{85m}Kr	1.5 ± 0.1(-2)	2.20 ± 0.03(-2)	1.8 ± 0.3(-2)	1.91 ± 0.03(-2)	1.61 ± 0.04(-2)	1.6 ± 0.2(-2)
^{85}Kr	<9(-3)	<5(-2)	<8(-4)	<2(-2)	*	<2(-2)
^{87}Kr	2.1 ± 0.1(-2)	3.0 ± 0.1(-2)	2.7 ± 0.2(-2)	2.8 ± 0.1(-2)	2.5 ± 0.2(-2)	2.5 ± 0.2(-2)
^{88}Kr	3.2 ± 0.1(-2)	4.76 ± 0.09(-2)	4.12 ± 0.08(-2)	4.43 ± 0.06(-2)	3.63 ± 0.05(-2)	3.70 ± 0.08(-2)
^{89}Kr	<2(-3)	*	*	*	*	<2(-2)
^{131m}Xe	<3(-3)	<4(-3)	4 ± 4(-5)	4 ± 1(-4)	<1(-3)	<2(-2)
^{133m}Xe	8.0 ± 0.2(-3)	1.3 ± 0.1(-2)	7.0 ± 0.2(-3)	6.1 ± 0.6(-3)	5.7 ± 0.7(-3)	6.4 ± 0.4(-3)
^{133}Xe	3.0 ± 0.1(-1)	6.1 ± 0.3(-1)	2.3 ± 0.2(-1)	2.0 ± 0.2(-1)	1.9 ± 0.1(-1)	1.97 ± 0.04(-1)
^{135m}Xe	<2(-2)	<9(-2)	3 ± 3(-2)	3.2 ± 0.8(-2)	<5(-2)	<4(-2)
^{135}Xe	1.1 ± 0.1(-1)	1.5 ± 0.1(-1)	1.4 ± 0.1(-1)	1.28 ± 0.07(-1)	1.12 ± 0.02(-1)	1.15 ± 0.06(-1)
^{137}Xe	6 ± 5(-3)	*	*	*	*	1.9 ± 0.4(-2)
^{138}Xe	2.9 ± 0.1(-2)	3.7 ± 0.6(-2)	4.7 ± 0.2(-2)	4.0 ± 0.2(-2)	4.3 ± 0.2(-2)	4.1 ± 0.1(-2)
^{84}Br	2.0 ± 0.6(-3)	5 ± 2(-3)	3.8 ± 0.7(-3)	5 ± 1(-3)	2.2 ± 0.9(-3)	3.6 ± 0.6(-3)
^{131}I	1.03 ± 0.02(-2)	2.6 ± 0.1(-2)	1.06 ± 0.01(-2)	8.2 ± 0.1(-3)	7.4 ± 0.2(-3)	7.1 ± 0.2(-3)
^{132}I	1.90 ± 0.05(-2)	2.46 ± 0.08(-2)	1.94 ± 0.02(-2)	1.83 ± 0.04(-2)	1.98 ± 0.02(-2)	2.06 ± 0.03(-2)
^{133}I	1.77 ± 0.03(-2)	3.19 ± 0.07(-2)	1.73 ± 0.03(-2)	1.72 ± 0.04(-2)	1.8 ± 0.1(-2)	1.68 ± 0.07(-2)
^{134}I	1.93 ± 0.04(-2)	2.24 ± 0.03(-2)	2.18 ± 0.06(-2)	2.06 ± 0.03(-2)	2.39 ± 0.03(-2)	2.43 ± 0.05(-2)
^{135}I	1.85 ± 0.05(-2)	2.46 ± 0.09(-2)	1.89 ± 0.05(-2)	1.83 ± 0.03(-2)	1.96 ± 0.03(-2)	1.98 ± 0.03(-2)
^{88}Rb	5.2 ± 0.2 (-2)	1.1 ± 0.3(-1)	6.2 ± 0.5(-2)	6.6 ± 0.8(-2)	6.2 ± 0.5(-2)	5.1 ± 0.2(-2)
^{89}Rb	1.14 ± 0.02(-2)	1.7 ± 0.2(-2)	1.38 ± 0.05(-2)	1.24 ± 0.08(-2)	1.63 ± 0.07(-2)	1.47 ± 0.04(-2)
^{134}Cs	2.15 ± 0.07(-3)	1.65 ± 0.04(-3)	1.61 ± 0.05(-3)	1.90 ± 0.05(-3)	1.65 ± 0.09(-3)	3.1 ± 0.1(-3)
^{136}Cs	3.9 ± 0.2(-5)	3.9 ± 0.2(-5)	2.4 ± 0.5(-5)	4.8 ± 0.5(-5)	3.4 ± 0.3(-5)	5.2 ± 0.4(-4)
^{137}Cs	3.92 ± 0.09(-3)	3.08 ± 0.09(-3)	3.0 ± 0.1(-3)	3.3 ± 0.2(-3)	3.16 ± 0.07(-3)	4.5 ± 0.1(-3)
^{138}Cs	4.8 ± 0.2(-2)	6.2 ± 0.5(-2)	7.8 ± 0.2(-2)	5.6 ± 0.2(-2)	5.3 ± 0.2(-2)	5.0 ± 0.1(-2)
^{139}Cs	1.1 ± 0.2(-2)	<2(-1)	4 ± 1(-2)	2 ± 2(-3)	<4(-2)	2.0 ± 0.3(-2)
^{24}Na	1.15 ± 0.03(-2)	1.17 ± 0.03(-2)	8.6 ± 0.3(-3)	9.2 ± 0.3(-3)	8.5 ± 0.2(-3)	8.4 ± 0.4(-3)
^{41}Ar	<2(-4)	<3(-4)	*	*	<2(-4)	<2(-4)
^{51}Cr	6 ± 3(-5)	1.1 ± 0.1(-3)	1.8 ± 0.1(-3)	2.3 ± 0.4(-4)	5 ± 2(-4)	5.5 ± 0.4(-4)
^{54}Mn	2.2 ± 0.4(-5)	3.6 ± 0.3(-4)	5.0 ± 0.3(-4)	7.0 ± 0.3(-5)	2.0 ± 0.2(-4)	4.3 ± 0.3(-5)
^{56}Mn	<2(-3)	4.2 ± 0.4(-3)	<6(-4)	<6(-4)	<1(-3)	<2(-3)
^{59}Fe	1.0 ± 0.3(-5)	2.1 ± 0.2(-4)	3.2 ± 0.2(-4)	3.1 ± 0.4(-5)	7.8 ± 0.5(-5)	2.4 ± 0.5(-5)
^{57}Co	<4(-6)	1.0 ± 0.1(-5)	1.9 ± 0.5(-5)	4 ± 2(-6)	4 ± 2(-6)	1.3 ± 0.5(-6)
^{58}Co	3.5 ± 0.2(-4)	5.2 ± 0.4(-3)	8.5 ± 0.4(-3)	1.55 ± 0.04(-3)	2.9 ± 0.3(-3)	1.50 ± 0.07(-3)

TABLE B.4 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT - UNIT #4
POWER OPERATIONS

Nuclide	4/17/78; 10:46 (μCi/ml)	4/25/78; 10:15 (μCi/ml)	5/1/78; 09:09 (μCi/ml)	5/9/78; 09:21 (μCi/ml)	5/16/78; 10:12 (μCi/ml)	5/23/78; 10:30 (μCi/ml)
^{60}Co	8 ± 2(-5)	3.5 ± 0.5(-4)	4.6 ± 0.9(-4)	3.3 ± 0.1(-4)	2.9 ± 0.2(-4)	2.0 ± 0.5(-4)
^{65}Zn	<4(-6)	1.5 ± 0.2(-5)	2.5 ± 0.9(-5)	<7(-6)	1.7 ± 0.5(-5)	<1(-4)
^{91}Sr	<3(-4)	<3(-4)	2 ± 2(-4)	<2(-4)	<3(-4)	<3(-4)
^{91m}Y	<2(-4)	<4(-4)	*	*	<4(-4)	<2(-4)
^{93}Y	<2(-3)	<1(-3)	<3(-4)	<3(-4)	<1(-3)	<2(-3)
^{95}Zr	1.4 ± 0.2(-5)	1.2 ± 0.1(-4)	1.6 ± 0.2(-4)	7.6 ± 0.3(-5)	4.4 ± 0.5(-5)	1.2 ± 0.1(-4)
^{95}Nb	1.9 ± 0.3(-5)	1.31 ± 0.07(-4)	2.2 ± 0.2(-4)	1.11 ± 0.05(-4)	9 ± 1(-5)	1.4 ± 0.4(-4)
^{99}Mo	1.4 ± 0.1(-4)	2.1 ± 0.2(-4)	7.1 ± 0.6(-5)	1.1 ± 0.1(-4)	1.7 ± 0.2(-4)	1.5 ± 0.1(-4)
^{99m}Tc	†	†	†	†	†	†
^{103}Ru	6 ± 3(-6)	1.6 ± 0.2(-5)	<5(-5)	1.3 ± 0.4(-5)	8 ± 4(-6)	6.0 ± 0.3(-5)
^{103m}Rh	†	†	†	†	†	†
^{106}Ru	<3(-5)	<6(-5)	<5(-5)	<5(-5)	<6(-5)	<3(-5)
^{106}Rh	†	†	†	†	†	†
^{110m}Ag	5 ± 2(-6)	1.4 ± 0.3(-5)	<2(-3)	2.2 ± 0.3(-5)	3 ± 2(-5)	1.6 ± 0.1(-5)
^{124}Sb	6 ± 2(-6)	4.0 ± 0.3(-5)	8.3 ± 0.9(-5)	1.9 ± 0.5(-5)	2.4 ± 0.5(-5)	6.5 ± 0.3(-5)
^{125}Sb	<2(-5)	1.6 ± 0.9(-5)	<3(-5)	<3(-5)	<2(-5)	<6(-5)
^{129m}Te	<8(-5)	<9(-5)	<3(-5)	<2(-4)	<2(-4)	<7(-5)
^{129}Te	<3(-2)	<6(-2)	<1(-2)	*	*	<3(-2)
^{131m}Te	<2(-4)	<3(-4)	<2(-4)	<2(-4)	<1(-3)	<1(-3)
^{131}Te	<9(-4)	<4(-3)	*	*	<2(-3)	<8(-4)
^{132}Te	<2(-5)	<2(-6)	2 ± 2(-5)	<9(-6)	<2(-5)	1.1 ± 0.2(-4)
^{139}Ba	5.1 ± 0.3(-3)	9 ± 4(-3)	6.3 ± 0.1(-3)	6.8 ± 0.1(-3)	8 ± 5(-3)	4 ± 1(-3)
^{140}Ba	6 ± 1(-5)	<2(-5)	<5(-5)	4 ± 2(-5)	<4(-5)	7.6 ± 0.3(-3)
^{140}La	<2(-4)	<1(-4)	<2(-3)	1.2 ± 0.3(-4)	<1(-4)	3.4 ± 0.1(-3)
^{141}Ce	<5(-6)	<6(-6)	1 ± 1(-5)	<8(-6)	<9(-6)	<8(-5)
^{143}Ce	<6(-5)	<9(-5)	<8(-5)	<6(-5)	<3(-4)	<3(-4)
^{144}Ce	<2(-5)	<4(-5)	<3(-5)	<3(-5)	<3(-5)	<6(-5)
^{144}Pr	†	†	†	†	†	†
^{152}Eu	<3(-5)	<3(-5)	<3(-5)	<4(-5)	<3(-5)	<3(-4)
^{154}Eu	<4(-6)	<4(-6)	<2(-5)	<7(-6)	<7(-6)	<7(-6)
^{155}Eu	<1(-5)	<3(-5)	*	<2(-5)	<3(-5)	<9(-6)
^{187}W	<2(-4)	7 ± 2(-4)	<2(-4)	<3(-4)	<4(-4)	<4(-4)
^{239}Np	<6(-5)	<2(-4)	<3(-5)	6 ± 4(-5)	<1(-4)	<9(-5)

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† Radionuclide not directly measured. Concentration can be inferred from parent or daughter.

* Radionuclide not detected.

** Radionuclide not measured.

TABLE B.5

BETA-ONLY-EMITTING RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
UNIT #3 - DURING REFUELING

Nuclide	11:48* 12/2/77 (μCi/ml)	11:32** 12/30/77 (μCi/ml)	14:35*** 1/3/78 (μCi/ml)	11:36** 1/11/78 (μCi/ml)	12:24*** 1/11/78 (μCi/ml)
^{3}H	3.8 ± 0.1(-2)	1.70 ± 0.05(-2)	5.1 ± 0.2(-3)	4.5 ± 0.1(-3)	4.4 ± 0.1(-3)
^{14}C	1.0 ± 0.2(-7)	1.9 ± 0.2(-6)	2.7 ± 0.3(-7)	4.7 ± 0.5(-7)	8.5 ± 0.9(-8)
^{55}Fe	1.5 ± 0.1(-4)	2.77 ± 0.04(-4)	4.67 ± 0.06(-3)	3.93 ± 0.02(-4)	5.21 ± 0.03(-4)
^{63}Ni	1.6 ± 0.1(-3)	3.7 ± 0.2(-4)	1.20 ± 0.01(-3)	6.1 ± 0.1(-4)	7.4 ± 0.3(-4)
^{89}Sr	1.01 ± 0.01(-4)	5.8 ± 0.2(-6)	8.1 ± 0.2(-6)	4.00 ± 0.08(-6)	1.26 ± 0.02(-5)
^{90}Sr	2.66 ± 0.07(-6)	9.5 ± 0.4(-7)	8.0 ± 0.1(-7)	2.62 ± 0.03(-6)	2.53 ± 0.03(-6)
^{91}Y	9.9 ± 0.4(-6)	1.39 ± 0.01(-5)	2.06 ± 0.02(-5)	1.60 ± 0.02(-5)	9.9 ± 0.1(-6)

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* Sample obtained from inlet to CVCS.

** Sample obtained from RHR

*** Dip sample obtained from reactor cavity.

TABLE B.6

BETA-ONLY-EMITTING RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT UNIT #3 - POWER OPERATIONS AFTER REFUELING

Nuclide	10:10 4/25/78 (μCi/ml)	09:40 6/1/78 (μCi/ml)
^{3}H	1.65 ± 0.08(-1)	1.20 ± 0.04(-1)
^{14}C	2.5 ± 0.3(-5)	6.7 ± 0.7(-5)
^{32}P	3.0 ± 0.2(-3)	4.37 ± 0.03(-3)
^{55}Fe	2.1 ± 0.2(-5)	9.7 ± 0.5(-6)
^{63}Ni	9.1 ± 0.8(-6)	1.9 ± 0.2(-6)
^{89}Sr	2.11 ± 0.04(-5)	1.76 ± 0.02(-5)
^{90}Sr	4.1 ± 0.4(-7)	1.7 ± 0.4(-8)
^{91}Y	5.9 ± 0.7(-7)	5.8 ± 0.2(-7)

TABLE B.7

BETA-ONLY-EMITTING RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
UNIT #4 - POWER OPERATIONS

Nuclide	16:10* 11/30/77 (μCi/ml)	09:29 12/2/77 (μCi/ml)	09:33* 12/12/77 (μCi/ml)	10:25 4/24/78 (μCi/ml)
^{3}H	1.60 ± 0.05(-1)	1.54 ± 0.01(-1)	1.48 ± 0.01(-1)	2.00 ± 0.06(-1)
^{14}C	3.2 ± 0.3(-6)	1.22 ± 0.03(-6)	1.41 ± 0.03(-6)	9.5 ± 1.0(-6)
^{32}P	†	1.58 ± 0.05(-4)	3.6 ± 0.1(-5)	8.2 ± 0.2(-3)
^{55}Fe	5.3 ± 0.5(-5)	3.80 ± 0.06(-6)	4.47 ± 0.06(-6)	9.8 ± 0.1(-4)
^{63}Ni	1.49 ± 0.04(-5)	1.68 ± 0.07(-6)	1.25 ± 0.07(-6)	1.76 ± 0.06(-4)
^{89}Sr	3.2 ± 0.1(-5)	4.8 ± 0.5(-7)	5.1 ± 0.2(-6)	5.9 ± 0.2(-6)
^{90}Sr	6.3 ± 0.6(-7)	2 ± 1(-8)	8 ± 2(-8)	4.3 ± 0.5(-7)
^{91}Y	4 ± 2(-7)	5 ± 4(-8)	1.1 ± 0.4(-7)	1.35 ± 0.09(-6)

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* Sample obtained from inlet to CVCS.

† Sample not analyzed soon enough to detect this radionuclide.

TABLE B.8

^{3}H AND ^{131}I CONCENTRATIONS IN REACTOR COOLANT UNIT #3 - FPL MEASUREMENTS

Date	^{3}H (μCi/ml)	Date	Time	^{131}I (μCi/ml)
11/3/77	1.7(-1)	11/1/77	0200	1.2(-2)
11/4/77	1.8(-1)	11/8/77	*	2.0(-2)
11/5/77	1.9(-1)	11/12/77	0520	3.2(-2)
11/6/77	1.8(-1)	11/15/77	0105	1.1(-2)
11/7/77	1.8(-1)	11/22/77	0936	1.4(-2)
11/9/77	1.5(-1)	11/24/78	0500	1.2(-1)
11/14/77	5.8(-2)	2/21/78	*	5.0(-3)
11/15/77	5.7(-2)	3/6/78	1830	1.3(-2)
11/20/77	8.8(-2)	3/7/78	0430	3.0(-2)
11/21/77	8.4(-2)	3/13/78	0910	2.0(-2)
11/28/77	5.1-6.9(-2)	3/13/78	1436	2.7(-2)
12/5/77	4.6(-2)	3/14/78	*	1.6(-2)
12/12/77	4.3(-2)	3/17/78	0419	1.8(-2)
12/19/77	4.0(-2)	3/17/78	1110	2.0(-2)
12/26/77	4.1(-2)	3/21/78	0800	6.0(-3)
1/2/78	2.2(-2)	3/21/78	2120	6.2(-3)
1/9/78	5.3(-3)	3/25/78	0400	3.3(-2)
1/16/78	6.7(-3)	3/25/78	1125	2.2(-2)
1/23/78	6.0(-3)	4/4/78	0815	7.6(-3)
1/30/78	4.9(-3)	4/11/78	*	8.8(-3)
2/6/78	2.8(-3)	4/18/78	0835	6.5(-3)
2/13/78	7.0(-3)	4/20/78	0250	3.9(-2)
2/20/78	4.1(-2)	4/20/78	1015	6.6(-2)
2/27/78	1.1(-1)	4/26/78	1320	1.2(-2)
3/6/78	1.9(-1)	4/26/78	2115	1.7(-2)
3/13/78	1.9(-1)	4/28/78	1325	1.7(-2)
3/20/78	2.2(-1)	5/2/78	0835	6.4(-3)
3/27/78	1.2(-1)	5/9/78	*	6.8(-3)
4/3/78	1.7(-1)	5/11/78	0904	2.5(-2)
4/10/78	2.2(-1)	5/11/78	1915	6.4(-2)
4/17/78	2.4(-1)	5/12/78	0218	4.0(-2)
4/24/78	2.8(-1)	5/13/78	0025	2.0(-2)
5/1/78	3.2(-1)	5/13/78	0915	4.4(-2)
5/8/78	2.1(-1)	5/16/78	0849	7.4(-3)
5/15/78	1.1(-1)	5/20/78	0200	5.3(-2)
5/22/78	9.8(-2)	5/22/78	0925	3.1(-2)
5/29/78	1.1(-1)	5/22/78	1332	2.2(-2)
		5/22/78	2045	1.4(-2)
		5/23/78	1840	8.0(-3)
		5/24/78	0235	8.1(-3)
		5/30/78	0855	5.9(-3)

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* Sample collection time not known.

TABLE B.9

^{3}H AND ^{131}I CONCENTRATIONS IN REACTOR COOLANT UNIT #4 - FPL MEASUREMENTS

Date	^{3}H (μCi/ml)	Date	Time	^{131}I (μCi/ml)
11/7/77	1.5(-2)	11/12/77	0525	2.8(-2)
11/14/77	3.4(-2)	11/15/77	*	5.8(-3)
11/21/77	1.0(-1)	11/29/77	0835	7.8(-3)
11/28/77	1.6(-1)	12/1/77	0130	1.1(-2)
12/5/77	1.8(-1)	12/1/77	2200	3.0(-2)
12/10/77	1.5(-1)	12/9/77	0430	1.2(-1)
12/12/77	1.5(-1)	12/9/77	1100	9.8(-2)
1/2/78	1.5(-1)	12/13/77	0025	1.0(-2)
1/9/78	1.8(-1)	12/17/77	0945	1.9(-1)
1/16/78	2.2(-1)	12/17/77	1530	2.0(-1)
1/23/78	2.5(-1)	12/20/77	*	1.1(-1)
1/30/78	1.1(-1)	12/26/77	1400	1.4(-1)
2/1/78	1.3(-1)	12/27/77	0545	1.8(-1)
2/2/78	1.3(-1)	1/9/78	0630	1.0(-2)
2/4/78	1.4(-1)	1/17/78	*	7.0(-3)
2/6/78	1.5(-1)	1/25/78	0620	1.7(-2)
2/7/78	1.5(-1)	1/25/78	2200	2.0(-1)
2/8/78	1.6(-1)	1/31/78	0825	2.9(-3)
2/9/78	1.6(-1)	2/14/78	*	1.2(-2)
2/10/78	1.7(-1)	2/14/78	1730	1.7(-1)
2/13/78	1.9(-1)	3/10/78	0130	1.2(-2)
2/14/78	1.9(-1)	3/14/78	0832	3.6(-3)
2/20/78	8.8(-2)	3/21/78	*	6.3(-3)
3/6/78	8.0(-2)	3/28/78	0900	5.8(-3)
3/13/78	4.6(-2)	4/11/78	0919	1.0(-1)
3/20/78	1.0(-1)	4/18/78	*	9.3(-3)
3/27/78	1.6(-1)	4/25/78	0020	1.5(-2)
4/3/78	2.1(-1)	4/25/78	0250	1.8(-2)
4/10/78	2.1(-1)	4/25/78	0935	2.4(-2)
4/17/78	3.0(-1)	5/9/78	0920	7.6(-3)
4/24/78	1.7(-1)	5/16/78	*	6.3(-3)
5/1/78	1.6(-1)	5/23/78	0833	6.3(-3)
5/8/78	2.4(-1)	5/31/78	0405	6.5(-3)
5/15/78	1.7(-1)	5/31/78	1323	1.8(-2)
5/22/78	3.1(-1)			
5/29/78	3.2(-1)			

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* Sample collection time not known.

TABLE B.10

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
1/24-26/78 SHUTDOWN OF UNIT #4

Time	10:31	04:14	05:04	06:20	07:16
Date	1/24/78	1/25/78	1/25/78	1/25/78	1/25/78
Power	100%	<100%	65%	0%	0%
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{131}I	6.0 ± 0.4(-3)	6.3 ± 0.3(-3)	7.5 ± 0.4(-3)	2.0 ± 0.1(-2)	1.29 ± 0.02(-1)
^{132}I	1.23 ± 0.02(-2)	1.29 ± 0.03(-2)	1.32 ± 0.03(-2)	2.11 ± 0.02(-2)	8.3 ± 0.1(-2)
^{133}I	1.02 ± 0.06(-2)	1.07 ± 0.06(-2)	1.19 ± 0.09(-2)	4.0 ± 0.3(-2)	1.19 ± 0.01(-1)
^{134}I	1.38 ± 0.04(-2)	1.37 ± 0.03(-2)	1.34 ± 0.02(-2)	1.30 ± 0.03(-2)	2.2 ± 0.1(-2)
^{135}I	1.23 ± 0.03(-2)	1.26 ± 0.03(-2)	1.28 ± 0.02(-2)	2.0 ± 0.1(-2)	7.8 ± 0.1(-2)
^{88}Rb	5.3 ± 0.2(-2)	5.2 ± 0.3(-2)	4.9 ± 0.1(-2)	5.3 ± 0.2(-2)	4.4 ± 0.2(-2)
^{89}Rb	1.0 ± 0.1(-2)	8.8 ± 0.3(-3)	6.2 ± 0.2(-3)	1.4 ± 0.2(-3)	<6(-4)
^{134}Cs	1.02 ± 0.09(-3)	9.6 ± 0.6(-4)	1.1 ± 0.1(-3)	1.1 ± 0.1(-3)	2.6 ± 0.1(-3)
^{136}Cs	3.5 ± 0.2(-5)	3.3 ± 0.3(-5)	<3(-4)	<5(-4)	9.9 ± 0.6(-4)
^{137}Cs	1.79 ± 0.08(-3)	1.85 ± 0.04(-3)	1.76 ± 0.04(-3)	1.79 ± 0.07(-3)	3.5 ± 0.1(-3)
^{138}Cs	4.1 ± 0.1(-2)	3.9 ± 0.1(-2)	3.5 ± 0.1(-2)	2.23 ± 0.02(-2)	1.01 ± 0.02(-2)
^{139}Cs	2.1 ± 0.4(-2)	1.0 ± 0.7(-4)	1.0 ± 0.3(-2)	<6(-4)	<2(-3)
^{24}Na	6.3 ± 0.2(-3)	6.0 ± 0.1(-3)	5.6 ± 0.1(-3)	5.1 ± 0.1(-3)	4.7 ± 0.1(-3)
^{51}Cr	4 ± 1(-5)	6 ± 3(-6)	1.0 ± 0.7(-5)	*	<2(-4)
^{54}Mn	1.9 ± 0.5(-6)	1.5 ± 0.7(-6)	<8(-4)	*	*
^{56}Mn	<5(-4)	<5(-4)	<4(-4)	3 ± 2(-4)	<6(-4)
^{59}Fe	<3(-6)	<3(-6)	<3(-4)	<4(-4)	<1(-3)
^{57}Co	<3(-6)	2 ± 1(-6)	<2(-4)	<2(-4)	<3(-4)
^{58}Co	1.22 ± 0.03(-4)	6 ± 4(-4)	8 ± 4(-4)	3.8 ± 0.3(-3)	8.3 ± 0.9(-3)
^{60}Co	8.2 ± 0.9(-6)	3.2 ± 0.6(-6)	<2(-4)	1.6 ± 0.5(-4)	<2(-4)
^{65}Zn	<3(-6)	1.6 ± 1.1(-6)	9 ± 6(-5)	1.2 ± 0.9(-4)	<3(-4)
^{91}Sr	<2(-4)	<2(-4)	<2(-4)	<3(-4)	<3(-4)
^{91m}Y	**	**	**	**	**
^{93}Y	<3(-4)	<3(-4)	<2(-4)	<4(-4)	<2(-3)
^{95}Zr	<3(-6)	3 ± 1(-6)	<2(-4)	<2(-4)	<2(-4)
^{95}Nb	2 ± 1(-6)	4 ± 2(-6)	*	*	<8(-4)
^{99}Mo	1.6 ± 0.1(-4)	1.23 ± 0.07(-4)	<3(-4)	<3(-4)	<2(-4)

TABLE B.10 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
1/24-26/78 SHUTDOWN OF UNIT #4

Time	10:31	04:14	05:04	06:20	07:16
Date	1/24/78	1/25/78	1/25/78	1/25/78	1/25/78
Power	100%	<100%	65%	0%	0%
Nuclide	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)
^{99m}Tc	**	**	**	**	**
^{103}Ru	2 ± 1(-6)	4 ± 3(-6)	<2(-4)	<2(-4)	<2(-4)
^{103m}Rh	**	**	**	**	**
^{106}Ru	<5(-6)	<4(-6)	*	*	*
^{106}Rh	**	**	**	**	**
^{110m}Ag	<4(-4)	<4(-4)	*	*	<2(-3)
^{124}Sb	1.1 ± 0.5(-6)	1.2 ± 0.6(-6)	<2(-4)	<3(-4)	<3(-4)
^{125}Sb	<6(-6)	<4(-6)	<2(-4)	<2(-4)	<4(-4)
^{129m}Te	<4(-6)	<3(-6)	<2(-4)	<2(-4)	<2(-4)
^{129}Te	<9(-3)	<7(-3)	<7(-3)	<5(-3)	<2(-3)
^{131m}Te	<3(-3)	<2(-4)	<2(-3)	<3(-3)	<5(-3)
^{131}Te	*	*	*	*	*
^{132}Te	<8(-6)	<3(-5)	*	*	*
^{139}Ba	2.8 ± 0.4(-3)	2.9 ± 0.3(-3)	3.0 ± 0.4(-3)	3.8 ± 0.3(-3)	3.2 ± 0.2(-3)
^{140}Ba	<8(-6)	1.5 ± 0.5(-5)	<6(-4)	<7(-4)	<2(-3)
^{140}La	<3(-5)	<2(-4)	<2(-4)	<2(-4)	<2(-4)
^{141}Ce	3 ± 2(-6)	<5(-6)	<2(-4)	<2(-4)	<3(-4)
^{143}Ce	<3(-4)	<2(-4)	<2(-4)	<2(-4)	<4(-4)
^{144}Ce	<3(-6)	<4(-6)	<4(-4)	<5(-4)	<8(-4)
^{144}Pr	**	**	**	**	**
^{152}Eu	<3(-5)	<5(-5)	<3(-4)	<3(-4)	<5(-4)
^{154}Eu	<3(-5)	<5(-5)	<2(-4)	<2(-4)	<2(-4)
^{155}Eu	**	**	**	**	**
^{187}W	<3(-4)	<2(-4)	<2(-4)	4 ± 2(-4)	2 ± 1(-4)
^{239}Np	<3(-5)	<9(-5)	<9(-5)	<2(-4)	<2(-4)

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* Radionuclide not detected
** Radionuclide not measured

TABLE B.10 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
1/24-26/78 SHUTDOWN OF UNIT #4

Time	08:18	09:17	10:24	10:05	12:55
Date	1/25/78	1/25/78	1/25/78	1/26/78	1/26/78
Power	0%	0%	0%	100%	100%
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{131}I	2.1 ± 0.1(-1)	2.4 ± 0.1(-1)	2.3 ± 0.1(-1)	5.7 ± 0.1(-2)	4.7 ± 0.1(-2)
^{132}I	1.23 ± 0.03(-1)	1.17 ± 0.03(-1)	9.2 ± 0.1(-2)	1.54 ± 0.01(-2)	1.43 ± 0.03(-2)
^{133}I	2.1 ± 0.1(-1)	2.3 ± 0.1(-1)	2.1 ± 0.1(-1)	3.4 ± 0.1(-2)	2.86 ± 0.05(-2)
^{134}I	1.75 ± 0.04(-2)	9.5 ± 0.2(-3)	3.9 ± 0.1(-3)	1.42 ± 0.03(-2)	1.40 ± 0.06(-2)
^{135}I	1.23 ± 0.02(-1)	1.25 ± 0.02(-1)	1.04 ± 0.01(-1)	1.59 ± 0.04(-2)	1.54 ± 0.04(-2)
^{88}Rb	3.4 ± 0.1(-2)	2.6 ± 0.1(-2)	1.7 ± 0.1(-2)	5.4 ± 0.2(-2)	4.7 ± 0.2(-2)
^{89}Rb	<2(-3)	<2(-3)	<1(-3)	8.3 ± 0.4(-3)	7.8 ± 0.3(-3)
^{134}Cs	4.7 ± 0.2(-3)	5.7 ± 0.1(-3)	5.7 ± 0.1(-3)	2.2 ± 0.1(-3)	1.90 ± 0.07(-3)
^{136}Cs	2.8 ± 0.2(-3)	3.6 ± 0.2(-3)	3.8 ± 0.2(-3)	9.8 ± 0.5(-4)	6.8 ± 0.5(-4)
^{137}Cs	6.5 ± 0.2(-3)	8.1 ± 0.2(-3)	8.2 ± 0.1(-3)	3.1 ± 0.1(-3)	2.62 ± 0.09(-3)
^{138}Cs	3.5 ± 0.2(-3)	9.8 ± 1.0(-4)	<4(-4)	3.9 ± 0.1(-2)	3.8 ± 0.1(-2)
^{139}Cs	<2(-3)	<2(-3)	<9(-4)	1 ± 1(-3)	6 ± 5(-4)
^{24}Na	3.9 ± 0.1(-3)	3.6 ± 0.1(-3)	2.9 ± 0.1(-3)	3.6 ± 0.1(-3)	3.6 ± 0.1(-3)
^{51}Cr	<3(-4)	5.4 ± 0.8(-3)	3 ± 1(-4)	<2(-3)	*
^{54}Mn	*	*	<6(-3)	*	*
^{56}Mn	<5(-4)	4.6 ± 0.3(-3)	2.9 ± 0.3(-3)	<5(-4)	6.9 ± 0.4(-3)
^{59}Fe	*	<2(-3)	<2(-3)	<4(-4)	2 ± 1(-4)
^{57}Co	<2(-4)	<3(-4)	<2(-4)	<4(-4)	<2(-4)
^{58}Co	1.0 ± 0.2(-2)	1.89 ± 0.08(-2)	1.58 ± 0.07(-2)	2.0 ± 0.2(-3)	6.5 ± 0.4(-3)
^{60}Co	1.5 ± 1.0(-4)	5.9 ± 0.6(-4)	5.2 ± 0.4(-4)	<6(-4)	5.4 ± 0.8(-4)
^{65}Zn	<3(-4)	<2(-4)	<3(-4)	<2(-4)	1.2 ± 1.0(-4)
^{91}Sr	<3(-4)	1.0 ± 0.9(-4)	<2(-4)	<2(-4)	<2(-4)
^{91m}Y	**	**	**	**	**
^{93}Y	<2(-2)	<2(-3)	<8(-3)	<3(-3)	<2(-4)
^{95}Zr	1.4 ± 1.0(-4)	5.8 ± 0.9(-4)	5.6 ± 0.9(-4)	<4(-4)	3.2 ± 0.8(-4)
^{95}Nb	<8(-4)	4 ± 3(-4)	3 ± 3(-4)	3 ± 2(-4)	<6(-4)
^{99}Mo	2 ± 1(-4)	1.09 ± 0.06(-3)	1.2 ± 0.1(-3)	2 ± 2(-4)	<5(-4)

TABLE B.10 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
1/24-26/78 SHUTDOWN OF UNIT #4

Time	08:18	09:17	10:24	10:05	12:55
Date	1/25/78	1/25/78	1/25/78	1/26/78	1/26/78
Power	0%	0%	0%	100%	100%
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{99m}Tc	**	**	**	**	**
^{103}Ru	2 ± 1(-4)	1 ± 1(-4)	<2(-4)	<2(-4)	<2(-4)
^{103m}Rh	**	**	**	**	**
^{106}Ru	*	*	*	*	*
^{106}Rh	**	**	**	**	**
^{110m}Ag	<4(-3)	<4(-3)	<5(-3)	<2(-3)	*
^{124}Sb	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<4(-4)
^{125}Sb	<4(-4)	<3(-4)	<3(-4)	<3(-4)	<2(-4)
^{129m}Te	<3(-4)	<3(-4)	<2(-4)	<3(-4)	<2(-4)
^{129}Te	<8(-4)	<4(-4)	<4(-4)	<7(-3)	<7(-3)
^{131m}Te	<4(-3)	<4(-3)	<3(-3)	<3(-3)	<3(-3)
^{131}Te	*	*	*	*	*
^{132}Te	<4(-4)	*	*	*	*
^{139}Ba	2.1 ± 0.4(-3)	1.8 ± 0.2(-3)	1.5 ± 0.2(-3)	5.1 ± 0.3(-3)	4.2 ± 0.2(-3)
^{140}Ba	<2(-3)	<1(-3)	<6(-4)	<7(-4)	<6(-4)
^{140}La	<2(-4)	7 ± 7(-5)	<2(-4)	<2(-4)	<2(-4)
^{141}Ce	<4(-4)	<3(-4)	<3(-4)	<2(-4)	<2(-4)
^{143}Ce	<6(-4)	<7(-4)	<5(-4)	<3(-4)	<2(-4)
^{144}Ce	<5(-4)	<3(-4)	<3(-4)	<4(-4)	<5(-4)
^{144}Pr	**	**	**	**	**
^{152}Eu	<9(-4)	<1(-2)	<2(-3)	<6(-4)	<6(-4)
^{154}Eu	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<3(-4)
^{155}Eu	**	**	**	**	**
^{187}W	5 ± 1(-3)	3.0 ± 0.7(-3)	1.6 ± 1.0(-4)	<2(-4)	<2(-4)
^{239}Np	<2(-4)	6 ± 2(-4)	<2(-4)	8 ± 7(-5)	<2(-4)

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* Radionuclide not detected

** Radionuclide not measured

TABLE B.11

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	09:51	21:41	22:51	23:52	00:51	01:46
Date	5/16/78	5/19/78	5/19/78	5/19/78	5/20/78	5/20/78
Power	100%	70%	26%	0%	0%	0%
Pressure (psi)	2240	2240	2240	2240	2260	2260
Temp. (°F)	570	565	553	548	540	540
Flow† (gpm)	54	52	52	50	50	50
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{85m}Kr	2.0 ± 0.1(-2)	1.4 ± 0.2(-2)	**	**	9.6 ± 0.2(-3)	**
^{85}Kr	**	**	**	**	**	**
^{87}Kr	4 ± 1(-2)	2.5 ± 0.9(-2)	**	**	6 ± 4(-3)	**
^{88}Kr	4.98 ± 0.08(-2)	3.53 ± 0.07(-2)	**	**	1.78 ± 0.06(-2)	**
^{89}Kr	**	**	**	**	**	**
^{131m}Xe	<2(-3)	<8(-2)	**	**	<2(-2)	**
^{133m}Xe	8.7 ± 0.6(-3)	<1(-2)	**	**	8 ± 4(-3)	**
^{133}Xe	3.1 ± 0.3(-1)	2.7 ± 0.1(-1)	**	**	2.9 ± 0.1(-1)	**
^{135m}Xe	<2(-1)	<1(-1)	**	**	<6(-2)	**
^{135}Xe	1.6 ± 0.1(-1)	1.3 ± 0.1(-1)	**	**	1.23 ± 0.03(-1)	**
^{137}Xe	**	**	**	**	**	**
^{138}Xe	1.33 ± 0.07(-1)	6.8 ± 0.1(-2)	**	**	7 ± 3(-4)	**
^{84}Br	2.2 ± 0.2(-2)	1.3 ± 0.1(-2)	4.8 ± 0.7(-3)	2.4 ± 0.4(-3)	<1(-3)	8 ± 4(-4)
^{131}I	7.8 ± 0.2(-3)	9.2 ± 0.5(-3)	9.9 ± 0.6(-3)	1.97 ± 0.06(-2)	5.1 ± 0.1(-2)	6.8 ± 0.2(-2)
^{132}I	1.02 ± 0.03(-1)	1.03 ± 0.03(-1)	1.11 ± 0.02(-1)	1.04 ± 0.03(-1)	1.30 ± 0.02(-1)	1.41 ± 0.05(-1)
^{133}I	6.0 ± 0.2(-2)	5.7 ± 0.2(-2)	5.87 ± 0.04(-2)	6.1 ± 0.1(-2)	9.94 ± 0.06(-2)	1.15 ± 0.02(-1)
^{134}I	1.86 ± 0.03(-1)	1.61 ± 0.03(-1)	1.23 ± 0.01(-1)	6.9 ± 0.1(-2)	4.17 ± 0.05(-2)	2.45 ± 0.02(-2)
^{135}I	1.06 ± 0.02(-1)	9.9 ± 0.2(-2)	9.2 ± 0.1(-2)	7.8 ± 0.2(-2)	9.1 ± 0.1(-2)	9.2 ± 0.1(-2)
^{88}Rb	8.0 ± 0.7(-2)	5.8 ± 0.1(-2)	6.9 ± 0.2(-2)	3.7 ± 0.1(-2)	3.1 ± 0.1(-2)	2.1 ± 0.1(-2)
^{89}Rb	7.6 ± 0.3(-2)	3.9 ± 0.1(-2)	1.8 ± 0.1(-2)	1.2 ± 0.4(-3)	<9(-4)	<9(-4)
^{134}Cs	7.9 ± 0.3(-4)	8 ± 1(-4)	4 ± 1(-4)	8 ± 1(-4)	1.7 ± 0.2(-3)	2.3 ± 0.1(-3)
^{136}Cs	1.0 ± 0.1(-4)	<4(-4)	<4(-4)	<2(-4)	5.5 ± 0.7(-4)	1.11 ± 0.07(-3)
^{137}Cs	1.12 ± 0.09(-3)	7 ± 2(-4)	<9(-4)	7.0 ± 0.8(-4)	1.5 ± 0.1(-3)	2.1 ± 0.2(-3)
^{138}Cs	2.48 ± 0.07(-1)	1.60 ± 0.04(-1)	8.3 ± 0.2(-2)	3.07 ± 0.06(-2)	1.11 ± 0.04(-2)	5.2 ± 0.4(-3)
^{139}Cs	1.2 ± 0.5(-1)	6.5 ± 0.4(-2)	3.1 ± 0.3(-2)	<5(-3)	<5(-3)	<5(-3)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	09:51	21:41	22:51	23:52	00:51	01:46
Date	5/16/78	5/19/78	5/19/78	5/19/78	5/20/78	5/20/78
Power	100%	70%	26%	0%	0%	0%
Pressure (psi)	2240	2240	2240	2240	2260	2260
Temp. (°F)	570	565	553	548	540	540
Flow† (gpm)	54	52	52	50	50	50
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{24}Na	8.5 ± 0.3(-3)	8.4 ± 0.2(-3)	8.8 ± 0.2(-3)	6.7 ± 0.2(-3)	6.6 ± 0.2(-3)	5.9 ± 0.1(-3)
^{41}Ar	<6(-4)	<6(-4)	**	**	<7(-4)	**
^{51}Cr	<4(-5)	*	*	*	*	*
^{54}Mn	1.7 ± 0.2(-5)	*	*	*	<3(-3)	<2(-3)
^{56}Mn	<6(-3)	<6(-3)	<5(-3)	<3(-3)	<2(-3)	<1(-3)
^{59}Fe	<4(-6)	<8(-4)	<9(-4)	<7(-4)	<7(-4)	<1(-3)
^{57}Co	<1(-6)	<2(-4)	<4(-4)	<2(-4)	<7(-5)	<7(-5)
^{58}Co	2.1 ± 0.1(-4)	2.7 ± 0.2(-3)	<4(-3)	3.7 ± 0.2(-3)	<4(-3)	<5(-3)
^{60}Co	1.88 ± 0.08(-4)	<2(-4)	<2(-4)	3.8 ± 0.9(-4)	1.3 ± 0.6(-4)	<2(-4)
^{65}Zn	<4(-6)	<5(-4)	<6(-4)	<2(-4)	<4(-4)	<2(-4)
^{91}Sr	<5(-4)	<5(-4)	<6(-4)	<3(-4)	<4(-4)	<3(-4)
^{91m}Y	<3(-4)	<3(-4)	<3(-4)	1.6 ± 0.7(-4)	<2(-4)	<2(-4)
^{93}Y	<2(-3)	<4(-3)	<3(-3)	<2(-3)	<2(-3)	<3(-3)
^{95}Zr	1.9 ± 0.3(-5)	<3(-4)	<4(-4)	2 ± 1(-4)	<3(-4)	<3(-4)
^{95}Nb	2.8 ± 0.3(-5)	**	**	**	<8(-4)	*
^{99}Mo	1.00 ± 0.04(-3)	<5(-3)	<4(-3)	<3(-3)	<2(-3)	2.1 ± 0.3(-4)
^{99m}Tc	**	**	**	**	**	**
^{103}Ru	4 ± 1(-6)	<3(-4)	<3(-4)	<2(-4)	<2(-4)	<2(-4)
^{103m}Rh	**	**	**	**	**	**
^{106}Ru	3.6 ± 0.8(-5)	*	*	*	*	*
^{106}Rh	**	**	**	**	**	**
^{110m}Ag	5 ± 1(-6)	*	*	*	*	*
^{124}Sb	6 ± 1(-6)	<3(-4)	<4(-4)	<3(-4)	<2(-4)	<2(-4)
^{125}Sb	1.2 ± 0.3(-5)	<9(-4)	<7(-4)	<6(-4)	<5(-4)	<8(-4)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	09:51	21:41	22:51	23:52	00:51	01:46
Date	5/16/78	5/19/78	5/19/78	5/19/78	5/20/78	5/20/78
Power	100%	70%	26%	0%	0%	0%
Pressure (psi)	2240	2240	2240	2240	2260	2260
Temp. (°F)	570	565	553	548	540	540
Flow† (gpm)	54	52	52	50	50	50
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{129m}Te	<8(-5)	<5(-3)	<6(-3)	<4(-3)	<4(-3)	<3(-3)
^{129}Te	<2(-1)	<2(-1)	<8(-2)	<4(-2)	<2(-2)	<8(-3)
^{131m}Te	<2(-3)	<2(-2)	<2(-2)	<1(-2)	<7(-3)	<3(-3)
^{131}Te	<5(-3)	<3(-3)	<4(-3)	<2(-3)	<3(-3)	<2(-3)
^{132}Te	3 ± 1(-5)	**	**	**	<2(-4)	<2(-5)
^{139}Ba	1.9 ± 0.6(-2)	6.9 ± 0.5(-2)	5.8 ± 0.5(-3)	4.2 ± 0.5(-3)	2.7 ± 0.4(-3)	2.8 ± 0.6(-3)
^{140}Ba	8.4 ± 0.6(-5)	<3(-3)	<1(-2)	<5(-3)	<5(-3)	<2(-3)
^{140}La	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<8(-5)
^{141}Ce	<3(-6)	<3(-4)	<3(-4)	<4(-4)	<4(-4)	<2(-4)
^{143}Ce	<5(-4)	<5(-4)	<4(-4)	<5(-4)	<5(-4)	<5(-4)
^{144}Ce	<8(-6)	<2(-2)	<2(-2)	<7(-3)	<7(-3)	<4(-3)
^{144}Pr	**	**	**	**	**	**
^{152}Eu	<4(-5)	<2(-3)	<6(-4)	<6(-4)	<6(-4)	<6(-4)
^{154}Eu	<4(-6)	<7(-4)	<6(-4)	<5(-4)	<5(-4)	<4(-4)
^{155}Eu	<4(-6)	<4(-4)	<9(-4)	<4(-4)	<4(-4)	<9(-4)
^{187}W	<8(-4)	<6(-4)	<2(-3)	<7(-4)	1.2 ± 0.3(-3)	<1(-3)
^{239}Np	<2(-4)	<3(-4)	<7(-4)	4 ± 2(-4)	3 ± 1(-4)	5 ± 2(-4)

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† Letdown flow
* Radionuclide not detected
** Radionuclide not measured

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	02:48	03:40	04:40	05:40	06:40	07:40
Date	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78
Power	0%	0%	0%	0%	0%	0%
Pressure (psi)	2260	2250	2250	2250	2250	2250
Temp. (°F)	540	546	546	546	546	546
Flow† (gpm)	50	51	51	50	50	50
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{85m}Kr	**	5.2 ± 0.2(-3)	**	**	2.9 ± 0.2(-3)	**
^{85}Kr	**	**	**	**	**	**
^{87}Kr	**	1.2 ± 0.2(-3)	**	**	1.0 ± 0.2(-3)	**
^{88}Kr	**	7.5 ± 0.3(-3)	**	**	3.5 ± 0.2(-3)	**
^{89}Kr	**	*	**	**	*	**
^{131m}Xe	**	<2(-2)	**	**	<5(-3)	**
^{133m}Xe	**	4.8 ± 0.7(-3)	**	**	5.9 ± 0.4(-3)	**
^{133}Xe	**	4.64 ± 0.05(-1)	**	**	2.37 ± 0.09(-1)	**
^{135m}Xe	**	<5(-2)	**	**	<5(-2)	**
^{135}Xe	**	1.00 ± 0.04(-1)	**	**	8.7 ± 0.1(-2)	**
^{137}Xe	**	<2(-3)	**	**	<4(-2)	**
^{138}Xe	**	<7(-4)	**	**	<9(-4)	**
^{84}Br	7 ± 3(-4)	6 ± 3(-4)	<5(-4)	4 ± 2(-4)	<6(-4)	<3(-4)
^{131}I	6.3 ± 0.2(-2)	6.1 ± 0.2(-2)	5.9 ± 0.1(-2)	5.6 ± 0.2(-2)	5.5 ± 0.1(-2)	5.1 ± 0.1(-2)
^{132}I	1.29 ± 0.04(-1)	1.19 ± 0.02(-1)	1.13 ± 0.02(-1)	1.09 ± 0.02(-1)	1.05 ± 0.01(-1)	1.00 ± 0.01(-1)
^{133}I	1.03 ± 0.01(-1)	9.7 ± 0.1(-2)	8.88 ± 0.04(-2)	8.17 ± 0.04(-2)	7.58 ± 0.04(-2)	6.86 ± 0.02(-2)
^{134}I	1.27 ± 0.03(-2)	6.5 ± 0.1(-3)	3.99 ± 0.09(-3)	2.48 ± 0.08(-3)	1.4 ± 0.1(-3)	7.1 ± 0.6(-4)
^{135}I	7.7 ± 0.1(-2)	6.3 ± 0.1(-2)	5.43 ± 0.08(-2)	4.65 ± 0.04(-2)	3.91 ± 0.06(-2)	3.37 ± 0.04(-2)
^{88}Rb	1.67 ± 0.05(-2)	1.4 ± 0.1(-2)	9.6 ± 0.3(-3)	7.8 ± 0.3(-3)	6.4 ± 0.7(-3)	3.9 ± 0.2(-3)
^{89}Rb	<7(-4)	<8(-4)	<6(-4)	<6(-4)	<1(-3)	<4(-4)
^{134}Cs	2.2 ± 0.2(-3)	2.98 ± 0.09(-3)	2.14 ± 0.07(-3)	2.2 ± 0.1(-3)	3.50 ± 0.06(-3)	2.17 ± 0.05(-3)
^{136}Cs	1.00 ± 0.09(-3)	1.18 ± 0.09(-3)	1.15 ± 0.08(-3)	1.1 ± 0.1(-3)	1.6 ± 0.1(-3)	1.03 ± 0.08(-3)
^{137}Cs	2.2 ± 0.2(-3)	3.6 ± 0.1(-3)	2.4 ± 0.1(-3)	2.3 ± 0.1(-3)	4.4 ± 0.2(-3)	2.4 ± 0.1(-3)
^{138}Cs	3.2 ± 0.3(-3)	2.0 ± 0.4(-3)	1.9 ± 0.4(-3)	1.0 ± 0.3(-3)	<3(-4)	<3(-4)
^{139}Cs	<4(-3)	<9(-3)	<3(-3)	<2(-3)	<8(-3)	<2(-3)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	02:48	03:40	04:40	05:40	06:40	07:40
Date	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78
Power	0%	0%	0%	0%	0%	0%
Pressure (psi)	2260	2250	2250	2250	2250	2250
Temp. (°F)	540	546	546	546	546	546
Flow† (gpm)	50	51	51	50	50	50
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{24}Na	5.3 ± 0.2(-3)	4.6 ± 0.1(-3)	4.3 ± 0.1(-3)	3.9 ± 0.1(-3)	3.6 ± 0.1(-3)	3.33 ± 0.08(-3)
^{41}Ar	**	<6(-4)	**	**	<6(-4)	**
^{51}Cr	<2(-3)	<8(-4)	<1(-3)	<7(-4)	<9(-4)	<7(-4)
^{54}Mn	<2(-3)	<2(-3)	<2(-3)	<2(-3)	<1(-3)	<1(-3)
^{56}Mn	<8(-4)	<5(-4)	<4(-4)	<2(-4)	<2(-4)	<2(-4)
^{59}Fe	<7(-4)	<5(-4)	<4(-4)	<4(-4)	<5(-4)	<3(-4)
^{57}Co	<8(-4)	<3(-4)	<6(-5)	<9(-5)	<6(-5)	<5(-5)
^{58}Co	<4(-3)	4.0 ± 0.2(-3)	4.4 ± 0.1(-3)	<4(-3)	3.8 ± 0.1(-3)	<3(-3)
^{60}Co	<8(-5)	3.2 ± 0.4(-4)	2.8 ± 0.3(-4)	<3(-4)	4.4 ± 0.4(-4)	1.8 ± 0.3(-4)
^{65}Zn	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)
^{91}Sr	<4(-4)	<3(-4)	<3(-4)	<3(-4)	9 ± 2(-4)	<2(-4)
^{91m}Y	<2(-4)	<2(-4)	<1(-4)	<1(-4)	1.5 ± 0.7(-4)	<1(-4)
^{93}Y	<3(-3)	<3(-3)	<2(-2)	<3(-3)	<3(-3)	<3(-3)
^{95}Zr	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)	2.7 ± 0.6(-4)
^{95}Nb	<3(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<9(-5)
^{99}Mo	4.1 ± 0.4(-4)	2.7 ± 0.3(-4)	3.7 ± 0.3(-4)	2.6 ± 0.4(-4)	4.0 ± 0.3(-4)	6.3 ± 0.2(-4)
^{99m}Tc	**	**	**	**	**	**
^{103}Ru	<2(-4)	<2(-4)	<1(-4)	<2(-4)	<2(-4)	<9(-5)
^{103m}Rh	**	**	**	**	**	**
^{106}Ru	*	*	*	*	*	*
^{106}Rh	**	**	**	**	**	**
^{110m}Ag	*	*	*	*	*	*
^{124}Sb	<2(-4)	<2(-4)	<1(-4)	<9(-5)	1.5 ± 0.6(-4)	<8(-5)
^{125}Sb	<3(-4)	<4(-4)	<3(-4)	<3(-4)	<4(-4)	<3(-4)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	02:48	03:40	04:40	05:40	06:40	07:40
Date	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78
Power	0%	0%	0%	0%	0%	0%
Pressure (psi)	2260	2250	2250	2250	2250	2250
Temp. (°F)	540	546	546	546	546	546
Flow† (gpm)	50	51	51	50	50	50
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{129m}Te	<3(-3)	<4(-3)	<4(-3)	<3(-3)	<3(-3)	<2(-3)
^{129}Te	<5(-3)	<3(-3)	<2(-3)	<3(-3)	<2(-3)	<2(-3)
^{131m}Te	<2(-3)	<2(-3)	<1(-3)	<1(-3)	<7(-4)	<4(-4)
^{131}Te	<2(-3)	<2(-3)	<8(-4)	<1(-3)	<1(-3)	<1(-3)
^{132}Te	<9(-6)	<2(-4)	1 ± 1(-5)	<7(-6)	1.9 ± 1.3(-4)	1.0 ± 0.3(-5)
^{139}Ba	<2(-3)	1.3 ± 1.0(-3)	9 ± 3(-4)	<5(-4)	<6(-4)	<6(-4)
^{140}Ba	<2(-3)	<2(-3)	<2(-3)	<2(-3)	<2(-3)	<2(-3)
^{140}La	<7(-5)	<7(-5)	<7(-5)	<6(-5)	<6(-5)	<6(-5)
^{141}Ce	<3(-4)	<3(-4)	<3(-4)	<3(-4)	<3(-4)	<3(-4)
^{143}Ce	<6(-4)	<4(-4)	<3(-4)	<3(-4)	<3(-4)	<2(-4)
^{144}Ce	<3(-3)	<1(-3)	<7(-4)	<5(-4)	<4(-4)	<4(-4)
^{144}Pr	**	**	**	**	**	**
^{152}Eu	<4(-4)	<6(-4)	<9(-4)	<9(-4)	<2(-3)	<8(-4)
^{154}Eu	<4(-4)	<3(-4)	<4(-4)	<3(-4)	<4(-4)	<3(-4)
^{155}Eu	<3(-4)	<3(-4)	<2(-4)	<4(-4)	<3(-4)	<3(-4)
^{187}W	2.4 ± 0.5(-3)	2.9 ± 0.5(-3)	1.7 ± 0.3(-3)	<2(-3)	<7(-4)	1.7 ± 0.3(-3)
^{239}Np	<3(-4)	<2(-4)	1.9 ± 0.9(-4)	2 ± 1(-4)	2 ± 1(-4)	<3(-4)

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† Letdown flow
* Radionuclide not detected
** Radionuclide not measured

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	08:40	09:40	10:45	11:40	12:47	13:45
Date	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78
Power	0%	0%	0%	0%	0%	0%
Pressure (psi)	2246	2252	2235	2235	2238	2235
Temp. (°F)	547	547	547	547	547	542
Flow †(gpm)	52	52	53	53	53	52
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{85m}Kr	**	1.9 ± 0.1(-3)	**	**	1.1 ± 0.1(-3)	**
^{85}Kr	**	**	**	**	**	**
^{87}Kr	**	<2(-4)	**	**	<3(-4)	**
^{88}Kr	**	1.9 ± 0.1(-3)	**	**	1.2 ± 0.2(-3)	**
^{89}Kr	**	**	**	**	**	**
^{131m}Xe	**	<6(-3)	**	**	<3(-3)	**
^{133m}Xe	**	6.1 ± 0.3(-3)	**	**	6.6 ± 0.7(-3)	**
^{133}Xe	**	2.7 ± 0.1(-1)	**	**	2.5 ± 0.2(-1)	**
^{135m}Xe	**	*	**	**	*	**
^{135}Xe	**	8.32 ± 0.07(-2)	**	**	6.69 ± 0.07(-2)	**
^{137}Xe	**	*	**	**	*	**
^{138}Xe	**	*	**	**	*	**
^{84}Br	5 ± 2(-4)	<5(-4)	<3(-4)	<3(-4)	<5(-4)	<2(-4)
^{131}I	4.8 ± 0.1(-2)	4.8 ± 0.1(-2)	4.27 ± 0.09(-2)	3.88 ± 0.06(-2)	3.94 ± 0.04(-2)	3.52 ± 0.07(-2)
^{132}I	9.6 ± 0.1(-2)	9.6 ± 0.1(-2)	1.01 ± 0.02(-1)	9.1 ± 0.1(-2)	9.2 ± 0.2(-2)	9.1 ± 0.2(-2)
^{133}I	6.31 ± 0.02(-2)	6.03 ± 0.07(-2)	5.19 ± 0.05(-2)	4.57 ± 0.07(-2)	4.41 ± 0.06(-2)	3.81 ± 0.07(-2)
^{134}I	3.7 ± 0.6(-4)	1.6 ± 0.6(-4)	<2(-4)	<1(-4)	<2(-4)	<9(-5)
^{135}I	2.80 ± 0.06(-2)	2.43 ± 0.07(-2)	2.05 ± 0.02(-2)	1.67 ± 0.02(-2)	1.41 ± 0.03(-2)	1.18 ± 0.02(-2)
^{88}Rb	2.5 ± 0.3(-3)	2.1 ± 0.2(-3)	1.8 ± 0.3(-3)	1.5 ± 0.2(-3)	6 ± 1(-4)	9 ± 1(-4)
^{89}Rb	*	*	*	*	*	*
^{134}Cs	1.94 ± 0.07(-3)	3.31 ± 0.06(-3)	1.85 ± 0.06(-3)	1.76 ± 0.05(-3)	1.95 ± 0.05(-3)	1.60 ± 0.04(-3)
^{136}Cs	9.5 ± 0.9(-4)	9.9 ± 0.4(-4)	9.8 ± 0.3(-4)	8.1 ± 0.4(-4)	7.9 ± 0.6(-4)	7.8 ± 0.4(-4)
^{137}Cs	2.25 ± 0.08(-3)	4.0 ± 0.1(-3)	2.10 ± 0.06(-3)	2.01 ± 0.05(-3)	2.37 ± 0.07(-3)	2.07 ± 0.05(-3)
^{138}Cs	<2(-4)	<3(-4)	<3(-4)	<2(-4)	<3(-4)	<2(-4)
^{139}Cs						

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	08:40	09:40	10:45	11:40	12:47	13:45
Date	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78
Power	0%	0%	0%	0%	0%	0%
Pressure (psi)	2246	2252	2235	2235	2238	2235
Temp. (°F)	547	547	547	547	547	542
Flow † (gpm)	52	52	53	53	53	52
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{24}Na	3.1 ± 0.1(-3)	2.76 ± 0.08(-3)	2.49 ± 0.06(-3)	2.12 ± 0.07(-3)	2.07 ± 0.09(-3)	1.87 ± 0.06(-3)
^{41}Ar	**	<5(-4)	**	**	<5(-4)	**
^{51}Cr	*	*	*	*	<8(-4)	<7(-4)
^{54}Mn	<8(-4)	<7(-4)	<5(-4)	<4(-4)	<4(-4)	<4(-4)
^{56}Mn	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<1(-4)
^{59}Fe	<2(-4)	<3(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)
^{57}Co	<6(-5)	<5(-5)	<4(-5)	<5(-5)	<7(-5)	<5(-5)
^{58}Co	6.4 ± 0.3(-3)	3.7 ± 0.1(-3)	<3(-3)	<3(-3)	<3(-3)	<3(-3)
^{60}Co	4.5 ± 0.4(-4)	3.2 ± 0.4(-4)	1.1 ± 0.2(-4)	3.4 ± 0.4(-4)	2.0 ± 0.3(-4)	5 ± 2(-5)
^{65}Zn	<2(-4)	<2(-4)	<1(-4)	<2(-4)	<2(-4)	<2(-4)
^{91}Sr	3.7 ± 0.9(-4)	6 ± 1(-4)	1.5 ± 0.1(-3)	7.1 ± 0.9(-4)	9 ± 1(-4)	4.7 ± 0.1(-3)
^{91m}Y	1.3 ± 0.5(-4)	<2(-4)	1.9 ± 0.5(-4)	1.7 ± 0.5(-4)	<2(-4)	5.3 ± 0.6(-4)
^{93}Y	<3(-3)	<3(-3)	<3(-3)	<3(-3)	<4(-3)	<3(-3)
^{95}Zr	2.4 ± 0.6(-4)	<2(-4)	<2(-4)	2.2 ± 0.5(-4)	2.1 ± 0.6(-4)	<2(-4)
^{95}Nb	<2(-4)	<8(-5)	<2(-4)	<9(-5)	<2(-4)	<7(-5)
^{99}Mo	7.1 ± 0.2(-4)	4.1 ± 0.3(-4)	3.1 ± 0.2(-4)	4.5 ± 0.5(-4)	4.2 ± 0.3(-4)	2.3 ± 0.2(-4)
^{99m}Tc	**	**	**	**	**	**
^{103}Ru	4 ± 2(-4)	<2(-4)	9 ± 4(-5)	<1(-4)	<1(-4)	<8(-5)
^{103m}Rh	**	**	**	**	**	**
^{106}Ru	*	*	*	*	*	*
^{106}Rh	**	**	**	**	**	**
^{110m}Ag	*	<1(-4)	<9(-5)	<7(-5)	<1(-4)	<7(-5)
^{124}Sb	1.7 ± 0.4(-4)	1.4 ± 0.5(-4)	<7(-5)	8 ± 3(-5)	<8(-5)	<6(-5)
^{125}Sb	<3(-4)	<5(-5)	<3(-4)	<3(-4)	<3(-4)	<3(-4)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	08:40	09:40	10:45	11:40	12:47	13:45
Date	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78	5/20/78
Power	0%	0%	0%	0%	0%	0%
Pressure (psi)	2246	2252	2235	2235	2238	2235
Temp. (°F)	547	547	547	547	547	542
Flow† (gpm)	52	52	53	53	53	52
Nuclide	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)
^{129m}Te	<3(-3)	<3(-3)	<2(-3)	<2(-3)	<3(-3)	<2(-3)
^{129}Te	<2(-3)	<2(-3)	<2(-3)	<2(-3)	<2(-3)	<2(-3)
^{131m}Te	<7(-4)	<6(-4)	<3(-4)	<4(-4)	<8(-4)	<8(-4)
^{131}Te	*	*	*	*	*	*
^{132}Te	<1(-4)	3.0 ± 0.5(-4)	2 ± 1(-5)	2 ± 2(-5)	8 ± 6(-5)	<6(-6)
^{139}Ba	<6(-4)	<5(-4)	<4(-4)	<4(-4)	<4(-4)	<5(-4)
^{140}Ba	<2(-3)	<2(-3)	<2(-3)	<2(-3)	<2(-3)	<2(-3)
^{140}La	<6(-5)	<7(-4)	<4(-5)	<4(-5)	<5(-5)	<4(-5)
^{141}Ce	<3(-4)	<3(-4)	<2(-4)	<3(-4)	<3(-4)	<3(-4)
^{143}Ce	<3(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)	<2(-4)
^{144}Ce	<4(-4)	<5(-4)	<4(-4)	<5(-4)	<7(-4)	<4(-4)
^{144}Pr	**	**	**	**	**	**
^{152}Eu	<8(-4)	<8(-4)	<7(-4)	<8(-4)	<7(-4)	<7(-4)
^{154}Eu	<3(-4)	<4(-4)	<3(-4)	<3(-4)	<3(-4)	<3(-4)
^{155}Eu	<8(-4)	<3(-4)	<2(-4)	<3(-4)	<4(-4)	<2(-4)
^{187}W	<6(-4)	<9(-4)	<7(-4)	3.6 ± 0.5(-3)	<6(-4)	1.3 ± 0.4(-3)
^{239}Np	5 ± 2(-4)	<3(-4)	<2(-4)	<3(-4)	<3(-4)	<2(-4)

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† Letdown flow
* Radionuclide not detected
** Radionuclide not measured

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	14:40	20:05	23:45	04:50	05:50
Date	5/20/78	5/21/78	5/21/78	5/22/78	5/22/78
Power	0%	0%	Just Critical	36%	99%
Pressure (psi)	2235	2255	2240	2256	2260
Temp. (°F)	542	545	545	547	570
Flow† (gpm)	52	55	52	61	90
Nuclide	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)
^{85m}Kr	**	**	<9(-5)	**	5 ± 2(-3)
^{85}Kr	**	**	**	**	**
^{87}Kr	**	**	<2(-4)	**	2.1 ± 0.3(-2)
^{88}Kr	**	**	2.9 ± 0.7(-4)	**	1.66 ± 0.04(-2)
^{89}Kr	**	**	<2(-2)	**	<2(-2)
^{131m}Xe	**	**	<2(-2)	**	<6(-2)
^{133m}Xe	**	**	3.4 ± 0.1(-3)	**	5 ± 3(-3)
^{133}Xe	**	**	1.8 ± 0.1(-1)	**	3.8 ± 0.2(-1)
^{135m}Xe	**	**	<2(-2)	**	<2(-2)
^{135}Xe	**	**	6.64 ± 0.04(-3)	**	1.65 ± 0.02(-2)
^{137}Xe	**	**	<5(-3)	**	<7(-3)
^{138}Xe	**	**	7 ± 3(-4)	**	5.86 ± 0.04(-2)
^{84}Br	*	*	*	4.0 ± 0.4(-3)	8.5 ± 0.6(-3)
^{131}I	3.29 ± 0.07(-2)	2.04 ± 0.02(-2)	1.87 ± 0.02(-2)	6.2 ± 0.2(-2)	6.1 ± 0.2(-2)
^{132}I	8.8 ± 0.2(-2)	7.7 ± 0.1(-2)	6.62 ± 0.08(-2)	6.86 ± 0.10(-2)	6.5 ± 0.1(-2)
^{133}I	3.44 ± 0.06(-2)	7.58 ± 0.08(-3)	6.14 ± 0.10(-3)	1.82 ± 0.02(-2)	2.04 ± 0.03(-2)
^{134}I	<1(-4)	<6(-5)	<6(-5)	2.85 ± 0.03(-2)	5.87 ± 0.07(-2)
^{135}I	1.02 ± 0.02(-2)	3.0 ± 0.4(-4)	3.5 ± 0.5(-4)	9.9 ± 0.4(-3)	2.13 ± 0.04(-2)
^{88}Rb	5 ± 2(-4)	<2(-4)	<2(-4)	7.7 ± 0.6(-3)	1.89 ± 0.09(-2)
^{89}Rb	*	*	*	2.28 ± 0.06(-2)	2.54 ± 0.05(-2)
^{134}Cs	1.57 ± 0.07(-3)	1.66 ± 0.03(-3)	1.76 ± 0.05(-3)	5.8 ± 0.2(-3)	5.6 ± 0.1(-3)
^{136}Cs	6.7 ± 0.3(-4)	6.5 ± 0.4(-4)	6.0 ± 0.5(-4)	1.9 ± 0.1(-3)	1.9 ± 0.1(-3)
^{137}Cs	1.9 ± 0.1(-3)	2.05 ± 0.06(-3)	2.33 ± 0.05(-3)	5.70 ± 0.08(-3)	5.3 ± 0.2(-3)
^{138}Cs	<2(-4)	*	9 ± 3(-4)	6.0 ± 0.3(-2)	1.14 ± 0.03(-1)
^{139}Cs	*	*	*	4.3 ± 0.2(-2)	3.7 ± 0.3(-2)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	14:40	20:05	23:45	04:50	05:50
Date	5/20/78	5/21/78	5/21/78	5/22/78	5/22/78
Power	0%	0%	Just Critical	36%	99%
Pressure (psi)	2235	2255	2240	2256	2260
Temp. (°F)	542	545	545	547	570
Flow † (gpm)	52	55	52	61	90
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{24}Na	1.67 ± 0.05(-3)	3.5 ± 0.2(-4)	2.9 ± 0.3(-4)	1.10 ± 0.04(-3)	2.05 ± 0.08(-3)
^{41}Ar	**	**	<4(-4)	**	<4(-4)
^{51}Cr	<7(-4)	*	*	*	*
^{54}Mn	<3(-4)	<3(-4)	6 ± 2(-5)	*	*
^{56}Mn	<1(-4)	<7(-5)	<8(-5)	<2(-3)	<3(-3)
^{59}Fe	<2(-4)	1.2 ± 0.3(-4)	<7(-5)	<3(-4)	<4(-4)
^{57}Co	<6(-5)	<3(-5)	<3(-5)	<5(-5)	<1(-4)
^{58}Co	<3(-3)	1.5 ± 0.1(-2)	4 ± 1(-3)	1.03 ± 0.09(-2)	1.1 ± 0.1(-2)
^{60}Co	2.4 ± 0.3(-4)	1.50 ± 0.04(-3)	6.3 ± 0.2(-4)	4.2 ± 0.4(-4)	9.7 ± 0.6(-4)
^{65}Zn	<2(-4)	<9(-5)	<8(-5)	<4(-4)	<6(-4)
^{91}Sr	1.03 ± 0.09(-3)	1.7 ± 0.4(-4)	2.2 ± 0.6(-4)	<4(-4)	5 ± 2(-4)
^{91m}Y	1.2 ± 0.4(-4)	<7(-5)	<7(-5)	<2(-4)	1.7 ± 0.8(-4)
^{93}Y	<3(-3)	<4(-3)	<4(-3)	<3(-3)	<3(-3)
^{95}Zr	<1(-4)	1.37 ± 0.07(-3)	3.5 ± 0.4(-4)	<2(-4)	9 ± 1(-4)
^{95}Nb	<8(-5)	1.27 ± 0.03(-3)	3.9 ± 0.7(-4)	<6(-4)	*
^{99}Mo	4.2 ± 0.2(-4)	1.06 ± 0.01(-3)	4.3 ± 0.2(-4)	<6(-4)	<1(-3)
^{99m}Tc	**	**	**	**	**
^{103}Ru	<8(-5)	4.5 ± 0.4(-4)	1.5 ± 0.3(-4)	<1(-4)	2.5 ± 0.7(-4)
^{103m}Rh	**	**	**	**	**
^{106}Ru	*	*	*	*	*
^{106}Rh	**	**	**	**	**
^{110m}Ag	<7(-5)	<5(-5)	3.7 ± 0.9(-4)	*	*
^{124}Sb	<6(-5)	4.2 ± 0.3(-4)	1.5 ± 0.3(-4)	<2(-4)	<4(-4)
^{125}Sb	<3(-4)	<2(-4)	<2(-4)	<5(-4)	<7(-4)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	14:40	20:05	23:45	04:50	05:50
Date	5/20/78	5/21/78	5/21/78	5/22/78	5/22/78
Power	0%	0%	Just Critical	36%	99%
Pressure (psi)	2235	2255	2240	2256	2260
Temp. (°F)	542	545	545	547	570
Flow † (gpm)	52	55	52	61	90
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{129m}Te	<3(-3)	<2(-3)	<2(-3)	<3(-3)	<4(-3)
^{129}Te	<2(-3)	<1(-3)	<1(-3)	<4(-2)	<6(-2)
^{131m}Te	<3(-4)	4.7 ± 0.1(-4)	<5(-4)	<8(-3)	<2(-2)
^{131}Te	<6(-4)	<1(-3)	<5(-4)	<1(-3)	<1(-3)
^{132}Te	<7(-6)	*	*	*	*
^{139}Ba	<3(-4)	<2(-3)	<2(-3)	6.4 ± 0.4(-3)	1.12 ± 0.06(-2)
^{140}Ba	<2(-3)	5.9 ± 0.9(-3)	5.4 ± 0.7(-3)	6.0 ± 0.4(-3)	9.4 ± 0.6(-3)
^{140}La	<4(-5)	1.4 ± 0.1(-4)	1.4 ± 0.2(-4)	<7(-5)	4 ± 1(-4)
^{141}Ce	<3(-4)	<2(-4)	<2(-4)	<3(-4)	<2(-4)
^{143}Ce	<2(-4)	<8(-5)	<9(-5)	<3(-4)	<3(-4)
^{144}Ce	<4(-4)	<3(-4)	<2(-4)	<3(-3)	<6(-3)
^{144}Pr	**	**	**	**	**
^{152}Eu	<8(-4)	<8(-4)	<7(-4)	<2(-3)	<2(-3)
^{154}Eu	<2(-4)	<2(-4)	<2(-4)	<3(-4)	<4(-4)
^{155}Eu	<2(-4)	<2(-3)	<3(-4)	<2(-4)	<7(-4)
^{187}W	2.5 ± 0.3(-3)	<7(-4)	7 ± 1(-4)	<5(-4)	<6(-4)
^{239}Np	<2(-4)	1.1 ± 0.1(-3)	2.3 ± 0.6(-4)	<2(-4)	4 ± 2(-4)

† Letdown flow
* Radionuclide not detected
** Radionuclide not measured

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	06:50	07:55	08:44	11:04	12:00	13:25
Date	5/22/78	5/22/78	5/22/78	5/22/78	5/22/78	5/22/78
Power	100%	100%	100%	45%	45%	45%
Pressure (psi)	2235	2250	2248	2250	2240	2240
Temp. (°F)	574	571	570	570	558	559
Flow † (gpm)	90	90	89	90	92	90
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{85m}Kr	**	4.7 ± 0.3(-3)	**	**	7 ± 2(-3)	**
^{85}Kr	**	**	**	**	**	**
^{87}Kr	**	1.2 ± 0.4(-2)	**	**	1.7 ± 0.9(-2)	**
^{88}Kr	**	1.43 ± 0.03(-2)	**	**	2.10 ± 0.04(-2)	**
^{89}Kr	**	<2(-2)	**	**	<5(-2)	**
^{131m}Xe	**	<6(-2)	**	**	<5(-2)	**
^{133m}Xe	**	<5(-3)	**	**	<2(-2)	**
^{133}Xe	**	2.9 ± 0.1(-1)	**	**	2.7 ± 0.1(-1)	**
^{135m}Xe	**	<2(-2)	**	**	<4(-2)	**
^{135}Xe	**	1.80 ± 0.02(-2)	**	**	3.18 ± 0.03(-2)	**
^{137}Xe	**	<9(-3)	**	**	<9(-2)	**
^{138}Xe	**	3.3 ± 0.8(-3)	**	**	5.82 ± 0.07(-2)	**
^{84}Br	3.3 ± 0.4(-3)	2.7 ± 0.6(-3)	4.2 ± 0.7(-3)	6 ± 1(-3)	6.7 ± 0.8(-3)	7 ± 1(-3)
^{131}I	5.2 ± 0.1(-2)	4.66 ± 0.08(-2)	4.3 ± 0.2(-2)	3.0 ± 0.2(-2)	3.11 ± 0.07(-2)	2.61 ± 0.09(-2)
^{132}I	4.79 ± 0.09(-2)	4.44 ± 0.07(-2)	4.97 ± 0.05(-2)	6.09 ± 0.07(-2)	6.4 ± 0.1(-2)	6.6 ± 0.1(-2)
^{133}I	1.84 ± 0.01(-2)	2.07 ± 0.02(-2)	2.42 ± 0.04(-2)	2.86 ± 0.06(-2)	2.89 ± 0.04(-2)	2.71 ± 0.06(-2)
^{134}I	3.69 ± 0.05(-2)	4.88 ± 0.04(-2)	7.2 ± 0.2(-2)	1.19 ± 0.04(-1)	1.05 ± 0.01(-1)	9.5 ± 0.2(-2)
^{135}I	2.22 ± 0.04(-2)	3.20 ± 0.07(-2)	4.38 ± 0.05(-2)	5.42 ± 0.08(-2)	5.16 ± 0.05(-2)	4.87 ± 0.04(-2)
^{88}Rb	2.01 ± 0.08(-2)	2.45 ± 0.09(-2)	2.6 ± 0.1(-2)	2.55 ± 0.07(-2)	3.4 ± 0.1(-2)	3.1 ± 0.1(-2)
^{89}Rb	3.0 ± 0.2(-3)	2.6 ± 0.2(-3)	4.4 ± 0.2(-3)	2.03 ± 0.02(-2)	2.94 ± 0.04(-2)	3.85 ± 0.04(-2)
^{134}Cs	4.83 ± 0.07(-3)	5.15 ± 0.08(-3)	4.19 ± 0.07(-3)	2.8 ± 0.2(-3)	2.99 ± 0.09(-3)	2.2 ± 0.2(-3)
^{136}Cs	1.5 ± 0.1(-3)	1.7 ± 0.1(-3)	1.3 ± 0.2(-3)	5 ± 2(-4)	9 ± 2(-4)	8.3 ± 0.9(-4)
^{137}Cs	4.57 ± 0.08(-3)	5.0 ± 0.1(-3)	3.90 ± 0.07(-3)	2.4 ± 0.2(-3)	2.5 ± 0.2(-3)	1.7 ± 0.1(-3)
^{138}Cs	5.8 ± 0.1(-2)	5.7 ± 0.1(-2)	7.6 ± 0.2(-2)	9.3 ± 0.2(-2)	8.6 ± 0.3(-2)	8.2 ± 0.2(-2)
^{139}Cs	<4(-3)	<5(-3)	<4(-3)	3.6 ± 0.2(-2)	6.6 ± 0.9(-2)	1.06 ± 0.03(-1)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	06:50	07:55	08:44	11:04	12:00	13:25
Date	5/22/78	5/22/78	5/22/78	5/22/78	5/22/78	5/22/78
Power	100%	100%	100%	45%	45%	45%
Pressure (psi)	2235	2250	2248	2250	2240	2240
Temp. (°F)	574	571	570	570	558	559
Flow †(gpm)	90	90	89	90	92	90
Nuclide	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)	(μCi/ml)
^{24}Na	2.16 ± 0.06(-3)	3.0 ± 0.2(-3)	3.99 ± 0.09(-3)	5.00 ± 0.09(-3)	4.6 ± 0.1(-3)	4.4 ± 0.1(-3)
^{41}Ar	**	<3(-4)	**	**	<4(-4)	**
^{51}Cr	*	*	*	*	*	*
^{54}Mn	*	*	*	*	*	*
^{56}Mn	<2(-3)	<3(-3)	<4(-3)	<6(-3)	<5(-3)	<4(-3)
^{59}Fe	<2(-4)	<3(-4)	<5(-4)	<5(-4)	<6(-4)	<4(-4)
^{57}Co	<5(-5)	<6(-5)	<6(-5)	<1(-4)	<8(-5)	<7(-5)
^{58}Co	7.2 ± 0.6(-3)	6.9 ± 0.4(-3)	7.8 ± 0.8(-3)	2.8 ± 0.2(-3)	9.6 ± 0.9(-3)	<2(-3)
^{60}Co	8.3 ± 0.6(-4)	8.9 ± 0.5(-4)	1.01 ± 0.05(-3)	<2(-4)	7 ± 1(-4)	<2(-4)
^{65}Zn	<2(-4)	<2(-4)	<2(-4)	5 ± 3(-4)	<5(-4)	<6(-4)
^{91}Sr	4 ± 2(-4)	8 ± 2(-4)	9 ± 2(-4)	<4(-4)	<5(-4)	4 ± 2(-4)
^{91m}Y	<2(-4)	2.6 ± 0.7(-4)	2.4 ± 0.7(-4)	<2(-4)	<3(-4)	2.6 ± 0.8(-4)
^{93}Y	<2(-3)	<2(-3)	<2(-3)	<4(-3)	<2(-3)	<2(-3)
^{95}Zr	7 ± 1(-4)	1.8 ± 0.8(-4)	6.7 ± 0.9(-4)	<4(-4)	9 ± 2(-4)	<3(-4)
^{95}Nb	*	*	*	*	*	*
^{99}Mo	<5(-4)	<5(-4)	<6(-4)	<8(-4)	<8(-4)	<6(-4)
^{99m}Tc	**	**	**	**	**	**
^{103}Ru	<2(-4)	1.7 ± 0.5(-4)	<1(-4)	<2(-4)	<2(-4)	<2(-4)
^{103m}Rh	**	**	**	**	**	**
^{106}Ru	*	*	*	*	*	*
^{106}Rh	**	**	**	**	**	**
^{110m}Ag	*	*	*	*	*	*
^{124}Sb	<2(-4)	<3(-4)	<3(-4)	<3(-4)	<4(-4)	<2(-4)
^{125}Sb	<3(-4)	<6(-4)	<4(-4)	<4(-4)	<4(-4)	<4(-4)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	06:50	07:55	08:44	11:04	12:00	13:25
Date	5/22/78	5/22/78	5/22/78	5/22/78	5/22/78	5/22/78
Power	100%	100%	100%	45%	45%	45%
Pressure (psi)	2235	2250	2248	2250	2240	2240
Temp. (°F)	574	571	570	570	558	559
Flow † (gpm)	90	90	89	90	92	90
Nuclide	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)	(µCi/ml)
^{129m}Te	<3(-3)	<3(-3)	<5(-3)	<4(-3)	<4(-3)	<5(-3)
^{129}Te	<3(-2)	<3(-2)	<5(-2)	<7(-2)	<6(-2)	<6(-2)
^{131m}Te	<9(-3)	<2(-2)	<2(-2)	<4(-2)	<2(-2)	<2(-2)
^{131}Te	<7(-4)	<1(-3)	<1(-3)	<2(-3)	<3(-3)	<4(-3)
^{132}Te	*	*	*	*	*	*
^{139}Ba	1.32 ± 0.03(-2)	1.20 ± 0.02(-2)	1.87 ± 0.03(-2)	8.9 ± 0.5(-3)	4 ± 1(-3)	1.4 ± 0.4(-3)
^{140}Ba	7.5 ± 0.5(-3)	1.61 ± 0.03(-2)	1.14 ± 0.05(-2)	<7(-3)	1.8 ± 0.7(-3)	2.3 ± 0.4(-3)
^{140}La	8 ± 4(-5)	6.5 ± 0.5(-4)	<9(-5)	<2(-4)	5.3 ± 0.7(-4)	<2(-4)
^{141}Ce	<2(-4)	<2(-4)	<2(-4)	<3(-4)	<2(-4)	<3(-4)
^{143}Ce	<2(-4)	<4(-4)	<3(-4)	<4(-4)	<5(-4)	<4(-4)
^{144}Ce	<4(-3)	<6(-3)	<8(-3)	<2(-2)	<1(-2)	<9(-3)
^{144}Pr	**	**	**	**	**	**
^{152}Eu	<2(-3)	<2(-3)	<1(-3)	<9(-4)	<8(-4)	<7(-4)
^{154}Eu	<4(-4)	<3(-4)	<3(-4)	<5(-4)	<5(-4)	<3(-4)
^{155}Eu	<4(-4)	<3(-4)	<5(-4)	<4(-4)	<6(-4)	<5(-4)
^{187}W	5 ± 2(-4)	4 ± 2(-4)	<8(-4)	<8(-4)	<8(-4)	<8(-4)
^{239}Np	<3(-4)	1.9 ± 0.9(-4)	<4(-4)	<3(-4)	<5(-4)	<4(-4)

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† Letdown flow
* Radionuclide not detected
** Radionuclide not measured

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	14:20
Date	5/22/78
Power	45%
Pressure (psi)	2240
Temp. (°F)	558
Flow † (gpm)	92

Nuclide	(μCi/ml)
^{85m}Kr	**
^{85}Kr	**
^{87}Kr	**
^{88}Kr	**
^{89}Kr	**
^{131m}Xe	**
^{133m}Xe	**
^{133}Xe	**
^{135m}Xe	**
^{135}Xe	**
^{137}Xe	**
^{138}Xe	**
^{84}Br	5 ± 1(-3)
^{131}I	2.50 ± 0.08(-2)
^{132}I	6.1 ± 0.2(-2)
^{133}I	2.61 ± 0.05(-2)
^{134}I	7.9 ± 0.1(-2)
^{135}I	4.63 ± 0.07(-2)
^{88}Rb	2.64 ± 0.08(-2)
^{89}Rb	2.3 ± 0.1(-2)
^{134}Cs	2.0 ± 0.1(-3)
^{136}Cs	6.4 ± 1.0(-4)
^{137}Cs	1.6 ± 0.1(-3)
^{138}Cs	7.4 ± 0.2(-2)
^{139}Cs	3.8 ± 0.4(-2)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	14:20
Date	5/22/78
Power	45%
Pressure (psi)	2240
Temp. (°F)	558
Flow† (gpm)	92

Nuclide	(μCi/ml)
^{24}Na	4.2 ± 0.1(-3)
^{41}Ar	**
^{51}Cr	*
^{54}Mn	*
^{56}Mn	<4(-3)
^{59}Fe	<5(-4)
^{57}Co	<1(-4)
^{58}Co	*
^{60}Co	2.6 ± 0.5(-4)
^{65}Zn	<3(-4)
^{91}Sr	<4(-4)
^{91m}Y	<2(-4)
^{93}Y	<3(-3)
^{95}Zr	<2(-4)
^{95}Nb	*
^{99}Mo	<6(-4)
^{99m}Tc	**
^{103}Ru	2.6 ± 0.6(-4)
^{103m}Rh	**
^{106}Ru	*
^{106}Rh	**
^{110m}Ag	*
^{124}Sb	<3(-4)
^{125}Sb	<3(-4)

TABLE B.11 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN REACTOR COOLANT
5/19-22/78 SHUTDOWN, STARTUP OF UNIT #3

Time	14:20
Date	5/22/78
Power	45%
Pressure (psi)	2240
Temp. (°F)	558
Flow† (gpm)	92

Nuclide	(μCi/ml)
^{129m}Te	<4(-3)
^{129}Te	<5(-2)
^{131m}Te	<3(-2)
^{131}Te	<2(-3)
^{132}Te	*
^{139}Ba	7.5 ± 0.4(-3)
^{140}Ba	<4(-3)
^{140}La	<1(-4)
^{141}Ce	<3(-4)
^{143}Ce	<3(-4)
^{144}Ce	<8(-3)
^{144}Pr	**
^{152}Eu	<5(-4)
^{154}Eu	<4(-4)
^{155}Eu	<3(-4)
^{187}W	<5(-4)
^{239}Np	<3(-4)

† Letdown flow
* Radionuclide not detected
** Radionuclide not measured

TABLE B.12

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
13:52; 2/21/78
Used for: 25 days
Bed Volumes Thru: 7.5 (3)
Letdown Flow Rate: 45 gpm
Reactor Coolant Boron: 867 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	3.37 ± 0.03(-3)	1.1 ± 0.1(-6)	3.1 ± 0.3(3)
^{132}I	3.45 ± 0.08(-2)	1.5 ± 0.1(-6)*	2.3 ± 0.2(4)
^{133}I	1.01 ± 0.02(-2)	1.6 ± 0.1(-5)	6.3 ± 0.4(2)
^{134}I	1.27 ± 0.03(-1)	2.8 ± 0.2(-5)*	4.5 ± 0.3(3)
^{135}I	7.9 ± 0.1(-2)	2.5 ± 0.4(-5)*	3.2 ± 0.5(3)
^{88}Rb	5.9 ± 0.3(-2)	2.2 ± 0.2(-2)	2.7 ± 0.3(0)
^{89}Rb	2.73 ± 0.04(-2)	1.3 ± 0.2(-3)	2.1 ± 0.3(1)
^{134}Cs	1.92 ± 0.03(-4)	1.43 ± 0.03(-5)	1.34 ± 0.04(1)
^{136}Cs	9.4 ± 3.2(-5)	1.0 ± 0.3(-7)*	9.4 ± 4.3(2)
^{137}Cs	2.38 ± 0.04(-4)	1.88 ± 0.04(-5)	1.27 ± 0.03(1)
^{138}Cs	9.0 ± 0.2(-2)	6.1 ± 0.5(-3)	1.5 ± 0.1(1)
^{139}Cs	6.9 ± 0.7(-2)	<1.1(-3)	>6.3(1)
^{24}Na	1.70 ± 0.03(-3)	<2.5(-8)*	>6.8(4)
^{51}Cr	1.80 ± 0.07(-4)	6.0 ± 2.4(-7)*	3.0 ± 1.2(2)
^{54}Mn	1.14 ± 0.01(-4)	3.4 ± 0.5(-7)	3.4 ± 0.5(2)
^{59}Fe	2.0 ± 0.1(-5)	3.0 ± 0.5(-7)*	6.7 ± 1.2(1)
^{57}Co	4.5 ± 0.2(-6)	9.9 ± 3.5(-8)	4.5 ± 1.6(1)
^{58}Co	1.45 ± 0.02(-3)	6.0 ± 0.1(-6)	2.4 ± 0.1(2)
^{60}Co	8.7 ± 0.1(-4)	2.0 ± 0.1(-6)	4.4 ± 0.2(2)
^{65}Zn	1.3 ± 0.1(-5)	<1.1(-7)*	>1.2(2)
^{84}Br			
^{91}Sr	5.25 ± 0.07(-3)	<1.5(-7)*	>3.5(4)
^{91m}Y			
^{93}Y	1.3 ± 0.2(-3)	<1.8(-7)*	>7.2(3)
^{95}Zr	3.1 ± 0.1(-5)	5.0 ± 0.5(-7)*	6.2 ± 0.7(1)
^{95}Nb	1.4 ± 0.5(-4)	6.7 ± 0.7(-7)	2.1 ± 0.8(2)
^{99}Mo	4.2 ± 0.1(-4)	1.5 ± 0.1(-7)*	2.8 ± 0.2(3)
^{103}Ru	3.12 ± 0.05(-5)	3.8 ± 1.2(-7)	8.2 ± 2.6(1)
^{106}Ru	<7.5(-6)	5.7 ± 1.3(-7)*	<1.3(1)
^{110m}Ag	3.3 ± 0.7(-4)	1.9 ± 0.4(-7)	1.7 ± 0.4(3)
^{124}Sb	5.0 ± 0.2(-5)	5.3 ± 0.2(-5)	9.4 ± 0.5(-1)
^{125}Sb	6.92 ± 0.09(-5)	7.38 ± 0.07(-5)	9.4 ± 0.2(-1)
^{129}Te	<1.2(-2)	<1.7(-4)*	
^{131m}Te	<2.3(-4)	<1.6(-7)*	
^{131}Te			
^{132}Te	1.5 ± 0.1(-4)	2.6 ± 0.4(-6)	5.8 ± 1.0(1)
^{139}Ba	1.73 ± 0.04(-2)	7.2 ± 0.1(-3)	2.4 ± 0.1(0)
^{140}Ba	5.90 ± 0.04(-4)	<8.5(-8)*	>6.9(3)
^{140}La	4.0 ± 1.5(-5)	<8.4(-8)*	>4.8(2)
^{141}Ce	3.2 ± 0.7(-6)	<8.0(-8)*	>4.0(1)
^{144}Ce	<2.2(-6)	2.0 ± 0.7(-7)*	<1.1(1)
^{187}W	1.9 ± 0.2(-4)	<1.7(-7)*	>1.1(3)
^{239}Np	1.0 ± 0.3(-4)	2.6 ± 0.8(-7)*	3.8 ± 1.7(2)

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
12:21; 2/23/78
Used for: 27 days
Bed Volumes Thru: 8.0(3)
Letdown Flow Rate: 45 gpm
Reactor Coolant Boron: 848 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	4.43 ± 0.03(-3)	1.6 ± 0.4(-6)	2.8 ± 0.7(3)
^{132}I	5.1 ± 0.1(-2)	<1.2(-4)	>4.3(2)
^{133}I	5.0 ± 0.1(-2)	2.0 ± 0.2(-5)	2.5 ± 0.3(3)
^{134}I	1.29 ± 0.03(-1)	<1.6(-4)	>8.1(2)
^{135}I	8.7 ± 0.1(-2)	1.6 ± 0.5(-5)*	5.4 ± 1.7(3)
^{88}Rb	7.0 ± 0.4(-2)	2.7 ± 0.3(-2)	2.6 ± 0.3(0)
^{89}Rb	2.41 ± 0.08(-2)	1.3 ± 0.2(-3)	1.9 ± 0.3(1)
^{134}Cs	4.99 ± 0.08(-5)	1.93 ± 0.04(-5)	2.59 ± 0.07(0)
^{136}Cs	3.5 ± 1.0(-5)	9.7 ± 8.6(-8)*	3.6 ± 3.4(2)
^{137}Cs	7.4 ± 0.1(-5)	2.60 ± 0.05(-5)	2.85 ± 0.07(0)
^{138}Cs	1.01 ± 0.02(-1)	1.16 ± 0.05(-2)	8.7 ± 0.4(0)
^{139}Cs	5.4 ± 1.2(-2)	<1.3(-3)	>4.2(1)
^{24}Na	2.34 ± 0.06(-3)	<1.5(-7)*	>1.6(4)
^{51}Cr	1.06 ± 0.09(-4)	<6.7(-7)	>1.6(2)
^{54}Mn	6.6 ± 0.2(-5)	2.0 ± 0.5(-7)	3.3 ± 0.8(2)
^{59}Fe	1.66 ± 0.07(-5)	<1.9(-7)*	>8.7(1)
^{57}Co	8.3 ± 1.6(-7)	1.3 ± 0.5(-7)	6.4 ± 2.7(0)
^{58}Co	3.6 ± 0.1(-4)	6.6 ± 0.1(-6)	5.5 ± 0.2(1)
^{60}Co	2.06 ± 0.04(-4)	2.4 ± 0.1(-6)	8.6 ± 0.4(1)
^{65}Zn	5.0 ± 0.6(-6)	<1.6(-7)*	>3.1(1)
^{84}Br			
^{91}Sr	3.96 ± 0.09(-3)	<7.5(-7)	>5.3(3)
^{91m}Y			
^{93}Y	1.4 ± 0.4(-3)	<8.4(-7)*	>1.7(3)
^{95}Zr	2.13 ± 0.04(-5)	5.0 ± 0.9(-7)	4.3 ± 0.8(1)
^{95}Nb	4.3 ± 0.8(-5)	1.0 ± 0.1(-6)	4.3 ± 0.9(1)
^{99}Mo	6.0 ± 0.1(-4)	3.0 ± 0.5(-7)*	2.0 ± 0.3(3)
^{103}Ru	2.21 ± 0.03(-5)	5.1 ± 0.9(-7)	4.3 ± 0.8(1)
^{106}Ru	4.1 ± 0.5(-5)	<1.4(-7)*	>2.9(2)
^{110m}Ag	5.0 ± 0.2(-5)	<6.6(-6)*	>7.6(0)
^{124}Sb	1.37 ± 0.04(-5)	7.3 ± 0.2(-5)	1.9 ± 0.1(-1)
^{125}Sb	1.64 ± 0.05(-5)	1.05 ± 0.02(-4)	1.56 ± 0.06(-1)
^{129}Te	1.1 ± 0.2(-2)	<3.4(-3)	>3.2(0)
^{131m}Te	<2.5(-4)	<2.4(-7)*	
^{131}Te			
^{132}Te	1.3 ± 0.1(-4)	1.7 ± 0.5(-5)	7.6 ± 2.3(0)
^{139}Ba	1.77 ± 0.02(-2)	7.2 ± 0.2(-3)	2.5 ± 0.1(0)
^{140}Ba	7.01 ± 0.07(-4)	<1.7(-7)*	>4.1(3)
^{140}La	2.8 ± 1.7(-5)	<1.8(-7)*	>1.6(2)
^{141}Ce	2.0 ± 0.3(-6)	<1.1(-7)	>1.8(1)
^{144}Ce	<2.1(-6)	<1.0(-7)*	
^{187}W	2.9 ± 0.6(-4)	<6.0(-7)*	>4.8(2)
^{239}Np	9.1 ± 3.0(-5)	7.5 ± 2.0(-7)*	1.2 ± 0.5(2)

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
18:21; 4/12/78
Used for: 75 days
Bed Volumes Thru: 2.43 (4)
Letdown Flow Rate: 55 gpm
Reactor Coolant Boron: 712 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	6.7 ± 0.2(-3)	2.5 ± 0.4(-6)	2.7 ± 0.4(3)
^{132}I	1.04 ± 0.03(-1)	2.6 ± 1.0(-4)	4.0 ± 1.5(2)
^{133}I	5.2 ± 0.2(-2)	2.0 ± 0.4(-5)	2.6 ± 0.5(3)
^{134}I	1.62 ± 0.03(-1)	<8.5(-5)	>1.9(3)
^{135}I	9.4 ± 0.2(-2)	<1.2(-4)	>7.8(2)
^{88}Rb	3.97 ± 0.05(-1)	3.50 ± 0.06(-1)	1.13 ± 0.02(0)
^{89}Rb	5.2 ± 0.7(-2)	<1.1(-3)	>4.7(1)
^{134}Cs	3.5 ± 0.1(-4)	3.2 ± 0.1(-4)	1.1 ± 0.05(0)
^{136}Cs	4.4 ± 0.8(-5)	7.1 ± 0.4(-6)	6.2 ± 1.2(0)
^{137}Cs	4.8 ± 0.1(-4)	4.6 ± 0.2(-4)	1.04 ± 0.05(0)
^{138}Cs	2.14 ± 0.04(-1)	5.1 ± 0.1(-2)	4.2 ± 0.1(0)
^{139}Cs	<2.3(-1)	<5.1(-2)	
^{24}Na	7.2 ± 0.2(-3)	4.8 ± 1.8(-6)	1.5 ± 0.6(3)
^{51}Cr	3.8 ± 1.6(-5)	<2.7(-6)	>1.4(1)
^{54}Mn	7.1 ± 0.3(-5)	8.8 ± 0.2(-8)	8.1 ± 0.4(2)
^{59}Fe	1.2 ± 0.2(-5)	<2.1(-7)	>5.7(1)
^{57}Co	<1.5(-6)	<3.1(-7)	
^{58}Co	1.24 ± 0.06(-4)	7.8 ± 0.8(-7)	1.6 ± 0.2(2)
^{60}Co	1.06 ± 0.02(-4)	4.6 ± 0.1(-7)	2.30 ± 0.07(2)
^{65}Zn	<1.9(-6)	<2.4(-7)	
^{84}Br	1.7 ± 0.4(-2)	<1.5(-3)	>1.1(1)
^{91}Sr	2.7 ± 0.2(-3)	<1.9(-5)	>1.4(2)
^{91m}Y	2.2 ± 0.2(-3)	<6.0(-5)	>3.7(1)
^{93}Y	2.8 ± 0.6(-2)	<2.7(-4)	>1.0(2)
^{95}Zr	4.9 ± 0.7(-6)	<3.0(-7)	>1.6(1)
^{95}Nb	3.1 ± 0.3(-6)	3.6 ± 1.6(-7)	8.6 ± 3.9(0)
^{99}Mo	8.1 ± 0.9(-4)	<2.3(-6)	>3.5(2)
^{103}Ru	3.2 ± 0.6(-6)	<3.8(-7)	>8.4(0)
^{106}Ru	<1.6(-5)	<2.5(-6)	
^{110m}Ag	<9.5(-7)	<1.7(-7)	
^{124}Sb	2.2 ± 0.4(-6)	6.1 ± 0.8(-7)	3.6 ± 0.8(0)
^{125}Sb	<2.5(-5)	1.5 ± 0.7(-6)	>1.7(0)
^{129}Te	<5.8(-2)	<1.4(-2)	
^{131m}Te	<1.4(-4)	<5.4(-6)	
^{131}Te	5.2 ± 2.1(-3)	<6.6(-4)	>7.9(0)
^{132}Te	1.2 ± 0.3(-5)	<7.5(-7)	>1.6(1)
^{139}Ba	4.2 ± 0.2(-3)	3.0 ± 0.1(-3)	1.4 ± 0.1(0)
^{140}Ba	1.03 ± 0.03(-3)	<1.7(-6)	>6.1(2)
^{140}La	7.66 ± 0.07(-5)	<4.4(-6)	>1.7(1)
^{141}Ce	<6.5(-6)	<1.3(-6)	
^{144}Ce	1.7 ± 0.4(-4)	<2.4(-6)	>7.1(1)
^{187}W	9.6 ± 1.1(-4)	<2.5(-5)	>3.8(1)
^{239}Np	<1.9(-5)	<8.8(-6)	

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
11:21; 4/13/78
Used for: 76 days
Bed Volumes Thru: 2.45(4)
Letdown Flow Rate: 53 gpm
Reactor Coolant Boron: 732 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	7.5 ± 0.3(-3)	1.2 ± 0.2(-5)	6.2 ± 1.1(2)
^{132}I	1.04 ± 0.05(-1)	<1.3(-4)	>8.0(2)
^{133}I	5.4 ± 0.1(-2)	6.5 ± 0.4(-5)	8.3 ± 0.5(2)
^{134}I	1.69 ± 0.03(-1)	<1.2(-4)	>1.4(3)
^{135}I	9.0 ± 0.4(-2)	6.6 ± 2.6(-6)	1.4 ± 0.5(3)
^{88}Rb	4.8 ± 0.2(-1)	1.30 ± 0.02(-1)	3.7 ± 0.2(0)
^{89}Rb	5.3 ± 0.4(-2)	1.7 ± 0.2(-3)	3.1 ± 0.4(1)
^{134}Cs	3.2 ± 0.1(-4)	3.3 ± 0.2(-4)	9.7 ± 0.7(-1)
^{136}Cs	4.0 ± 0.3(-5)	8.2 ± 0.7(-6)	4.9 ± 0.6(0)
^{137}Cs	4.6 ± 0.1(-4)	4.4 ± 0.3(-4)	1.0 ± 0.1(0)
^{138}Cs	2.3 ± 0.1(-1)	4.32 ± 0.08(-1)	5.3 ± 0.3(0)
^{139}Cs	<2.4(-1)	<1.3(-2)	
^{24}Na	7.5 ± 0.2(-3)	7.5 ± 2.6(-6)	1.0 ± 0.3(3)
^{51}Cr	6.1 ± 1.3(-5)	<4.8(-6)	>1.3(1)
^{54}Mn	5.8 ± 0.1(-5)	<3.5(-7)	>1.7(2)
^{59}Fe	7.7 ± 1.1(-6)	<3.9(-7)	>2.0(1)
^{57}Co	<1.4(-6)	<1.0(-6)	
^{58}Co	1.16 ± 0.02(-4)	2.9 ± 0.2(-6)	4.0 ± 0.3(1)
^{60}Co	8.8 ± 0.1(-5)	1.4 ± 0.1(-6)	6.3 ± 0.5(1)
^{65}Zn	<2.4(-6)	<4.4(-7)	
^{84}Br	1.7 ± 0.4(-2)	<1.4(-3)	>1.2(1)
^{91}Sr	2.3 ± 0.2(-3)	<1.8(-5)	>1.3(2)
^{91m}Y	4.5 ± 0.3(-3)	<6.8(-5)	>6.6(1)
^{93}Y	1.1 ± 0.4(-3)	<2.1(-4)	>5.2(0)
^{95}Zr	5.3 ± 1.3(-6)	<5.6(-7)	>9.5(0)
^{95}Nb	<4.3(-6)	<4.9(-7)	
^{99}Mo	9.4 ± 0.3(-4)	<3.8(-6)	>2.5(2)
^{103}Ru	3.1 ± 0.5(-6)	<6.0(-7)	>5.2(0)
^{106}Ru	<7.3(-5)	<4.7(-6)	
^{110m}Ag	<1.2(-6)	<4.6(-7)	
^{124}Sb	1.9 ± 0.7(-6)	8.0 ± 1.6(-7)	2.4 ± 1.0(0)
^{125}Sb	<1.3(-5)	<1.8(-6)	
^{129m}Te	<6.5(-5)	<1.5(-5)	
^{129}Te	<3.3(-2)	<2.3(-2)	
^{131m}Te	<1.5(-4)	<6.5(-6)	
^{131}Te	<4.9(-3)	<6.1(-4)	
^{132}Te	1.1 ± 0.3(-5)	<1.0(-6)	>1.1(1)
^{139}Ba	1.30 ± 0.02(-2)	6.1 ± 0.2(-3)	2.1 ± 0.1(0)
^{140}Ba	1.0 ± 0.1(-3)	<3.2(-6)	>3.1(2)
^{140}La	3.7 ± 0.1(-5)	<1.7(-6)	>2.2(1)
^{141}Ce	<3.9(-6)	<2.4(-6)	
^{144}Ce	1.0 ± 0.2(-4)	<5.9(-6)	>1.7(1)
^{187}W	1.1 ± 0.1(-3)	<1.9(-5)	>5.8(1)
^{239}Np	<2.0(-5)	<1.1(-5)	

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
11:17; 4/15/78
Used for: 78 days
Bed Volumes Thru: 2.53(4)
Letdown Flow Rate: 53 gpm
Reactor Coolant Boron: 703 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	6.02 ± 0.02(-3)	1.6 ± 0.8(-6)	3.8 ± 1.9(3)
^{132}I	1.04 ± 0.01(-1)	<8.1 (-5)	>1.3(3)
^{133}I	5.26 ± 0.03(-2)	9.3 ± 2.5(-6)	5.7 ± 1.5(3)
^{134}I	1.73 ± 0.02(-1)	<1.2 (-4)	>1.4(3)
^{135}I	9.7 ± 0.1(-2)	<1.3 (-4)	>7.5(2)
^{88}Rb	1.27 ± 0.04(-1)	5.6 ± 0.1(-2)	2.3 ± 0.1(0)
^{89}Rb	5.9 ± 0.2(-2)	2.1 ± 0.2(-3)	2.8 ± 0.3(1)
^{134}Cs	2.89 ± 0.02(-4)	2.97 ± 0.03(-4)	9.7 ± 0.1(-1)
^{136}Cs	5.5 ± 0.1(-5)	1.03 ± 0.04(-5)	5.3 ± 0.2(0)
^{137}Cs	4.16 ± 0.02(-4)	3.92 ± 0.07(-4)	1.06 ± 0.02(0)
^{138}Cs	2.35 ± 0.02(-1)	2.5 ± 0.6(-2)	9.4 ± 2.3(0)
^{139}Cs	1.20 ± 0.09(-1)	<4.4 (-3)	>2.7(1)
^{24}Na	7.1 ± 0.1(-3)	<3.7 (-6)	>1.9(3)
^{51}Cr	<4.0(-6)	<6.6 (-6)	
^{54}Mn	6.3 ± 0.1(-5)	4.2 ± 1.5(-7)	1.5 ± 0.5(2)
^{59}Fe	9.6 ± 1.1(-6)	<5.4 (-7)	>1.8(1)
^{57}Co	<1.7(-6)	<5.0 (-7)	
^{58}Co	1.12 ± 0.02(-4)	2.3 ± 0.3(-6)	4.9 ± 0.6(1)
^{60}Co	9.3 ± 0.1(-5)	8.6 ± 2.3(-7)	1.1 ± 0.3(2)
^{65}Zn	<2.5(-6)	<5.1 (-7)	
^{84}Br	1.5 ± 0.1(-2)	<8.1 (-4)	>1.9(1)
^{91}Sr	2.2 ± 0.1(-3)	<3.9 (-5)	>5.6(1)
^{91m}Y	9.9 ± 1.3(-4)	<6.6 (-5)	>1.5(1)
^{93}Y	3.8 ± 0.6(-3)	<3.8 (-4)	>1.0(1)
^{95}Zr	1.1 ± 0.1(-5)	<7.4 (-7)	>1.5(1)
^{95}Nb	7.2 ± 0.4(-6)	8.4 ± 2.6(-7)	8.6 ± 2.7(0)
^{99}Mo	9.19 ± 0.04(-4)	<3.7 (-6)	>2.5(2)
^{103}Ru	2.4 ± 0.5(-6)	<1.1 (-6)	>2.2(0)
^{106}Ru	<2.8(-6)	<6.8 (-6)	
^{110m}Ag	4.4 ± 2.0(-6)	<3.7 (-7)	>1.2(1)
^{124}Sb	3.0 ± 0.4(-6)	8.8 ± 3.3(-7)	3.4 ± 1.4(0)
^{125}Sb	3.9 ± 1.5(-6)	<2.3 (-6)	>1.7(0)
^{129}Te	<6.3 (-2)	<2.8 (-2)	
^{131m}Te	<1.9 (-4)	<5.3 (-6)	
^{131}Te	<2.7 (-3)	<1.3 (-3)	
^{132}Te	1.7 ± 0.2(-5)	<4.1 (-6)	>4.1(0)
^{139}Ba	1.96 ± 0.04(-2)	6.1 ± 0.2(-3)	3.2 ± 0.1(0)
^{140}Ba	9.4 ± 0.1(-4)	<4.3 (-6)	>2.2(2)
^{140}La	8.3 ± 0.2(-5)	<5.9 (-7)	>1.4(2)
^{141}Ce	<2.5 (-6)	<1.0 (-6)	
^{144}Ce	<2.4 (-6)	<3.7 (-6)	
^{187}W	7.8 ± 0.5(-4)	<3.8 (-5)	>2.1(1)
^{239}Np	<1.8 (-5)	<1.6 (-5)	

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
13:54; 4/27/78
Used for: 90 days
Bed Volumes Thru: 2.99(4)
Letdown Flow Rate: 55 gpm
Reactor Coolant Boron: 673 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	1.25 ± 0.01(-2)	3.6 ± 0.7(-6)	3.5 ± 0.7(3)
^{132}I	9.79 ± 0.07(-2)	3.6 ± 1.2(-5)	2.7 ± 0.9(3)
^{133}I	5.82 ± 0.04(-2)	1.0 ± 0.3(-4)	5.8 ± 1.7(2)
^{134}I	1.74 ± 0.01(-1)	<3.7(-5)	>4.7(3)
^{135}I	9.7 ± 0.1(-2)	<9(-5)	>1.1(3)
^{88}Rb	1.18 ± 0.03(-1)	7.5 ± 0.1(-2)	1.57 ± 0.05(0)
^{89}Rb	6.0 ± 0.2(-2)	8.7 ± 0.8(-4)	6.9 ± 0.7(1)
^{134}Cs	5.32 ± 0.09(-4)	5.09 ± 0.06(-4)	1.05 ± 0.02(0)
^{136}Cs	5.0 ± 1.2(-5)	2.1 ± 0.4(-5)	2.4 ± 0.7(0)
^{137}Cs	7.54 ± 0.09(-4)	6.48 ± 0.07(-4)	1.16 ± 0.02(0)
^{138}Cs	2.03 ± 0.02(-1)	2.00 ± 0.03(-2)	1.02 ± 0.02(1)
^{139}Cs	1.26 ± 0.08(-1)	<4.2(-3)	>3.0(1)
^{24}Na	9.5 ± 0.3(-3)	<6.9(-6)	>1.4(3)
^{51}Cr	<4.7(-6)	1.7 ± 0.3(-5)	<2.8(-1)
^{54}Mn	6.7 ± 0.2(-5)	9.2 ± 1.6(-7)	7.3 ± 1.3(1)
^{59}Fe	1.0 ± 0.1(-5)	<8.7(-7)	>1.1(1)
^{57}Co	<1.1(-6)	<4.4(-7)	
^{58}Co	1.8 ± 0.07(-4)	2.65 ± 0.06(-5)	6.8 ± 0.3(0)
^{60}Co	1.11 ± 0.02(-4)	9.0 ± 0.3(-6)	1.23 ± 0.05(1)
^{65}Zn	<1.3(-6)	<1.5(-7)	
^{84}Br	1.3 ± 0.1(-2)	<4.7(-4)	>2.8(1)
^{91}Sr	6.0 ± 1.9(-3)	<6.6(-5)	>9.1(1)
^{91m}Y	8.2 ± 2.7(-4)	<2.3(-5)	>3.6(1)
^{93}Y	2.1 ± 0.9(-2)	<2.1(-4)	>1.0(2)
^{95}Zr	1.7 ± 0.1(-5)	3.5 ± 0.4(-6)	4.9 ± 0.6(0)
^{95}Nb	7.8 ± 1.4(-6)	2.6 ± 0.3(-6)	3.0 ± 0.6(0)
^{99}Mo	8.8 ± 0.9(-4)	1.5 ± 0.2(-5)	5.9 ± 0.8(1)
^{103}Ru	5.5 ± 1.5(-6)	1.7 ± 0.4(-6)	3.2 ± 1.2(0)
^{106}Ru	2.9 ± 1.6(-6)	<5.7(-8)	>5.1(1)
^{110m}Ag	<1.4(-5)	<9.4(-7)	
^{124}Sb	7.9 ± 1.2(-6)	1.9 ± 0.3(-6)	4.2 ± 0.9(0)
^{125}Sb	<4.7(-6)	<7.6(-7)	
^{129}Te	3.5 ±±0.3(-2)	<2.7(-3)	>1.3(1)
^{131m}Te	1.1 ± 0.7(-4)	<9.8(-7)	>1.1(2)
^{131}Te	<4.0(-3)	<2.0(-4)	
^{132}Te	2.7 ± 0.3(-5)	<2.2(-6)	>1.2(1)
^{139}Ba	9.5 ± 0.5(-3)	2.6 ± 0.3(-3)	3.7 ± 0.5(0)
^{140}Ba	9.04 ± 0.09(-4)	9.2 ± 0.3(-5)	9.8 ± 0.3(0)
^{140}La	<3.1(-4)	<2.3(-5)	
^{141}Ce	<2.9(-6)	<1.3(-6)	
^{144}Ce	<3.0(-7)	<2.4(-7)	
^{187}W	<3.8(-4)	<8.0(-5)	
^{239}Np	<1.1(-5)	<2.9(-6)	

TABLE B.12 (cont'd)

UNIT #3 CVCS PURICICATION DEMINERALIZER

Demineralizer B
09:45; 4/29/78
Used for: 92 days
Bed Volumes Thru: 3.05(4)
Letdown Flow Rate: 55 gpm
Reactor Coolant Boron: 681 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	1.25 ± 0.01(-2)	<1.4(-6)	>8.9(3)
^{132}I	9.9 ± 0.2(-2)	<8.9(-5)	>1.1(3)
^{133}I	4.97 ± 0.03(-2)	1.2 ± 0.4(-5)	4.1 ± 1.4(3)
^{134}I	1.75 ± 0.03(-1)	<1.1(-4)	>1.6(3)
^{135}I	1.06 ± 0.01(-1)	<2.3(-4)	>4.6(2)
^{88}Rb	1.72 ± 0.05(-1)	1.05 ± 0.01(-1)	1.64 ± 0.05(0)
^{89}Rb	5.4 ± 0.2(-2)	1.6 ± 0.2(-3)	3.4 ± 0.4(1)
^{134}Cs	5.27 ± 0.08(-4)	5.77 ± 0.06(-4)	9.1 ± 0.2(-1)
^{136}Cs	<9.1(-5)	2.7 ± 0.2(-5)	<3.4(0)
^{137}Cs	6.1 ± 0.1(-4)	7.8 ± 0.1(-4)	9.1 ± 0.2(-1)
^{138}Cs	2.19 ± 0.04(-1)	3.74 ± 0.06(-2)	5.9 ± 0.1(0)
^{139}Cs	1.6 ± 0.3(-1)	9.9 ± 4.7(-3)	1.6 ± 0.8(1)
^{24}Na	1.03 ± 0.01(-2)	<3.9(-6)	>2.6(3)
^{51}Cr	<4.5(-6)	<1.7(-7)	
^{54}Mn	6.7 ± 0.2(-5)	<5.2(-8)	>1.3(3)
^{59}Fe	9.8 ± 1.4(-6)	<1.9(-7)	>5.2(1)
^{57}Co	<1.7(-6)	<1.4(-7)	
^{58}Co	1.21 ± 0.09(-4)	1.2 ± 0.2(-6)	1.0 ± 0.2(2)
^{60}Co	9.8 ± 0.3(-5)	1.3 ± 0.1(-6)	7.5 ± 0.6(1)
^{65}Zn	7.3 ± 2.2(-6)	<4.1(-7)	>1.8(1)
^{84}Br	1.3 ± 0.1(-2)	<1.1(-3)	>1.2(1)
^{91}Sr	4.2 ± 0.2(-3)	<1.7(-4)	>2.5(1)
^{91m}Y	1.5 ± 0.2(-3)	<6.9(-5)	>2.2(1)
^{93}Y	<2.5(-3)	<7.1(-4)	
^{95}Zr	6.8 ± 1.5(-6)	7.3 ± 3.5(-7)	9.3 ± 4.9(0)
^{95}Nb	5.9 ± 1.1(-6)	8.7 ± 2.4(-7)	6.8 ± 2.3(0)
^{99}Mo	7.83 ± 0.07(-4)	<2.3(-6)	>3.4(2)
^{103}Ru	5.5 ± 1.2(-6)	<6.3(-7)	>8.7(0)
^{106}Ru	3.7 ± 1.6(-6)	1.1 ± 0.8(-6)	3.4 ± 2.9(0)
^{110m}Ag	<7.5(-5)	<5.4(-5)	
^{124}Sb	3.2 ± 0.8(-6)	8.4 ± 1.4(-7)	3.8 ± 1.1(0)
^{125}Sb	2.7 ± 1.9(-6)	<1.7(-7)	>1.6(1)
^{129}Te	3.7 ± 1.7(-2)	<2.1(-2)	>1.8(0)
^{131m}Te	1.3 ± 0.6(-4)	<3.8(-7)	>3.4(2)
^{131}Te	<3.2(-3)	<7.2(-4)	
^{132}Te	1.3 ± 0.3(-5)	<3.3(-6)	>3.9(0)
^{139}Ba	7.7 ± 0.09(-3)	4.5 ± 0.3(-3)	1.7 ± 0.1(0)
^{140}Ba	1.12 ± 0.01(-3)	3.2 ± 0.2(-5)	3.5 ± 0.2(1)
^{140}La	<2.9(-4)	3.8 ± 0.1(-6)	<7.6(1)
^{141}Ce	<3.2(-7)	<1.3(-7)	
^{144}Ce	3.0 ± 1.3(-6)	<3.3(-7)	>9.1(0)
^{187}W	6.9 ± 1.0(-4)	<1.8(-4)	>3.8(0)
^{239}Np	<1.1(-5)	<3.0(-6)	

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
10:15; 5/9/78
Used for: 102 days
Bed Volumes Thru: 3.40(4)
Letdown Flow Rate: 53 gpm
Reactor Coolant Boron: 618 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	7.3 ± 0.1(-3)	1.5 ± 0.7(-6)	4.9 ± 2.3(3)
^{132}I	1.05 ± 0.02(-1)		
^{133}I	5.3 ± 0.1(-2)	<1.4(-5)	>3.8(3)
^{134}I	1.72 ± 0.03(-1)	<1.3(-4)	>1.3(3)
^{135}I	1.0 ± 0.01(-1)	<7.2(-5)	>1.4(3)
^{88}Rb	1.25 ± 0.04(-1)	4.14 ± 0.08(-1)	3.0 ± 0.1(-1)
^{89}Rb	5.4 ± 0.2(-2)	<1.7(-3)	>3.2(1)
^{134}Cs	8.0 ± 0.1(-4)	8.5 ± 0.1(-4)	9.4 ± 0.2(-1)
^{136}Cs	7.4 ± 1.0(-5)	2.12 ± 0.04(-5)	3.5 ± 0.5(0)
^{137}Cs	1.15 ± 0.02(-3)	1.13 ± 0.01(-3)	1.02 ± 0.02(0)
^{138}Cs	2.03 ± 0.03(-1)	4.80 ± 0.03(-2)	4.23 ± 0.07(0)
^{139}Cs	8.9 ± 1.9(-2)	<1.5(-2)	>5.9(0)
^{24}Na	1.12 ± 0.01(-2)	<3.6(-6)	>3.1(3)
^{51}Cr	<2.2(-5)	<2.0(-6)	
^{54}Mn	6.9 ± 0.1(-5)	<4.2(-7)	>1.6(2)
^{59}Fe	1.3 ± 0.1(-5)	<7.6(-7)	>1.7(1)
^{57}Co	<1.8(-6)	<8.0(-7)	
^{58}Co	1.33 ± 0.03(-4)	8.3 ± 1.4(-7)	1.6 ± 0.3(2)
^{60}Co	9.9 ± 0.2(-5)	1.0 ± 0.1(-7)	9.9 ± 1.0(2)
^{65}Zn	<3.7(-6)	<8.3(-7)	
^{84}Br	1.5 ± 0.1(-2)		
^{91}Sr	2.7 ± 0.3(-3)	<6.5(-5)	>4.1(1)
^{91m}Y	1.1 ± 0.2(-3)		
^{93}Y	1.5 ± 0.2(-2)	<4.6(-5)	>3.3(2)
^{95}Zr	4.2 ± 1.0(-6)	<1.1(-6)	>3.8(0)
^{95}Nb	1.08 ± 0.06(-6)	<5.3(-7)	>2.0(0)
^{99}Mo	9.72 ± 0.07(-4)	<1.6(-6)	>6.1(2)
^{103}Ru	<2.3(-6)	<1.2(-6)	
^{106}Ru	<3.4(-6)	<1.6(-6)	
^{110m}Ag	<2.4(-6)	<5.1(-7)	
^{124}Sb	3.0 ± 1.2(-6)	6.4 ± 1.1(-7)	4.7 ± 2.0(0)
^{125}Sb	<2.3(-5)	<1.9(-6)	
^{129}Te			
^{131m}Te	<2.6(-4)	<8.5(-6)	>8.5(-6)
^{131}Te			
^{132}Te	6.8 ± 2.6(-6)	<1.5(-6)	>4.5(0)
^{139}Ba	1.15 ± 0.02(-2)	5.7 ± 0.1(-3)	2.0 ± 0.05(0)
^{140}Ba	1.07 ± 0.02(-3)	5.6 ± 2.5(-6)	1.9 ± 0.9(2)
^{140}La	<2.0(-4)	5.9 ± 0.3(-7)	<3.4(2)
^{141}Ce	2.6 ± 0.9(-6)	<1.8(-6)	>1.4(0)
^{144}Ce	1.5 ± 0.1(-4)	<7.1(-6)	>2.1(1)
^{187}W		<4.3(-5)	
^{239}Np	<1.4(-5)	<6.0(-5)	

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
09:55; 5/16/78
Used for: 109 days
Bed Volumes Thru: 3.66(4)
Letdown Flow Rate: 54 gpm
Reactor Coolant Boron: 605 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	7.5 ± 0.1(-3)	6.6 ± 0.6(-6)	1.1 ± 0.1(3)
^{132}I	9.9 ± 0.1(-2)	3.8 ± 1.4(-5)	2.6 ± 1.0(3)
^{133}I	5.7 ± 0.1(-2)	2.0 ± 0.3(-5)	2.9 ± 0.4(3)
^{134}I	1.75 ± 0.01(-1)	<1.3(-4)	>1.4(3)
^{135}I	1.03 ± 0.01(-1)	<4.5(-5)	>2.3(3)
^{88}Rb	2.92 ± 0.05(-1)		
^{89}Rb	5.6 ± 0.5(-2)	<4.7(-2)	>1.2(0)
^{134}Cs	4.31 ± 0.03(-4)	4.16 ± 0.05(-4)	1.04 ± 0.01(0)
^{136}Cs	6.1 ± 0.2(-5)	9.3 ± 0.2(-6)	6.6 ± 0.3(0)
^{137}Cs	6.02 ± 0.04(-4)	5.63 ± 0.04(-4)	1.07 ± 0.01(0)
^{138}Cs	2.24 ± 0.02(-1)	4.96 ± 0.06(-2)	4.52 ± 0.07(0)
^{139}Cs	<1.7(-1)		
^{24}Na	7.5 ± 0.1(-3)	4.4 ± 1.5(-6)	1.7 ± 0.6(3)
^{51}Cr	5.2 ± 1.6(-5)	<4.7(-6)	>1.1(1)
^{54}Mn	9.0 ± 0.2(-5)	5 ± 1.2(-7)	1.8 ± 0.4(2)
^{59}Fe	1.6 ± 0.2(-5)	<4.1(-7)	>3.9(1)
^{57}Co	<1.4(-6)	9.9 ± 4.4(-7)	<1.4(0)
^{58}Co	1.86 ± 0.02(-4)	1.1 ± 0.09(-6)	1.7 ± 0.1(2)
^{60}Co	1.44 ± 0.02(-4)	9 ± 2.(-7)	1.6 ± 0.4(2)
^{65}Zn	<4.1(-6)	<3.9(-7)	
^{84}Br			
^{91}Sr	4.1 ± 0.3(-3)	<3.3(-5)	>1.2(2)
^{91m}Y	2.8 ± 0.2(-3)	<1.1(-4)	>2.6(1)
^{93}Y	<7.3(-3)	<9.7(-5)	
^{95}Zr	<3.5(-6)	<5.1(-7)	
^{95}Nb	9.5 ± 1.1(-6)	<3.1(-7)	>3.1(1)
^{99}Mo	8.92 ± 0.03(-4)	<1.9(-6)	>4.7(2)
^{103}Ru	4.4 ± 1.0(-6)	<5.6(-7)	>7.9(0)
^{106}Ru	<2.1(-5)	<3.2(-6)	
^{110m}Ag	<2.2(-6)	<2.7(-7)	
^{124}Sb	4.1 ± 0.9(-6)	6.5 ± 0.9(-7)	6.3 ± 1.6(0)
^{125}Sb	<9.1(-6)	<1.2(-6)	
^{129}Te	2.7 ± 2.4(-2)	<8.9(-3)	>3.0(0)
^{131m}Te	<3.5(-4)	<1.1(-5)	
^{131}Te	8.9 ± 1.7(-3)	<5.5(-3)	>1.6(0)
^{132}Te	7.8 ± 1.9(-6)	<1.5(-6)	>5.2(0)
^{139}Ba	2.67 ± 0.04(-2)	8.2 ± 0.4(-3)	3.3 ± 0.2(0)
^{140}Ba	1.45 ± 0.03(-3)	5.9 ± 1.2(-6)	2.5 ± 0.5(2)
^{140}La	<1.3(-4)	1.01 ± 0.4(-7)	>1.3(3)
^{141}Ce	<3.6(-6)	<9.5(-7)	
^{144}Ce	<1.3(-5)	<2.3(-6)	
^{187}W	<5.0(-4)	<3.4(-5)	
^{239}Np	1.4 ± 0.3(-4)	<9.3(-6)	>1.5(1)

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
21:20; 5/19/78
Used for: 112 days
Bed Volumes Thru: 3.78(4)
Letdown Flow Rate: 52 gpm
Reactor Coolant Boron:

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	6.8 ± 0.1(-3)	3.0 ± 0.08(-6)	2.3 ± 0.1(3)
^{132}I	1.05 ± 0.02(-1)	<1.3(-6)	>8.1(4)
^{133}I	5.67 ± 0.04(-2)	2.3 ± 0.7(-6)	2.5 ± 0.8(4)
^{134}I	1.70 ± 0.02(-1)	<1.2(-6)	>1.4(5)
^{135}I	1.02 ± 0.02(-1)	<1.3(-6)	>7.8(4)
^{88}Rb	1.12 ± 0.02(-1)	3.7 ± 0.7(-5)	3.0 ± 0.6(3)
^{89}Rb	4.22 ± 0.07(-2)	<5.7(-6)	>7.4(3)
^{134}Cs	3.98 ± 0.02(-4)	4.1 ± 0.1(-4)	9.7 ± 0.2(-1)
^{136}Cs	6.3 ± 0.2(-5)	7.4 ± 0.3(-6)	8.5 ± 0.4(0)
^{137}Cs	5.68 ± 0.04(-4)	5.43 ± 0.02(-4)	1.05 ± 0.01(0)
^{138}Cs	1.65 ± 0.03(-1)	6.9 ± 0.9(-6)	2.4 ± 0.3(4)
^{139}Cs	6.6 ± 0.7(-2)	<4.6(-5)	>1.4(3)
^{24}Na	8.2 ± 0.2(-3)	<3.8(-7)	>2.2(4)
^{51}Cr	8.0 ± 0.6(-5)	<7.5(-6)	>1.1(1)
^{54}Mn	1.01 ± 0.01(-4)	3.2 ± 0.3(-6)	3.2 ± 0.3(1)
^{59}Fe	1.7 ± 0.1(-5)	<7.3(-7)	>2.3(1)
^{57}Co	1.7 ± 0.5(-6)	<5.2(-7)	>3.3(0)
^{58}Co	2.98 ± 0.03(-4)	6.94 ± 0.03(-6)	4.29 ± 0.05(1)
^{60}Co	1.91 ± 0.04(-4)	1.8 ± 0.6(-6)	1.1 ± 0.4(2)
^{65}Zn	<3.5(-6)	<8.9(-7)	
^{84}Br			
^{91}Sr	2.9 ± 0.7(-3)	<1.4(-6)	>2.1(3)
^{91m}Y	9.3 ± 1.8(-4)	<2.0(-6)	>4.7(2)
^{93}Y	<3.3(-3)	<1.3(-5)	
^{95}Zr	2.6 ± 0.1(-5)	<9.0(-7)	>2.9(1)
^{95}Nb	1.86 ± 0.08(-5)	2.3 ± 0.5(-6)	8.1 ± 1.8(0)
^{99}Mo	7.15 ± 0.06(-4)	<1.4(-6)	>5.1(2)
^{103}Ru	6.6 ± 0.8(-6)	<1.1(-6)	>6.0(0)
^{106}Ru	<1.3(-5)	<6.3(-6)	
^{110m}Ag	2.6 ± 1.0(-6)	<4.7(-7)	>5.5(0)
^{124}Sb	7.4 ± 0.6(-6)	1.2 ± 0.2(-6)	6.2 ± 1.1(0)
^{125}Sb	<1.8(-5)	<2.5(-6)	
^{129}Te		<2.5(-5)	
^{131m}Te	<1.9(-4)	2.8 ± 1.1(-5)	<6.8(0)
^{131}Te	<1.8(-3)	<1.8(-5)	
^{132}Te	1.7 ± 0.3(-5)	<1.4(-6)	>1.2(1)
^{139}Ba	1.13 ± 0.04(-2)	<4.9(-5)	>2.3(2)
^{140}Ba	1.35 ± 0.01(-3)	2.2 ± 0.2(-5)	6.1 ± 0.6(1)
^{140}La	6.38 ± 0.08(-3)		
^{141}Ce	<2.7(-6)	<1.1(-6)	
^{144}Ce	<1.2(-5)	<5.9(-6)	
^{187}W	<9.8(-4)	<6.4(-5)	
^{239}Np	<1.9(-5)	<8.0(-6)	

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
20:00; 5/21/78
Used for: 114 days
Bed Volumes Thru: 3.85 (4)
Letdown Flow Rate: 55 gpm
Reactor Coolant Boron:

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	1.88 ± 0.03(-2)	3.5 ± 0.2(-6)	5.4 ± 0.3(3)
^{132}I	7.16 ± 0.07(-2)	<1.5(-6)	>4.8(4)
^{133}I	7.2 ± 0.1(-3)	<1.2(-5)	>6.0(2)
^{134}I			
^{135}I	3.4 ± 0.6(-4)	<9.0(-7)	>3.8(2)
^{88}Rb			
^{89}Rb			
^{134}Cs	1.38 ± 0.01(-3)	3.78 ± 0.05(-4)	3.65 ± 0.06(0)
^{136}Cs	5.65 ± 0.05(-4)	9.5 ± 0.2(-6)	6.0 ± 0.1(1)
^{137}Cs	1.90 ± 0.02(-3)	5.18 ± 0.01(-4)	3.67 ± 0.04(0)
^{138}Cs			
^{139}Cs			
^{24}Na	3.2 ± 0.2(-4)	<4.1(-7)	>7.8(2)
^{51}Cr	1.8 ± 0.2(-4)	<2.3(-6)	>7.8(1)
^{54}Mn	1.74 ± 0.01(-4)	4.0 ± 0.7(-7)	4.4 ± 0.8(2)
^{59}Fe	4.0 ± 0.2(-5)	<2.7(-7)	>1.5(2)
^{57}Co	2.6 ± 1.2(-6)	<1.3(-7)	>2.0(1)
^{58}Co	8.08 ± 0.07(-4)	4.03 ± 0.01(-6)	2.00 ± 0.02(2)
^{60}Co	4.7 ± 0.1(-4)	3.2 ± 0.3(-6)	1.5 ± 0.1(2)
^{65}Zn	1.1 ± 0.2(-5)	<2.1(-7)	>5.2(1)
^{84}Br			
^{91}Sr	3.6 ± 0.4(-4)	<3.1(-6)	>1.2(2)
^{91m}Y	5.6 ± 0.7(-3)	<2.0(-6)	>2.8(3)
^{93}Y	3.6 ± 1.4(-2)	<2.0(-5)	>1.8(3)
^{95}Zr	3.0 ± 0.1(-5)	3.7 ± 1.6(-7)	8.1 ± 3.5(1)
^{95}Nb	2.9 ± 0.1(-5)	9.0 ± 0.8(-7)	3.2 ± 0.3(1)
^{99}Mo	4.59 ± 0.01(-3)	<1.5(-6)	>3.1(3)
^{103}Ru	2.1 ± 0.1(-5)	<2.3(-7)	>9.1(1)
^{106}Ru	<2.0(-5)	<1.6(-6)	
^{110m}Ag	4.8 ± 1.6(-6)	<1.4(-7)	>3.4(1)
^{124}Sb	2.4 ± 0.1(-5)	1.93 ± 0.07(-6)	1.24 ± 0.07(1)
^{125}Sb	<6.3(-5)	2.1 ± 0.4(-6)	<3.0(1)
^{129}Te			
^{131m}Te	<7.5(-5)	<2.4(-6)	
^{131}Te			
^{132}Te	4.9 ± 0.4(-5)	<1.1(-6)	>4.5(1)
^{139}Ba			
^{140}Ba	3.11 ± 0.03(-3)	8.5 ± 0.6(-6)	3.7 ± 0.3(2)
^{140}La	4.76 ± 0.04(-3)	1.37 ± 0.04(-5)	3.5 ± 0.1(2)
^{141}Ce	<7.6(-6)	<4.6(-7)	
^{144}Ce	<2.6(-5)	<1.0(-6)	
^{187}W	<1.7(-4)	<6.0(-6)	
^{239}Np	<2.7(-5)	<9.3(-6)	

TABLE B.12 (cont'd)

UNIT #3 CVCS PURIFICATION DEMINERALIZER

Demineralizer B
09:10; 5/25/78
Used for: 118 days
Bed Volumes Thru: 3.97(4)
Letdown Flow Rate: 50 gpm
Reactor Coolant Boron:

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	7.65 ± 0.06(-3)	1.6 ± 0.6(-6)	4.8 ± 1.8(3)
^{132}I	8.5 ± 0.3(-2)	<1.1(-4)	>7.7(2)
^{133}I	6.0 ± 0.1(-2)	<1.9(-5)	>3.2(3)
^{134}I	1.92 ± 0.04(-1)	<1.0(-4)	>1.9(3)
^{135}I	1.11 ± 0.02(-1)	<2.0(-4)	>5.6(2)
^{88}Rb	3.70 ± 0.09(-1)	1.05 ± 0.01(-1)	3.52 ± 0.09(0)
^{89}Rb	6.3 ± 0.5(-2)	2.2 ± 0.2(-3)	2.9 ± 0.3(1)
^{134}Cs	3.99 ± 0.04(-4)	3.32 ± 0.04(-4)	1.20 ± 0.02(0)
^{136}Cs	1.12 ± 0.05(-4)	9.2 ± 0.3(-6)	1.21 ± 0.07(1)
^{137}Cs	5.65 ± 0.08(-4)	4.2 ± 0.3(-4)	1.34 ± 0.09(0)
^{138}Cs	2.44 ± 0.05(-1)	4.20 ± 0.07(-2)	5.81 ± 0.2(0)
^{139}Cs	1.5 ± 0.7(-1)	<7.9(-3)	>1.9(1)
^{24}Na	8.8 ± 0.1(-3)	<1.3(-5)	>6.8(2)
^{51}Cr	7.2 ± 0.1(-5)	8 ± 3(-7)	9.0 ± 3.4(1)
^{54}Mn	6.60 ± 0.09(-5)	2.9 ± 0.1(-6)	2.30 ± 0.08(1)
^{59}Fe	1.12 ± 0.06(-5)	<5.4(-7)	>2.1(1)
^{57}Co	<6.(-7)	7.2 ± 3.0(-7)	<8.(-1)
^{58}Co	2.17 ± 0.03(-4)	5 ± 2(-7)	4.3 ± 1.7(2)
^{60}Co	1.38 ± 0.05(-4)	<8.4(-6)	>1.6(1)
^{65}Zn	3.7 ± 0.4(-6)	<4.6(-7)	>8.0(0)
^{84}Br			
^{91}Sr	2.2 ± 0.2(-3)	<1.5(-4)	>1.5(1)
^{91m}Y	1.8 ± 0.2(-3)	<8.4(-5)	>2.1(1)
^{93}Y	6.2 ± 1.2(-2)	<7.8(-4)	>8.0(1)
^{95}Zr	6.4 ± 0.3(-6)	1.4 ± 0.6(-6)	5 ± 2(0)
^{95}Nb	6.5 ± 0.3(-6)	1.6 ± 0.2(-6)	4.1 ± 0.5(0)
^{99}Mo	8.61 ± 0.06(-4)	<2.4(-6)	>3.6(2)
^{103}Ru	4.1 ± 0.3(-6)	<3.6(-7)	>1.1(1)
^{106}Ru	<5.6(-6)	<5.4(-7)	
^{110m}Ag	<1.8(-6)	<8.9(-7)	
^{124}Sb	5.3 ± 0.4(-6)	1.33 ± 0.09(-6)	4.0 ± 0.4(0)
^{125}Sb	1.8 ± 0.6(-6)	<7(-7)	>2.6(0)
^{129}Te	<6.3(-2)	<3.5(-2)	
^{131m}Te	<4.0(-4)	1.1 ± 0.8(-4)	<3.6(0)
^{131}Te	3.3 ±± 1.5(-3)	<5.2(-4)	>6.4(0)
^{132}Te	1.4 ± 0.3(-6)	<1.2(-6)	>1.2(0)
^{139}Ba	3.3 ± 0.1(-2)	7.2 ± 0.4(-3)	4.6 ± 0.3(0)
^{140}Ba	1.18 ± 0.01(-3)	4.1 ± 0.9(-6)	2.9 ± 0.6(2)
^{140}La	<1.2(-4)	<6.4(-5)	
^{141}Ce	<9.4(-7)	8 ± 4(-7)	<1.2(0)
^{144}Ce	<2.6(-6)	<4.0(-7)	
^{187}W	<6.7(-4)	<4.6(-5)	
^{239}Np	<2.7(-5)	<8.8(-6)	

TABLE B.13

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
16:09; 11/30/77
Used for: 180 days
Bed Volumes Thru: 6.3(4)
Letdown Flow Rate: 60 gpm
Reactor Coolant Boron: 651 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	5.97 ± 0.03(-3)	<1.6(-6)	>3.7(3)
^{132}I	6.8 ± 0.1(-3)	<1.0(-4)	>6.8(1)
^{133}I	7.39 ± 0.06(-3)	<6.2(-5)	>1.4(2)
^{134}I	6.9 ± 0.3(-3)	<1.4(-4)	>4.9(1)
^{135}I	8.0 ± 0.2(-3)	<1.2(-4)	>6.7(1)
^{88}Rb	4.4 ± 0.7(-2)	2.5 ± 0.3(-2)	1.8 ± 0.4(0)
^{89}Rb	5.7 ± 0.5(-3)	<6.2(-4)	>9.2(0)
^{134}Cs	1.13 ± 0.01(-3)	5.77 ± 0.07(-4)	1.96 ± 0.03(0)
^{136}Cs	5.0 ± 0.3(-5)	3.08 ± 0.04(-5)	1.62 ± 0.10(0)
^{137}Cs	2.19 ± 0.02(-3)	9.5 ± 0.1(-4)	2.31 ± 0.03(0)
^{138}Cs	3.2 ± 0.1(-2)	3.2 ± 0.3(-3)	1.00 ± 0.10(1)
^{139}Cs	<5.2(-3)		
^{3}H	1.60 ± 0.05(-1)	1.63 ± 0.05(-1)	9.8 ± 0.4(-1)
^{14}C	3.2 ± 0.3(-6)	7.9 ± 0.8(-5)	4.1 ± 0.6(-2)
^{24}Na	6.9 ± 0.1(-3)	<2.6(-5)	>2.7(2)
^{51}Cr	1.3 ± 0.3(-4)	<1.2(-6)	>1.1(2)
^{54}Mn	1.68 ± 0.03(-4)	2.2 ± 0.1(-6)	7.6 ± 0.4(1)
^{55}Fe	5.3 ± 0.5(-5)	1.45 ± 0.04(-5)	3.7 ± 0.4(0)
^{59}Fe	<1.1(-5)	<6.9(-7)	
^{57}Co	2.2 ± 0.2(-5)	<1.3(-6)	>1.7(1)
^{58}Co	1.49 ± 0.02(-2)	1.03 ± 0.01(-4)	1.45 ± 0.02(2)
^{60}Co	2.45 ± 0.04(-3)	1.98 ± 0.04(-5)	1.24 ± 0.03(2)
^{63}Ni	1.49 ± 0.04(-5)	2.8 ± 0.1(-6)	5.3 ± 0.2(0)
^{65}Zn	<1.2(-5)	<4.8(-7)	
^{89}Sr	3.2 ± 0.1(-5)	1.4 ± 0.3(-7)	2.3 ± 0.5(2)
^{90}Sr	6.3 ± 0.6(-7)	7 ± 3(-9)	9.0 ± 4.0(1)
^{91}Sr	<1.6(-4)	<1.0(-4)	
^{91}Y	4 ± 2(-7)	2.4 ± 0.2(-7)	1.7 ± 0.8(0)
^{93}Y	<1.5(-4)	<5.8(-5)	
^{95}Zr	1.6 ± 0.4(-5)	<7.2(-7)	>2.2(1)
^{95}Nb	3.7 ± 0.9(-5)	1.4 ± 0.4(-6)	2.6 ± 1.0(1)
^{99}Mo	4.6 ± 0.2(-5)	<2.5(-6)	>1.8(1)
^{103}Ru	<1.1(-5)	1.1 ± 0.4(-6)	<1.0(1)
^{110m}Ag	5.7 ± 0.9(-5)	<1.3(-4)	>4.4(-1)
^{124}Sb	1.06 ± 0.03(-4)	1.6 ± 0.1(-6)	6.6 ± 0.5(1)
^{125}Sb	3.1 ± 0.7(-5)	6.3 ± 2.4(-6)	4.9 ± 2.2(0)
^{129m}Te	1.8 ± 0.8(-4)	<8.4(-7)	>2.1(2)
^{132}Te	<1.3(-5)	<2.4(-6)	
^{139}Ba	4.7 ± 0.1(-3)	3.61 ± 0.09(-3)	1.30 ± 0.04(0)
^{140}Ba	5.2 ± 1.4(-5)	<2.1(-6)	>2.5(1)
^{140}La	<1.6(-4)	<8.6(-7)	
^{141}Ce	<5.0(-6)	<1.1(-6)	
^{143}Ce	<3.5(-5)	<1.0(-5)	
^{144}Ce	<9.1(-6)	<9.7(-7)	
^{187}W	1.7 ± 0.2(-3)	<3.8(-5)	>4.5(1)
^{239}Np	<1.2(-5)	<3.6(-6)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
14:55, 12/6/77
Used for: 186 days
Bed Volumes Thru: 6.5(4)
Letdown Flow Rate: 60 gpm
Reactor Coolant Boron: 630 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	3.83 ± 0.08(-2)	<4.2(-6)	>9.1(3)
^{132}I	9.06 ± 0.09(-3)	<9.2(-5)	>9.8(1)
^{133}I	1.63 ± 0.02(-2)	<1.1(-5)	>1.5(3)
^{134}I	9.8 ± 0.4(-3)	<1.2(-4)	>8.2(1)
^{135}I	1.05 ± 0.01(-2)	<1.7(-5)	>6.2(2)
^{88}Rb	5.8 ± 0.5(-2)	1.5 ± 0.2(-2)	3.9 ± 0.6(0)
^{89}Rb	7.2 ± 0.3(-3)	<3.6(-4)	>2.0(1)
^{134}Cs	1.02 ± 0.01(-3)	1.13 ± 0.02(-3)	9.0 ± 0.2(-1)
^{136}Cs	7.7 ± 0.8(-5)	4.7 ± 0.2(-5)	1.6 ± 0.2(0)
^{137}Cs	2.06 ± 0.03(-3)	2.12 ± 0.03(-3)	9.7 ± 0.2(-1)
^{138}Cs	4.0 ± 0.1(-2)	3.2 ± 0.2(-3)	1.25 ± 0.08(1)
^{139}Cs	<2.1(-3)	<8.4(-4)	
^{24}Na	9.1 ± 0.2(-3)	<3.0(-6)	>3.0(3)
^{51}Cr	<3.5(-5)	<3.9(-6)	
^{54}Mn	<5.7(-5)	1.06 ± 0.07(-5)	<5.4(0)
^{56}Mn	<2.7(-4)	<1.3(-4)	
^{59}Fe	<1.5(-5)	<1.7(-6)	
^{57}Co	<6.6(-6)	<6.6(-6)	
^{58}Co	4.0 ± 0.1(-4)	5.8 ± 0.6(-5)	6.9 ± 0.7(0)
^{60}Co	4.4 ± 0.7(-5)	4.4 ± 0.7(-6)	1.0 ± 0.2(1)
^{65}Zn	<1.0(-5)	<1.4(-6)	
^{91}Sr	<5.2(-5)	<1.1(-5)	
^{93}Y	6.1 ± 1.6(-4)	<2.0(-5)	>3.1(1)
^{95}Zr	1.1 ± 0.3(-5)	<2.4(-6)	>4.6(0)
^{95}Nb	<2.9(-5)	4.6 ± 1.0(-6)	<6.3(0)
^{99}Mo	6.3 ± 0.3(-5)	<8.0(-6)	>7.9(0)
^{103}Ru	<7.7(-6)	<4.5(-6)	
^{110m}Ag	1.8 ± 0.8(-4)	<3.0(-4)	>6.0(-1)
^{124}Sb	<6.8(-6)	6.1 ± 1.2(-6)	<1.1(0)
^{125}Sb	<6.9(-6)	<4.2(-6)	
^{129m}Te	<5.1(-5)	<2.8(-6)	
^{132}Te	<1.8(-5)	<7.9(-6)	
^{139}Ba	6.8 ± 0.1(-3)	4.9 ± 0.1(-3)	1.39 ± 0.03(0)
^{140}Ba	4.5 ± 1.1(-5)	<4.0(-6)	>1.1(1)
^{140}La	<1.2(-5)	<1.9(-6)	
^{141}Ce	<1.1(-5)	<1.1(-5)	
^{143}Ce	<1.5(-5)	<6.4(-6)	
^{144}Ce	<7.3(-5)	<6.6(-6)	
^{187}W	1.3 ± 0.1(-3)	<1.1(-5)	>1.2(2)
^{239}Np	<9.3(-6)	<8.4(-6)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
12:42; 12/8/77
Used for: 188 days
Bed Volumes Thru: 6.6(4)
Letdown Flow Rate: 60 gpm
Reactor Coolant Boron: 637 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	6.8 ± 0.1(-3)	1.1 ± 0.3(-5)	6.2 ± 1.7(2)
^{132}I	9.1 ± 0.1(-3)	<4.6(-5)	>2.0(2)
^{133}I	9.8 ± 0.3(-3)	1.1 ± 0.4(-4)	8.9 ± 3.2(1)
^{134}I	9.7 ± 0.2(-3)	<4.6(-5)	>2.1(2)
^{135}I	9.7 ± 0.2(-3)	<2.9(-7)*	>3.3(4)
^{88}Rb	5.3 ± 0.3(-2)	1.18 ± 0.09(-2)	4.5 ± 0.4(0)
^{89}Rb	7.5 ± 0.2(-3)	2.0 ± 0.5(-4)	3.8 ± 0.9(1)
^{134}Cs	1.14 ± 0.02(-3)	1.09 ± 0.01(-3)	1.05 ± 0.02(0)
^{136}Cs	5.2 ± 0.5(-5)	4.3 ± 0.2(-5)	1.2 ± 0.1(0)
^{137}Cs	2.07 ± 0.02(-3)	1.98 ± 0.02(-3)	1.05 ± 0.01(0)
^{138}Cs	3.77 ± 0.09(-2)	2.4 ± 0.1(-3)	1.57 ± 0.08(1)
^{139}Cs	8.7 ± 2.1(-3)	<3.6(-4)	>2.4(1)
^{24}Na	7.7 ± 0.2(-3)	3.4 ± 0.2(-6)*	2.3 ± 0.1(3)
^{51}Cr	1.6 ± 0.2(-4)	1.0 ± 0.1(-5)*	1.6 ± 0.3(1)
^{54}Mn	5.5 ± 0.3(-5)	7.1 ± 1.2(-7)*	7.7 ± 1.4(1)
^{59}Fe	1.1 ± 0.4(-5)	3.7 ± 1.5(-7)*	3.0 ± 1.6(1)
^{57}Co	6.2 ± 3.4(-7)*	<3.3(-7)*	>1.9(0)
^{58}Co	3.5 ± 0.1(-4)	4.7 ± 0.2(-5)	7.4 ± 0.4(0)
^{60}Co	5.2 ± 0.5(-5)	6.9 ± 1.6(-6)	7.5 ± 1.9(0)
^{65}Zn	<9.2(-7)	<2.4(-7)*	
^{91}Sr	1.11 ± 0.08(-4)*	<3.6(-6)*	>3.1(1)
^{93}Y	6.1 ± 0.3(-4)*	<1.5(-7)*	>4.1(3)
^{95}Zr	7.9 ± 0.2(-6)*	9.1 ± 1.8(-7)*	8.7 ± 1.7(0)
^{95}Nb	7.7 ± 1.9(-6)	4.6 ± 1.1(-6)	1.7 ± 0.6(0)
^{99}Mo	8.3 ± 0.7(-5)	6.6 ± 0.1(-8)*	1.3 ± 0.1(3)
^{103}Ru	8.6 ± 3.5(-7)*	6.6 ± 1.4(-7)*	1.3 ± 0.6(0)
^{110m}Ag	<5.9(-4)	<3.1(-4)*	
^{124}Sb	6.2 ± 1.2(-6)*	2.1 ± 0.7(-6)	3.0 ± 1.1(0)
^{125}Sb	<1.3(-6)*	4.0 ± 3.6(-7)*	<3.3(0)
^{129m}Te	<6.5(-6)	2.2 ± 1.9(-7)*	<3.0(1)
^{132}Te	<1.5(-6)*	<1.0(-6)*	
^{139}Ba	7.7 ± 0.2(-3)	4.32 ± 0.09(-3)	1.8 ± 0.1(0)
^{140}Ba	4.9 ± 1.4(-5)	2.6 ± 0.7(-5)	1.9 ± 0.7(0)
^{140}La	3.53 ± 0.05(-5)*	1.9 ± 0.5(-7)*	1.9 ± 0.5(2)
^{141}Ce	<1.0(-6)*	<4.0(-7)*	
^{143}Ce	<2.4(-6)*	<1.4(-6)*	
^{144}Ce	<4.0(-5)*	<3.2(-7)*	
^{187}W	1.15 ± 0.05(-3)*	<1.5(-5)*	>7.7(1)
^{239}Np	6.2 ± 1.0(-6)*	2.2 ± 0.2(-6)*	2.8 ± 0.5(0)

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
08:38; 12/9/77
Used for: 189 days
Bed Volumes Thru: 6.7(4)
Letdown Flow Rate: 62 gpm
Reactor Coolant Boron: 638 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	9.8 ± 0.1(-2)	2.33 ± 0.06(-5)*	4.2 ± 0.1(3)
^{132}I	3.52 ± 0.05(-2)	<8.2(-5)	>4.3(2)
^{133}I	1.14 ± 0.01(-1)	2.27 ± 0.03(-5)*	5.02 ± 0.08(3)
^{134}I	1.03 ± 0.04(-2)	<8.2(-5)	>1.3(2)
^{135}I	5.2 ± 0.2(-2)	7.5 ± 0.4(-6)*	6.9 ± 0.5(3)
^{88}Rb	5.7 ± 0.7(-2)	1.6 ± 0.2(-2)	3.6 ± 0.6(0)
^{89}Rb	7.9 ± 0.5(-3)	8.1 ± 1.7(-4)	9.8 ± 2.1(0)
^{134}Cs	4.82 ± 0.05(-3)	8.23 ± 0.09(-4)	5.86 ± 0.09(0)
^{136}Cs	2.65 ± 0.04(-3)	3.6 ± 0.2(-5)	7.4 ± 0.4(1)
^{137}Cs	7.71 ± 0.09(-3)	1.52 ± 0.02(-3)	5.07 ± 0.09(0)
^{138}Cs	5.0 ± 0.1(-2)	3.2 ± 0.3(-3)	1.6 ± 0.1(1)
^{139}Cs	<2.6(-3)	<1.0(-3)	
^{24}Na	4.5 ± 0.2(-3)	6.1 ± 0.4(-6)*	6.4 ± 0.6(2)
^{51}Cr	2.1 ± 0.3(-3)	4.2 ± 1.3(-5)	5.0 ± 1.7(1)
^{54}Mn	3.3 ± 0.1(-4)	5.7 ± 0.9(-6)	5.8 ± 0.9(1)
^{59}Fe	2.1 ± 0.1(-4)	1.26 ± 0.06(-6)*	1.7 ± 0.1(2)
^{57}Co	<9.4(-6)*	<2.6(-7)*	
^{58}Co	5.06 ± 0.04(-3)	1.27 ± 0.03(-4)	4.0 ± 0.1(1)
^{60}Co	3.9 ± 0.2(-4)	3.0 ± 0.2(-5)	1.3 ± 0.1(1)
^{65}Zn	5.6 ± 1.5(-5)	2.6 ± 1.0(-7)*	2.2 ± 1.0(2)
^{91}Sr	1.1 ± 0.4(-4)*	<8.2(-6)*	>1.3(1)
^{93}Y	5.1 ± 0.7(-3)	<2.1(-7)*	>2.4(4)
^{95}Zr	1.3 ± 0.1(-4)	1.0 ± 0.2(-5)	1.3 ± 0.3(1)
^{95}Nb	1.3 ± 0.2(-4)	9.4 ± 1.8(-6)	1.4 ± 0.3(1)
^{99}Mo	2.43 ± 0.02(-3)	4.3 ± 0.2(-6)*	5.7 ± 0.3(2)
^{103}Ru	<1.1(-5)*	<6.0(-6)*	
^{110m}Ag	2.9 ± 1.3(-4)	<2.2(-4)*	>1.3(0)
^{124}Sb	5.2 ± 0.7(-5)	7.9 ± 1.4(-6)	6.6 ± 1.5(0)
^{125}Sb	<1.0(-5)*	7.2 ± 3.2(-7)*	<1.4(1)
^{129m}Te	<3.2(-5)	<3.3(-7)	
^{132}Te	<1.7(-5)*	<6.2(-7)*	
^{139}Ba	6.3 ± 0.4(-3)	4.7 ± 0.2(-3)	1.3 ± 0.1(0)
^{140}Ba	8.8 ± 4.1(-5)*	<7.4(-7)*	>1.2(2)
^{140}La	2.0 ± 0.2(-4)	4.6 ± 0.4(-7)*	4.3 ± 0.6(2)
^{141}Ce	<1.8(-5)*	<3.1(-7)*	
^{143}Ce	<2.4(-5)*	<1.3(-6)*	
^{144}Ce	<3.2(-5)	2.1 ± 1.3(-7)*	<1.5(2)
^{187}W	2.3 ± 0.3(-3)	<4.2(-5)*	>5.5(1)
^{239}Np	1.9 ± 1.1(-5)*	1.9 ± 0.2(-6)*	1.0 ± 0.6(1)

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
09:18; 12/10/77
Used for: 190 days
Bed Volumes Thru: 6.7(4)
Letdown Flow Rate: 65 gpm
Reactor Coolant Boron: 644 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	2.00 ± 0.04(-2)	1.58 ± 0.03(-6)*	1.27 ± 0.03(4)
^{132}I	1.00 ± 0.05(-2)	<8.0(-5)	>1.3(2)
^{133}I	1.88 ± 0.03(-2)	8.4 ± 1.3(-7)*	2.2 ± 0.3(4)
^{134}I		<1.2(-4)	
^{135}I	1.23 ± 0.02(-2)	<1.2(-6)*	>1.0(4)
^{88}Rb		3.3 ± 0.6(-2)	
^{89}Rb		<1.1(-3)	
^{134}Cs	1.19 ± 0.01(-3)	7.1 ± 0.1(-4)	1.68 ± 0.03(0)
^{136}Cs	3.35 ± 0.09(-4)	2.31 ± 0.05(-5)	1.45 ± 0.05(1)
^{137}Cs	2.22 ± 0.02(-3)	1.38 ± 0.02(-3)	1.61 ± 0.03(0)
^{138}Cs		3.9 ± 1.2(-3)	
^{139}Cs		<8.3(-3)	
^{24}Na	5.03 ± 0.09(-3)	6.7 ± 1.7(-6)*	7.5 ± 1.9(2)
^{51}Cr	2.5 ± 0.5(-4)	2.9 ± 0.3(-5)	8.6 ± 1.9(0)
^{54}Mn	8.2 ± 0.2(-5)	4.9 ± 0.2(-6)	1.67 ± 0.08(1)
^{59}Fe	2.9 ± 0.2(-5)	2.1 ± 0.3(-6)	1.4 ± 0.2(1)
^{57}Co	1.9 ± 0.4(-6)*	<3.8(-7)*	>5.0(0)
^{58}Co	8.2 ± 0.1(-4)	1.01 ± 0.02(-4)	8.1 ± 0.2(0)
^{60}Co	8.5 ± 0.2(-5)	1.70 ± 0.06(-5)	5.0 ± 0.2(0)
^{65}Zn	7.3 ± 0.3(-6)*	<2.8(-7)*	>2.6(1)
^{91}Sr	2.2 ± 0.2(-4)	<5.6(-5)	>3.9(0)
^{93}Y	3.8 ± 0.8(-4)	<6.0(-6)*	>6.3(1)
^{95}Zr	2.2 ± 0.2(-5)	7.7 ± 0.4(-6)	2.9 ± 0.3(0)
^{95}Nb	1.7 ± 0.4(-5)	9.0 ± 0.6(-6)	1.9 ± 0.5(0)
^{99}Mo	7.14 ± 0.06(-4)	1.05 ± 0.01(-6)*	6.8 ± 0.1(2)
^{103}Ru	3.8 ± 1.4(-6)	<1.2(-6)*	>3.2(0)
^{110m}Ag	<3.8(-4)*	<2.2(-4)*	
^{124}Sb	7.9 ± 1.1(-6)	6.3 ± 0.4(-6)	1.3 ± 0.2(0)
^{125}Sb	<4.5(-6)	3.2 ± 0.6(-6)	<1.4(0)
^{129m}Te	<4.5(-6)*	<4.6(-7)	
^{132}Te	7.7 ± 2.3(-6)	9.3 ± 3.0(-7)*	8.3 ± 3.6(0)
^{139}Ba	<1.4(-3)	4.07 ± 0.08(-3)	<3.4(-1)
^{140}Ba	7.9 ± 0.6(-5)	<1.1(-6)*	>7.2(1)
^{140}La	2.03 ± 0.07(-5)	6.2 ± 1.1(-7)*	3.3 ± 0.6(1)
^{141}Ce	<2.8(-6)*	<4.3(-7)*	
^{143}Ce	<8.3(-6)*	5.5 ± 2.2(-6)*	<1.5(0)
^{144}Ce	<2.5(-6)*	<4.0(-7)*	
^{187}W	4.6 ± 0.5(-4)	<2.8(-5)*	>1.6(1)
^{239}Np	1.4 ± 0.6(-5)	1.5 ± 0.8(-6)*	9.3 ± 6.4(0)

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
10:54; 12/11/77
Used for: 191 days
Bed Volumes Thru: 6.7(4)
Letdown Flow Rate: 60 gpm
Reactor Coolant Boron: 621 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	7.96 ± 0.09(-3)	8.9 ± 0.1(-7)*	8.9 ± 0.1(3)
^{132}I	1.11 ± 0.02(-2)	<1.0(-4)	>1.1(2)
^{133}I	1.28 ± 0.02(-2)	<6.0(-7)*	>2.1(4)
^{134}I	1.09 ± 0.03(-2)	<1.1(-4)	>9.9(1)
^{135}I	1.18 ± 0.04(-2)	<1.3(-6)*	>9.1(3)
^{88}Rb	6.1 ± 1.6(-2)	1.7 ± 0.3(-2)	3.7 ± 1.2(0)
^{89}Rb	4.2 ± 1.5(-3)	<4.3(-4)	>9.8(0)
^{134}Cs	7.7 ± 0.2(-4)	7.4 ± 0.1(-4)	1.04 ± 0.03(0)
^{136}Cs	6.8 ± 0.7(-5)	2.36 ± 0.05(-5)	2.9 ± 0.3(0)
^{137}Cs	1.51 ± 0.03(-3)	1.39 ± 0.02(-3)	1.09 ± 0.03(0)
^{138}Cs	4.1 ± 0.3(-2)	1.9 ± 0.2(-3)	2.1 ± 0.3(1)
^{139}Cs		<1.8(-3)	
^{24}Na	5.7 ± 0.2(-3)	3.8 ± 1.1(-6)*	1.5 ± 0.4(3)
^{51}Cr	1.90 ± 0.07(-4)	9.5 ± 5.7(-6)	2.0 ± 1.2(1)
^{54}Mn	6.5 ± 0.o(-5)	9.6 ± 0.9(-7)	6.8 ± 0.7(1)
^{59}Fe	2.3 ± 0.1(-5)	9.7 ± 2.4(-7)	2.4 ± 0.6(1)
^{57}Co	1.1 ± 0.2(-6)	<4.8(-7)*	>2.3(0)
^{58}Co	6.8 ± 0.2(-4)	2.13 ± 0.05(-5)	3.2 ± 0.1(1)
^{60}Co	6.3 ± 0.2(-5)	2.7 ± 0.1(-6)	2.3 ± 0.1(1)
^{65}Zn	2.6 ± 0.7(-6)	<3.2(-7)*	>3.1(0)
^{90}Sr	7.9 ± 0.7(-4)*	<6.6(-5)*	>1.2(1)
^{91}Y	3.1 ± 0.2(-3)*	<1.0(-5)*	>3.1(2)
^{95}Zr	1.80 ± 0.08(-5)	3.3 ± 0.3(-6)	5.4 ± 0.6(0)
^{95}Nb	1.8 ± 0.2(-5)	4.3 ± 0.3(-6)	4.2 ± 0.5(0)
^{99}Mo	7.9 ± 0.2(-4)*	6.1 ± 0.1(-7)*	1.3 ± 0.1(3)
^{103}Ru	1.9 ± 0.3(-6)*	<1.1(-6)*	>1.7(0)
^{110m}Ag	<2.6(-4)*	<2.2(-4)*	
^{124}Sb	8.1 ± 0.7(-6)	2.2 ± 0.2(-6)	3.6 ± 0.5(0)
^{125}Sb	<1.4(-6)*	<1.0(-6)	
^{129m}Te	<2.3(-6)	2.2 ± 0.7(-5)	<1.0(-1)
^{132}Te	5.6 ± 0.6(-6)*	<1.9(-6)*	>2.9(0)
^{139}Ba	5.1 ± 0.2(-3)	4.5 ± 0.1(-3)	1.13 ± 0.06(0)
^{140}Ba	7.8 ± 0.7(-5)	<1.3(-6)*	>6.0(1)
^{140}La	6.7 ± 5.5(-6)*	<4.2(-7)*	>1.6(1)
^{141}Ce	<1.9(-6)	1.2 ± 0.4(-6)	>1.6(0)
^{143}Ce	2.6 ± 2.4(-6)*	<4.2(-6)*	>6.2(-1)
^{144}Ce	<1.5(-6)	<5.2(-7)*	
^{187}W	9.0 ± 2.2(-4)	<2.6(-5)*	>3.5(1)
^{239}Np	<1.8(-6)*	1.2 ± 0.6(-6)*	<1.5(0)

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
09:31; 12/12/77
Used for: 192 days
Bed Volumes Thru: 6.8(4)
Letdown Flow Rate: 53 gpm
Reactor Coolant Boron: 616 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	8.1 ± 0.1(-3)	4.0 ± 0.1(-7)*	2.0 ± 0.1(4)
^{132}I	3.48 ± 0.07(-3)	<8.4(-5)	>4.1(1)
^{133}I	7.7 ± 0.1(-3)	<9.7(-8)*	>7.9(4)
^{134}I	3.6 ± 0.1(-3)	<3.3(-4)	>1.1(1)
^{135}I	4.8 ± 0.2(-3)	<4.2(-7)*	>1.1(3)
^{88}Rb	5.0 ± 1.0(-2)	1.5 ± 0.7(-1)	3.3 ± 1.7(-1)
^{89}Rb	<4.4(-3)	<2.2(-2)	
^{134}Cs	7.3 ± 0.2(-4)	7.22 ± 0.06(-4)	1.01 ± 0.02(0)
^{136}Cs	5.7 ± 0.7(-5)	2.32 ± 0.05(-5)	2.4 ± 0.3(0)
^{137}Cs	1.50 ± 0.03(-3)	1.39 ± 0.01(-3)	1.08 ± 0.02(0)
^{138}Cs	1.3 ± 0.2(-2)	1.34 ± 0.05(-2)	9.9 ± 1.5(-1)
^{139}Cs	<4.6(-2)		
^{3}H	1.48 ± 0.01(-2)	1.27 ± 0.01(-1)	1.17 ± 0.01(-1)
^{14}C	1.41 ± 0.03(-6)	6.82 ± 0.02(-5)	2.07 ± 0.04(-2)
^{24}Na	3.26 ± 0.09(-3)	2.4 ± 0.4(-6)*	1.4 ± 0.2(3)
^{32}P	3.6 ± 0.1(-5)	1.6 ± 0.5(-7)	2.3 ± 0.7(2)
^{51}Cr	8.3 ± 1.0(-5)	4.5 ± 0.3(-6)*	1.8 ± 0.3(1)
^{54}Mn	6.2 ± 0.2(-5)	1.3 ± 0.2(-6)	4.9 ± 0.8(1)
^{55}Fe	4.47 ± 0.06(-6)	4.43 ± 0.06(-6)	1.01 ± 0.02(0)
^{59}Fe	1.61 ± 0.08(-5)	2.2 ± 1.2(-7)*	7.3 ± 4.0(1)
^{57}Co	1.1 ± 0.3(-6)	<3.6(-7)*	>3.1(0)
^{58}Co	4.2 ± 0.1(-4)	4.28 ± 0.04(-5)	9.8 ± 0.3(0)
^{60}Co	6.5 ± 0.1(-5)	7.7 ± 0.2(-6)	8.5 ± 0.3(0)
^{63}Ni	1.25 ± 0.07(-6)	2.27 ± 0.07(-6)	5.5 ± 0.4(-1)
^{65}Zn	1.9 ± 0.4(-6)*	<2.3(-7)*	>8.3(0)
^{89}Sr	5.1 ± 0.2(-6)	3 ± 1(-7)	1.7 ± 0.6(1)
^{90}Sr	8 ± 2(-8)	<1.4(-7)	>5.7(-1)
^{91}Sr	1.8 ± 0.3(-4)*	<1.2(-5)*	>1.5(1)
^{91}Y	1.1 ± 0.4(-7)	7 ± 4(-8)	2 ± 1(0)
^{93}Y	1.34 ± 0.09(-3)*	<5.1(-7)*	>2.6(3)
^{95}Nb	5.0 ± 0.9(-6)	3.0 ± 0.3(-6)	1.7 ± 0.3(0)
^{99}Mo	6.5 ± 1.8(-5)	4.29 ± 0.05(-7)*	1.5 ± 0.4(2)
^{103}Ru	8.3 ± 3.7(-7)*	<7.2(-7)*	>1.2(0)
^{110m}Ag	<2.3(-4)*	<2.1(-4)*	
^{124}Sb	6.2 ± 0.5(-6)	2.4 ± 0.2(-6)	2.6 ± 0.3(0)
^{125}Sb	1.2 ± 0.8(-6)*	<1.1(-6)*	>1.1(0)
^{129m}Te	<2.1(-6)	3.6(-7)*	
^{132}Te	3.8 ± 0.5(-6)*	<9.0(-7)*	>4.2(0)
^{139}Ba	1.7 ± 0.2(-3)	2.90 ± 0.06(-3)	5.9 ± 0.5(-1)
^{140}Ba	1.06 ± 0.07(-4)	<8.1(-7)*	>1.3(2)
^{140}La	1.00 ± 0.03(-4)*	9.7 ± 7.5(-8)*	1.0 ± 0.8(3)
^{141}Ce	<1.4(-6)*	<3.4(-7)*	
^{143}Ce	<2.2(-6)*	4.4 ± 1.5(-6)*	<5.0(-1)
^{144}Ce	<1.3(-6)	<3.2(-7)*	
^{187}W	3.7 ± 0.6(-4)*	<1.2(-5)*	>3.1(1)
^{239}Np	2.6 ± 1.8(-6)*	1.2 ± 0.4(-6)*	2.2 ± 1.7(0)

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
14:14; 12/13/77
Used for: 193 days
Bed Volumes Thru: 6.8(4)
Letdown Flow Rate: 62 gpm
Reactor Coolant Boron: 620 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	5.93 ± 0.07(-3)	8.3 ± 0.2(-7)*	7.1 ± 0.2(3)
^{132}I	1.09 ± 0.02(-2)	<2.2(-5)	>5.0(2)
^{133}I	7.0 ± 0.2(-3)*	2.1 ± 0.3(-7)*	3.3 ± 0.5(4)
^{134}I	1.09 ± 0.05(-2)	<2.2(-5)	>5.0(2)
^{135}I	1.14 ± 0.03(-2)	<3.4(-7)*	>3.4(4)
^{88}Rb	5.0 ± 0.1(-2)	7.5 ± 0.6(-3)	6.7 ± 0.5(0)
^{89}Rb	7.3 ± 0.2(-3)	9.8 ± 2.1(-5)	7.4 ± 1.6(1)
^{134}Cs	7.0 ± 0.2(-4)	7.2 ± 0.1(-4)	9.7 ± 0.3(-1)
^{136}Cs	3.0 ± 0.8(-5)	2.19 ± 0.05(-5)	1.4 ± 0.4(0)
^{137}Cs	1.40 ± 0.03(-3)	1.36 ± 0.02(-3)	1.03 ± 0.03(0)
^{138}Cs	3.67 ± 0.05(-2)	1.47 ± 0.07(-3)	2.5 ± 0.1(1)
^{139}Cs	1.3 ± 0.2(-2)	<1.5(-4)	>8.7(1)
^{24}Na	5.0 ± 0.1(-3)	3.1 ± 0.3(-6)*	1.6 ± 0.2(3)
^{51}Cr	2.73 ± 0.09(-4)	1.2 ± 0.3(-5)	2.3 ± 0.6(1)
^{54}Mn	5.9 ± 0.1(-5)	9.5 ± 0.6(-7)	6.2 ± 0.4(1)
^{59}Fe	1.70 ± 0.09(-5)	7.7 ± 1.6(-7)	2.2 ± 0.5(1)
^{57}Co	9.9 ± 2.2(-7)	<4.4(-7)*	>2.3(0)
^{58}Co	6.5 ± 0.2(-4)	2.35 ± 0.03(-5)	2.8 ± 0.1(1)
^{60}Co	5.5 ± 0.1(-5)	4.3 ± 0.1(-6)	1.3 ± 0.1(1)
^{65}Zn	2.5 ± 0.5(-6)	<3.6(-7)*	>6.9(0)
^{91}Sr	5.5 ± 0.7(-5)*	<3.8(-6)*	>1.4(1)
^{93}Y	4.2 ± 0.3(-4)*	<1.2(-7)*	>3.5(3)
^{95}Zr	1.89 ± 0.09(-5)	2.5 ± 0.2(-6)	7.6 ± 0.7(0)
^{95}Nb	1.8 ± 0.1(-5)	3.1 ± 0.3(-6)	5.8 ± 0.6(0)
^{99}Mo	4.0 ± 0.8(-4)	3.36 ± 0.07(-7)*	1.2 ± 0.2(3)
^{103}Ru	1.4 ± 0.2(-6)*	<7.4(-7)*	>1.9(0)
^{110m}Ag	<2.5(-4)*	<2.3(-4)*	
^{124}Sb	7.1 ± 0.5(-6)	2.1 ± 0.1(-6)	3.4 ± 0.3(0)
^{125}Sb	1.6 ± 0.6(-6)*	<7.8(-7)*	>2.1(0)
^{129m}Te	<2.2(-6)	<3.7(-7)*	
^{132}Te	7.8 ± 3.9(-7)*	<6.8(-7)*	>1.1(0)
^{139}Ba	5.3 ± 0.3(-3)	2.17 ± 0.02(-3)	2.4 ± 0.1(0)
^{140}Ba	7.4 ± 0.7(-5)	<7.8(-7)*	>9.5(1)
^{140}La	6.0 ± 0.1(-5)*	2.4 ± 0.3(-7)*	2.5 ± 0.3(2)
^{141}Ce	<1.3(-6)*	<3.6(-7)*	
^{143}Ce	<2.3(-6)*	<1.3(-6)*	
^{144}Ce	<9.0(-7)	<5.0(-7)	
^{187}W	8.2 ± 1.8(-4)	<9.0(-6)*	>9.1(1)
^{239}Np	<1.3(-4)	1.5 ± 0.3(-6)*	<8.7(1)

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* : Resin Column Data

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
11:41; 2/10/78
Used for: 252 days
Bed Volumes Thru: 9.2(4)
Letdown Flow Rate: 65 gpm
Reactor Coolant Boron: 448 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	6.68 ± 0.06(-3)	<1.5(-6)	>4.5(3)
^{132}I	1.45 ± 0.01(-2)	<4.2(-5)	>3.5(2)
^{133}I	1.25 ± 0.02(-2)	4.8 ± 1.1(-5)	2.6 ± 0.6(2)
^{134}I	1.45 ± 0.03(-2)	<6.0(-5)	>2.4(2)
^{135}I	1.35 ± 0.02(-2)	<1.2(-5)	>1.1(3)
^{88}Rb	4.9 ± 0.2(-2)	1.0 ± 0.2(-2)	4.8 ± 0.8(0)
^{89}Rb	8.0 ± 0.2(-3)	4.1 ± 0.7(-4)	2.0 ± 0.4(1)
^{134}Cs	7.60 ± 0.09(-4)	7.86 ± 0.05(-4)	9.7 ± 0.1(-1)
^{136}Cs	2.6 ± 0.4(-5)	1.20 ± 0.02(-5)	2.2 ± 0.3(0)
^{137}Cs	1.51 ± 0.01(-3)	1.53 ± 0.01(-3)	9.87 ± 0.09(-1)
^{138}Cs	3.65 ± 0.08(-2)	2.3 ± 0.3(-3)	1.6 ± 0.2(1)
^{139}Cs	1.4 ± 0.3(-2)	<4.4(-4)	>3.1(1)
^{24}Na	4.81 ± 0.08(-3)	<1.7(-6)	>2.8(3)
^{51}Cr	6.3 ± 1.0(-5)	<1.0(-6)	>6.3(1)
^{54}Mn	4.9 ± 0.2(-5)	5.8 ± 0.4(-6)	8.5 ± 0.6(0)
^{59}Fe	8.5 ± 1.1(-6)	<4.4(-7)	
^{57}Co	<2.0(-6)	<9.4(-7)	
^{58}Co	2.93 ± 0.05(-4)	2.6 ± 0.2(-6)	1.11 ± 0.07(2)
^{60}Co	3.0 ± 0.1(-5)	4.5 ± 1.3(-7)	6.6 ± 1.9(1)
^{65}Zn	<2.3(-6)	<4.7(-7)	
^{91}Sr	1.8 ± 0.4(-4)	<6.1(-6)	>2.9(1)
^{93}Y	3.7 ± 2.2(-4)	<1.4(-5)	>2.6(1)
^{95}Zr	5.4 ± 0.9(-6)	<7.2(-7)	>7.5(0)
^{95}Nb	6.2 ± 0.8(-6)	<6.8(-7)	>9.1(0)
^{99}Mo	7.4 ± 0.3(-5)	<3.6(-6)	>2.1(1)
^{103}Ru	<4.4(-6)	<1.2(-6)	
^{110m}Ag	<2.9(-4)	<2.0(-4)	
^{124}Sb	1.7 ± 0.4(-6)	5.6 ± 0.8(-7)	3.1 ± 0.9(0)
^{125}Sb	6.1 ± 2.7(-6)	<1.8(-6)	>3.4(0)
^{129m}Te	<2.6(-6)	<7.6(-7)	
^{132}Te	<1.1(-5)	<2.2(-6)	
^{139}Ba	6.1 ± 0.1(-3)	3.40 ± 0.04(-3)	1.80 ± 0.04(0)
^{140}Ba	6.6 ± 0.5(-5)	<1.4(-6)	>4.7(1)
^{140}La	<1.1(-5)	<5.0(-7)	
^{141}Ce	<2.8(-6)	<1.2(-6)	
^{143}Ce	<1.0(-5)	<4.3(-6)	
^{144}Ce	<2.2(-6)	<1.2(-6)	
^{187}W	5.5 ± 0.7(-4)	<1.6(-5)	>3.5(1)
^{239}Np	<6.0(-6)	<5.0(-6)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
16:03; 2/10/78
Used for: 252 days
Bed Volumes Thru: 9.2(4)
Letdown Flow Rate: 65 gpm
Reactor Coolant Boron: 448 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	6.31 ± 0.06(-3)	<2.8(-6)	>2.3(3)
^{132}I	1.32 ± 0.01(-2)	<6.8(-5)	>1.9(2)
^{133}I	1.22 ± 0.02(-2)	<6.2(-6)	>2.0(3)
^{134}I	1.25 ± 0.04(-2)	<8.8(-5)	>1.4(2)
^{135}I	1.26 ± 0.01(-2)	<1.2(-5)	>1.1(3)
^{88}Rb	4.9 ± 0.3(-2)	1.2 ± 0.2(-2)	4.1 ± 0.8(0)
^{89}Rb	8.4 ± 0.3(-3)	<2.1(-4)	>4.0(1)
^{134}Cs	7.29 ± 0.07(-4)	7.72 ± 0.08(-4)	9.4 ± 0.1(-1)
^{136}Cs	2.7 ± 0.4(-5)	1.30 ± 0.04(-5)	2.1 ± 0.3(0)
^{137}Cs	1.47 ± 0.01(-3)	1.49 ± 0.02(-3)	9.9 ± 0.1(-1)
^{138}Cs	3.94±± 0.08(-2)	2.5 ± 0.3(-3)	1.6 ± 0.2(1)
^{139}Cs	<8.8(-4)	<6.2(-4)	
^{24}Na	4.61 ± 0.07(-3)	1.4 ± 0.4(-6)	3.3 ± 1.0(3)
^{51}Cr	4.7 ± 1.2(-5)	<1.7(-6)	>2.8(1)
^{54}Mn	5.2 ± 0.1(-5)	1.2 ± 0.1(-6)	4.3 ± 0.5(1)
^{59}Fe	1.5 ± 0.6(-6)	<6.8(-7)	>1.6(0)
^{57}Co	1.5 ± 0.6(-6)	<9.4(-7)	>1.6(0)
^{58}Co	3.37 ± 0.05(-4)	2.89 ± 0.05(-5)	1.17 ± 0.03(1)
^{60}Co	3.4 ± 0.1(-5)	2.5 ± 0.1(-6)	1.33 ± 0.09(1)
^{65}Zn	<2.6(-6)	<6.1(-7)	
^{91}Sr	1.18 ± 0.08(-4)	<5.6(-6)	>2.1(1)
^{93}Y	2.4 ± 0.6(-4)	<1.8(-5)	>1.3(1)
^{95}Zr	8.4 ± 1.0(-6)	2.1 ± 0.6(-6)	4.0 ± 1.1(0)
^{95}Nb	7.5 ± 1.1(-6)	2.1 ± 0.2(-6)	3.5 ± 0.6(0)
^{99}Mo	6.6 ± 0.2(-5)	<6.5(-6)	>1.0(1)
^{103}Ru	<4.4(-6)	<1.9(-6)	
^{110m}Ag	2.9 ± 0.9(-4)	<2.4(-4)	>1.2(0)
^{124}Sb	2.8 ± 0.7(-6)	8.3 ± 1.3(-7)	3.4 ± 1.0(0)
^{125}Sb	<3.4(-6)	<1.7(-6)	
^{129m}Te	<2.7(-6)	<1.2(-6)	
^{132}Te	<8.8(-6)	<9.5(-6)	
^{139}Ba	5.7 ± 0.1(-4)	4.07 ± 0.08(-3)	1.40 ± 0.04(-1)
^{140}Ba	5.6 ± 0.5(-5)	<2.6(-6)	>2.1(1)
^{140}La	1.3 ± 0.4(-5)	<1.0(-6)	>1.3(1)
^{141}Ce	<3.8(-6)	<1.5(-6)	
^{143}Ce	<1.1(-5)	<6.4(-6)	
^{144}Ce	<2.3(-6)	<9.9(-7)	
^{187}W	4.7 ± 0.3(-4)	<1.9(-5)	>2.5(1)
^{239}Np	<5.6(-6)	<6.0(-6)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
13:25; 2/14/78
Used for: 256 days
Bed Volumes Thru: 9.4(4)
Letdown Flow Rate: 62 gpm
Reactor Coolant Boron: 428 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	8.11 ± 0.08(-3)	1.4 ± 1.0(-7)*	5.8 ± 4.1(4)
^{132}I	1.49 ± 0.02(-2)	<3.2(-6)*	>4.7(3)
^{133}I	1.34 ± 0.02(-2)	<3.0(-7)*	>4.5(4)
^{134}I	1.64 ± 0.06(-2)	<4.5(-5)*	>3.6(2)
^{135}I	1.35 ± 0.01(-2)	<9.7(-7)*	>1.4(4)
^{88}Rb	4.9 ± 0.3(-2)	1.2 ± 0.1(-2)	4.1 ± 0.4(0)
^{89}Rb	8.7 ± 0.3(-3)	3.9 ± 0.8(-4)	2.2 ± 0.5(1)
^{134}Cs	8.0 ± 0.1(-4)	7.69 ± 0.06(-4)	1.04 ± 0.02(0)
^{136}Cs	2.3 ± 0.2(-5)	1.09 ± 0.02(-5)	2.1 ± 0.2(0)
^{137}Cs	1.51 ± 0.02(-3)	1.54 ± 0.01(-3)	9.8 ± 0.1(-1)
^{138}Cs	3.6 ± 0.1(-2)	2.7 ± 0.2(-3)	1.3 ± 0.1(1)
^{139}Cs	8.0 ± 2.1(-3)	<6.8(-4)	>1.2(1)
^{24}Na	4.73 ± 0.05(-3)	2.5 ± 0.4(-6)	1.9 ± 0.3(3)
^{51}Cr	<5.9 ± (-6)	2.7 ± 0.4(-6)*	<2.2(0)
^{54}Mn	4.9 ± 0.1(-5)	<8.4(-7)	>5.8(1)
^{59}Fe	1.05 ± 0.09(-5)	1.3 ± 0.3(-7)*	8.1 ± 2.0(1)
^{57}Co	<3.2 ± (-6)	<6.8(-8)*	
^{58}Co	3.52 ± 0.04(-4)	1.45 ± 0.04(-5)	2.43 ± 0.07(1)
^{60}Co	3.21 ± 0.07(-5)	1.2 ± 0.2(-6)	2.7 ± 0.4(1)
^{65}Zn	<1.7 ± (-6)	4.2 ± 3.2(-8)	<4.0(1)
^{91}Sr	1.2 ± 0.2(-4)	<2.4(-7)*	>5.0(2)
^{93}Y	<6.4 ± (-5)	<3.1(-7)*	
^{95}Zr	6.3 ± 1.0(-6)	4.2 ± 0.3(-7)*	1.5 ± 0.3(1)
^{95}Nb	6.2 ± 0.7(-6)	1.1 ± 0.2(-6)	5.6 ± 1.2(0)
^{99}Mo	7.7 ± 0.3(-5)	5.2 ± 4.2(-8)*	1.5 ± 1.2(3)
^{103}Ru	<5.1(-6)	<1.9(-7)*	
^{110m}Ag	2.8 ± 0.3(-4)	<1.7(-4)	>1.6(0)
^{124}Sb	2.5 ± 0.4(-6)	7.5 ± 1.9(-7)	3.3 ± 1.0(0)
^{125}Sb	<4.4(-6)	3.1 ± 2.0(-7)*	<1.4(1)
^{129m}Te	<2.7(-6)	<1.2(-7)*	
^{132}Te	<1.0(-5)	2.3 ± 0.9(-7)*	<4.3(1)
^{139}Ba	4.4 ± 0.2(-3)	4.38 ± 0.06(-3)	1.00 ± 0.05(0)
^{140}Ba	5.5 ± 0.4(-5)	<1.6(-7)*	>3.4(2)
^{140}La	1.17 ± 0.05(-5)	1.7 ± 0.6(-7)*	6.9 ± 2.4(1)
^{141}Ce	<3.8(-6)	9.9 ± 4.1(-8)*	<3.8(1)
^{143}Ce	<1.1(-5)	<2.1(-7)*	
^{144}Ce	<4.4(-6)	9.0 ± 3.4(-8)*	<4.9(1)
^{187}W	6.0 ± 0.7(-4)	<6.9(-6)	>8.7(1)
^{239}Np	<5.5 ± (-6)	<1.4(-7)*	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
17:55; 4/12/78
Used for: 299 days
Bed Volumes Thru: 1.10(5)
Letdown Flow Rate: 65 gpm
Reactor Coolant Boron: 337 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	8.6 ± 0.2(-2)	9.3 ± 0.2(-2)	9.2 ± 0.3(-1)
^{132}I	1.97 ± 0.04(-2)	2.33 ± 0.07(-2)	8.5 ± 0.3(-1)
^{133}I	4.4 ± 0.1(-2)	5.0 ± 0.1(-2)	8.8 ± 0.3(-1)
^{134}I	1.72 ± 0.05(-2)	2.11 ± 0.05(-2)	8.2 ± 0.3(-1)
^{135}I	2.59 ± 0.03(-2)	2.72 ± 0.05(-2)	9.5 ± 0.2(-1)
^{88}Rb	4.3 ± 0.1(-2)	6.5 ± 0.8(-2)	6.6 ± 0.8(-1)
^{89}Rb	9.5 ± 0.3(-3)	6.6 ± 1.3(-3)	1.4 ± 0.3(0)
^{134}Cs	1.66 ± 0.03(-3)	1.65 ± 0.05(-3)	1.01 ± 0.04(0)
^{136}Cs	2.2 ± 0.2(-4)	2.6 ± 0.2(-4)	8.5 ± 1.0(-1)
^{137}Cs	2.83 ± 0.04(-3)	2.94 ± 0.05(-3)	9.6 ± 0.2(-1)
^{138}Cs	4.06 ± 0.07(-2)	4.3 ± 0.2(-2)	9.4 ± 0.5(-1)
^{139}Cs	1.4 ± 0.4(-2)	<1.8(-2)	>7.8(-1)
^{24}Na	2.33 ± 0.03(-2)	2.34 ± 0.04(-2)	1.00 ± 0.02(0)
^{51}Cr	<5.2(-5)	<9.6(-5)	
^{54}Mn	<2.0(-4)	<2.3(-4)	
^{59}Fe	<4.5(-5)	<4.6(-5)	
^{57}Co	<1.9(-5)	<6.4(-5)	
^{58}Co	4.6 ± 0.2(-4)	6.4 ± 0.2(-4)	7.2 ± 0.4(-1)
^{60}Co	4.0 ± 0.6(-5)	6.5 ± 1.0(-5)	6.2 ± 1.3(-1)
^{65}Zn	<1.5(-5)	<4.1(-5)	
^{91}Sr	<6.4(-5)	<1.2(-4)	
^{93}Y	2.0 ± 0.4(-3)	<1.0(-4)	>2.0(1)
^{95}Zr	<1.1(-5)	<2.8(-5)	
^{95}Nb	<6.4(-5)	<9.4(-5)	
^{99}Mo	9.6 ± 1.9(-5)	1.1 ± 0.1(-4)	8.7 ± 1.9(-1)
^{103}Ru	<2.4(-5)	<9.6(-5)	
^{110m}Ag	<7.0(-4)	<1.0(-3)	
^{124}Sb	<1.0(-5)	<3.3(-5)	
^{125}Sb	<1.4(-5)	<5.8(-5)	
^{129m}Te	<1.2(-4)	<2.2(-4)	
^{132}Te	<2.7(-5)	<2.4(-4)	
^{139}Ba	3.1 ± 0.4(-3)	4.1 ± 0.3(-3)	7.6 ± 1.1(-1)
^{140}Ba	<6.0(-5)	<2.1(-4)	
^{140}La	2.9 ± 0.7(-5)	<3.5(-5)	>8.3(-1)
^{141}Ce	<2.2(-5)	<8.1(-5)	
^{143}Ce	<2.4(-5)	<1.2(-4)	
^{144}Ce	<1.1(-4)	<1.0(-4)	
^{187}W	1.92 ± 0.06(-3)	2.5 ± 0.1(-3)	7.7 ± 0.4(-1)
^{239}Np	<2.6(-5)	<4.9(-5)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
11:33; 4/13/78
Used for: 300 days
Bed Volumes Thru: 1.11(5)
Letdown Flow Rate: 65 gpm
Reactor Coolant Boron: 336 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	1.01 ± 0.02(-1)	1.03 ± 0.03(-1)	9.8 ± 0.3(-1)
^{132}I	2.08 ± 0.02(-2)	2.15 ± 0.06(-2)	9.7 ± 0.3(-1)
^{133}I	4.7 ± 0.1(-2)	5.0 ± 0.1(-2)	9.4 ± 0.3(-1)
^{134}I	1.94 ± 0.03(-2)	2.07 ± 0.06(-2)	9.4 ± 0.3(-1)
^{135}I	2.61 ± 0.02(-2)	2.72 ± 0.03(-2)	9.6 ± 0.1(-1)
^{88}Rb	1.00 ± 0.03(-1)	6.1 ± 0.6(-2)	1.6 ± 0.2(0)
^{89}Rb	9.3 ± 2.4(-3)	8.6 ± 1.0(-3)	1.1 ± 0.3(0)
^{134}Cs	1.67 ± 0.02(-3)	1.67 ± 0.03(-3)	1.00 ± 0.02(0)
^{136}Cs	2.2 ± 0.2(-4)	2.4 ± 0.2(-4)	9.2 ± 1.1(-1)
^{137}Cs	3.06 ± 0.03(-3)	2.99 ± 0.05(-3)	1.02 ± 0.02(0)
^{138}Cs	6.4 ± 0.1(-2)	4.3 ± 0.1(-2)	1.5 ± 0.1(0)
^{139}Cs	<5.8(-2)	<1.0(-2)	
^{24}Na	2.36 ± 0.02(-2)	2.38 ± 0.04(-2)	9.9 ± 0.2(-1)
^{51}Cr	<6.1(-5)	<5.0(-5)	
^{54}Mn	<1.0(-4)	<7.5(-5)	
^{59}Fe	<3.0(-5)	<2.4(-5)	
^{57}Co	1.2 ± 0.4(-5)	<1.2(-5)	>1.0(0)
^{58}Co	5.7 ± 0.1(-4)	5.4 ± 0.2(-4)	1.1 ± 0.1(0)
^{60}Co	5.4 ± 0.6(-5)	4.4 ± 0.6(-5)	1.2 ± 0.2(0)
^{65}Zn	<2.0(-5)	<1.3(-5)	
^{91}Sr	<9.4(-5)	<7.7(-5)	
^{93}Y	1.2 ± 0.3(-3)	2.8 ± 0.7(-3)	4.3 ± 1.5(-1)
^{95}Zr	<1.2(-5)	4.4 ± 0.9(-5)	<2.7(-1)
^{95}Nb	<5.8(-5)	<5.6(-5)	
^{99}Mo	1.10 ± 0.07(-4)	9.4 ± 1.4(-5)	1.2 ± 0.2(0)
^{103}Ru	<1.4(-5)	1.5 ± 0.6(-5)	<9.3(-1)
^{110m}Ag	<8.4(-4)	<6.8(-4)	
^{124}Sb	<1.2(-5)	<9.0(-6)	
^{125}Sb	<1.3(-5)	<2.0(-5)	
^{129m}Te	<1.4(-4)	<1.2(-4)	
^{132}Te	<1.8(-5)	<1.8(-5)	
^{139}Ba	5.8 ± 0.1(-3)	5.0 ± 0.2(-3)	1.2 ± 0.1(0)
^{140}Ba	<3.7(-5)	<4.7(-5)	
^{140}La	<1.9(-5)	2.7 ± 0.7(-5)	<7.0(-1)
^{141}Ce	<2.3(-5)	<2.7(-5)	
^{143}Ce	<2.6(-5)	<3.1(-5)	
^{144}Ce	<1.1(-4)	<8.9(-5)	
^{187}W	2.0 ± 0.1(-3)	2.0 ± 0.1(-3)	1.0 ± 0.1(0)
^{239}Np	<1.6(-5)	<2.0(-5)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
13:53; 4/14/78
Used for: 301 days
Bed Volumes Thru: 1.11(5)
Letdown Flow Rate: 65 gpm
Reactor Coolant Boron: 320 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	6.91 ± 0.02(-2)	6.8 ± 1.5(-6)	1.0 ± 0.2(4)
^{132}I	1.85 ± 0.02(-2)	<9.6(-5)	>1.9(2)
^{133}I	3.23 ± 0.03(-2)	<9.7(-6)	>3.3(3)
^{134}I	1.87 ± 0.02(-2)	<8.2(-5)	>2.3(2)
^{135}I	1.98 ± 0.02(-2)	<4.4(-5)	>4.5(2)
^{88}Rb	1.32 ± 0.02(-1)	3.9 ± 1.1(-4)	3.4 ± 1.0(2)
^{89}Rb	9.1 ± 0.5(-3)	5.6 ± 1.3(-4)	1.6 ± 0.4(1)
^{134}Cs	1.63 ± 0.02(-3)	1.98 ± 0.03(-3)	8.2 ± 0.2(-1)
^{136}Cs	1.29 ± 0.03(-4)	7.8 ± 1.8(-6)	1.7 ± 0.4(1)
^{137}Cs	3.15 ± 0.03(-3)	3.50 ± 0.06(-3)	9.0 ± 0.2(-1)
^{138}Cs	5.82 ± 0.07(-2)	1.00 ± 0.01(-2)	5.82 ± 0.09(0)
^{139}Cs	<1.3(-4)	<4.5(-3)	
^{24}Na	1.56 ± 0.01(-2)	2.2 ± 1.0(-6)	7.1 ± 3.2(3)
^{51}Cr	2.3 ± 1.1(-4)	9.4 ± 0.8(-5)	2.4 ± 1.2(0)
^{54}Mn	5.1 ± 0.1(-5)	2.60 ± 0.07(-5)	1.96 ± 0.07(0)
^{59}Fe	1.7 ± 0.1(-5)	1.1 ± 0.1(-5)	1.5 ± 0.2(0)
^{57}Co	<3.6(-6)	2.0 ± 0.7(-6)	<1.8(0)
^{58}Co	1.03 ± 0.01(-3)	9.4 ± 0.3(-4)	1.10 ± 0.04(0)
^{60}Co	6.1 ± 0.1(-5)	4.6 ± 0.1(-5)	1.33 ± 0.04(0)
^{65}Zn	2.8 ± 1.0(-6)	<1.5(-6)	>1.9(0)
^{91}Sr	<2.2(-4)	<2.3(-5)	
^{93}Y	<9.0(-4)	<2.4(-4)	
^{95}Zr	2.0 ± 0.1(-5)	1.8 ± 0.1(-5)	1.11 ± 0.08(0)
^{95}Nb	2.0 ± 0.1(-5)	2.3 ± 0.1(-5)	8.7 ± 0.6(-1)
^{99}Mo	1.13 ± 0.07(-4)	<5.6(-6)	>2.0(1)
^{103}Ru	7.9 ± 1.7(-6)	<2.6(-6)	>3.0(0)
^{110m}Ag	4.4 ± 0.9(-6)	2.3 ± 0.7(-6)	1.9 ± 0.7(0)
^{124}Sb	2.0 ± 0.1(-5)	2.1 ± 0.1(-5)	9.5 ± 0.7(-1)
^{125}Sb	<6.0(-6)	<1.1(-5)	
^{129m}Te	<7.2(-6)	<4.3(-5)	
^{132}Te	<1.1(-5)	<4.6(-6)	
^{139}Ba	5.5 ± 0.3(-3)	4.8 ± 0.2(-3)	1.1 ± 0.1(0)
^{140}Ba	3.8 ± 0.6(-5)	<1.1(-5)	>3.5(0)
^{140}La	1.4 ± 0.2(-4)	<1.1(-6)	>1.3(2)
^{141}Ce	<8.0(-6)	<2.7(-6)	
^{143}Ce	<3.2(-5)	<9.2(-6)	
^{144}Ce	<5.2(-6)	<1.6(-5)	
^{187}W	1.61 ± 0.04(-3)	<9.5(-5)	>1.7(1)
^{239}Np	<4.9(-5)	<2.6(-5)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
09:57; 4/15/78
Used for: 302 days
Bed Volumes Thru: 1.11(5)
Letdown Flow Rate: 60 gpm
Reactor Coolant Boron: 323 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	1.70 ± 0.01(-2)	6.7 ± 2.0(-6)	2.5 ± 0.8(3)
^{132}I	1.74 ± 0.03(-2)	<5.3(-5)	>3.3(2)
^{133}I	1.51 ± 0.01(-2)	<1.6(-5)	>9.4(2)
^{134}I	1.94 ± 0.03(-2)	<7.5(-5)	>2.6(2)
^{135}I	1.54 ± 0.02(-2)	<1.8(-4)	>8.6(1)
^{88}Rb	1.66 ± 0.02(-1)	5.01 ± 0.07(-2)	3.31 ± 0.06(0)
^{89}Rb	1.15 ± 0.04(-2)	4.2 ± 1.0(-4)	2.7 ± 0.7(1)
^{134}Cs	1.77 ± 0.02(-3)	1.92 ± 0.01(-3)	9.2 ± 0.1(-1)
^{136}Cs	4.1 ± 0.1(-5)	1.42 ± 0.07(-5)	2.9 ± 0.2(0)
^{137}Cs	3.35 ± 0.02(-3)	3.54 ± 0.04(-3)	9.5 ± 0.1(-1)
^{138}Cs	5.9 ± 0.1(-2)	8.8 ± 0.1(-3)	6.7 ± 0.1(0)
^{139}Cs	1.5 ± 0.6(-2)	<4.3(-3)	>3.5(0)
^{24}Na	9.3 ± 0.1(-3)	5.4 ± 0.6(-5)	1.7 ± 0.2(2)
^{51}Cr	1.8 ± 0.4(-4)	2.8 ± 0.8(-5)	6.4 ± 2.3(0)
^{54}Mn	4.3 ± 0.1(-5)	5.9 ± 0.3(-6)	7.3 ± 0.4(0)
^{59}Fe	1.2 ± 0.1(-5)	2.8 ± 0.6(-6)	4.3 ± 1.0(0)
^{57}Co	<2.0(-6)	<1.1(-6)	
^{58}Co	5.61 ± 0.02(-4)	2.28 ± 0.02(-4)	2.46 ± 0.02(0)
^{60}Co	3.78 ± 0.06(-5)	1.22 ± 0.05(-5)	3.1 ± 0.1(0)
^{65}Zn	<1.5(-6)	<1.2(-6)	
^{91}Sr	<2.4(-4)	<1.1(-4)	
^{93}Y	<1.0(-3)	<6.3(-4)	
^{95}Zr	1.21±± 0.07(-5)	4.9 ± 0.8(-6)	2.5 ± 0.4(0)
^{95}Nb	1.34 ± 0.06(-5)	6.4 ± 0.6(-6)	2.1 ± 0.2(0)
^{99}Mo	1.13 ± 0.04(-4)	<5.5(-6)	>2.1(1)
^{103}Ru	4.4 ± 1.1(-6)	<3.2(-6)	>1.4(0)
^{110m}Ag	1.3 ± 0.6(-6)	<9.4(-7)	>1.4(0)
^{124}Sb	1.07 ± 0.06(-5)	9.7 ± 0.8(-6)	1.1 ± 0.1(0)
^{125}Sb	<4.2(-6)	<6.3(-6)	
^{129m}Te	<3.3(-6)	<3.5(-5)	
^{132}Te	8.7 ± 2.5(-6)	<5.0(-6)	>1.7(0)
^{139}Ba	5.3 ± 0.3(-3)	4.9 ± 0.1(-3)	1.1 ± 0.1(0)
^{140}Ba	3.3 ± 0.5(-5)	<1.1(-5)	>3.0(0)
^{140}La	7.9 ± 0.4(-5)	<7.4(-6)	>1.1(1)
^{141}Ce	<5.8(-6)	<2.3(-6)	
^{143}Ce	<2.3(-5)	<1.3(-5)	
^{144}Ce	<3.0(-6)	<8.3(-6)	
^{187}W	1.27 ± 0.04(-3)	<1.5(-4)	>8.5(0)
^{239}Np	5.9 ± 3.6(-5)	<2.0(-5)	>3.0(0)

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
14:04; 4/27/78
Used for: 313 days
Bed Volumes Thru: 1.15(5)
Letdown Flow Rate: 45 gpm
Reactor Coolant Boron: 288 ppm

Nuclide	Inlet Activity (µCi/ml)	Outlet Activity (µCi/ml)	Decontamination Factor
^{131}I	1.27 ± 0.01(-2)	3.3 ± 0.1(-5)	3.8 ± 0.1(2)
^{132}I	2.01 ± 0.04(-2)	<1.9(-5)	>1.1(3)
^{133}I	1.95 ± 0.02(-2)	2.5 ± 1.1(-5)	7.8 ± 3.4(2)
^{134}I	2.09 ± 0.06(-2)	<4.8(-5)	>4.4(2)
^{135}I	1.93 ± 0.05(-2)	<6.6(-5)	>2.9(2)
^{88}Rb	7.4 ± 0.2(-1)	1.39 ± 0.02(-1)	5.3 ± 0.2(0)
^{89}Rb	1.2 ± 0.3(-2)	<2.7(-4)	>4.4(1)
^{134}Cs	1.22 ± 0.01(-3)	1.24 ± 0.01(-3)	9.8 ± 0.1(-1)
^{136}Cs	2.4 ± 0.3(-5)	5.4 ± 0.4(-6)	4.4 ± 0.6(0)
^{137}Cs	2.30 ± 0.03(-3)	2.24 ± 0.03(-3)	1.03 ± 0.02(0)
^{138}Cs	7.9 ± 0.1(-2)	5.6 ± 0.1(-3)	1.41 ± 0.03(1)
^{139}Cs	<4.7(-1)	<1.6(-2)	
^{24}Na	9.4 ± 0.2(-3)	1.9 ± 0.4(-5)	4.9 ± 1.0(2)
^{51}Cr	1.3 ± 0.4(-4)	<1.1(-6)	>1.2(2)
^{54}Mn	4.59 ± 0.07(-5)	4.4 ± 0.2(-6)	1.04 ± 0.05(1)
^{59}Fe	2.0 ± 0.1(-5)	1.8 ± 0.4(-6)	1.1 ± 0.2(1)
^{57}Co	8.9 ± 3.8(-7)	<1.1(-6)	>8.1(-1)
^{58}Co	6.3 ± 0.1(-4)	9.2 ± 0.1(-5)	6.8 ± 0.1(0)
^{60}Co	4.6 ± 0.1(-5)	1.17 ± 0.06(-5)	3.9 ± 0.2(0)
^{65}Zn	<6.8(-7)	<9.6(-8)	
^{91}Sr	<4.0(-4)	<3.6(-5)	
^{93}Y	<4.0(-4)	<1.4(-4)	
^{95}Zr	7.6 ± 0.7(-6)	2.9 ± 1.1(-6)	2.6 ± 1.0(0)
^{95}Nb	7.7 ± 0.7(-6)	1.6 ± 0.3(-6)	4.8 ± 1.0(0)
^{99}Mo	1.14 ± 0.03(-4)	<1.1(-6)	>1.0(2)
^{103}Ru	2.8 ± 0.7(-6)	<1.2(-6)	>2.3(0)
^{110m}Ag	<1.6(-4)	<1.1(-6)	
^{124}Sb	7.9 ± 0.6(-6)	4.3 ± 0.4(-6)	1.8 ± 0.2(0)
^{125}Sb	<2.3(-7)	<1.6(-6)	
^{129m}Te	1.7 ± 1.1(-6)	<2.1(-7)	>8.1(0)
^{132}Te	<3.3(-6)	<3.8(-6)	
^{139}Ba	1.07 ± 0.04(-2)	2.5 ± 1.6(-3)	4.3 ± 2.7(0)
^{140}Ba	4.7 ± 0.5(-5)	9.5 ± 2.8(-6)	5.0 ± 1.6(0)
^{140}La	<5.7(-6)	<9.9(-7)	
^{141}Ce	<2.6(-7)	1.7 ± 1.5(-6)	<1.5(-1)
^{143}Ce	<9.5(-6)	<1.9(-5)	
^{144}Ce	<1.4(-6)	<5.1(-7)	
^{187}W	<6.6(-4)	<4.2(-5)	
^{239}Np	<5.0(-6)	<5.0(-6)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
09:53; 4/29/78
Used for: 315 days
Bed Volumes Thru: 1.16(5)
Letdown Flow Rate: 45 gpm
Reactor Coolant Boron: 288 ppm

Nuclide	Inlet Activity (µCi/ml)	Outlet Activity (µCi/ml)	Decontamination Factor
^{131}I	1.06 ± 0.01(-2)	1.7 ± 0.5(-6)	6.2 ± 1.8(3)
^{132}I	1.75 ± 0.02(-2)	<6.5(-5)	>2.7(2)
^{133}I	1.76 ± 0.02(-2)	<1.6(-5)	>1.1(3)
^{134}I	1.89 ± 0.05(-2)	<1.0(-4)	>1.9(2)
^{135}I	1.81 ± 0.05(-2)	<1.8(-4)	>1.0(2)
^{88}Rb	1.97 ± 0.04(-1)	1.67 ± 0.03(-1)	1.18 ± 0.03(0)
^{89}Rb	9.5 ± 0.8(-3)	<5.6(-4)	>1.7(1)
^{134}Cs	1.13 ± 0.01(-3)	1.22 ± 0.01(-3)	9.3 ± 0.1(-1)
^{136}Cs	2.6 ± 0.3(-5)	5.4 ± 0.2(-6)	4.8 ± 0.6(0)
^{137}Cs	2.26 ± 0.03(-3)	2.31 ± 0.03(-3)	9.8 ± 0.2(-1)
^{138}Cs	6.1 ± 0.1(-2)	1.18 ± 0.04(-2)	5.2 ± 0.2(0)
^{139}Cs	<2.9(-2)	<1.8(-2)	
^{24}Na	8.6 ± 0.2(-3)	3.2 ± 0.6(-5)	2.7 ± 0.5(2)
^{51}Cr	8.4 ± 3.3(-5)	<6.2(-7)	>1.4(2)
^{54}Mn	4.2 ± 0.2(-5)	8.9 ± 1.1(-7)	4.7 ± 0.6(1)
^{59}Fe	1.38 ± 0.08(-5)	6.4 ± 1.5(-7)	2.2 ± 0.5(1)
^{57}Co	<1.3(-6)	<3.2(-8)	
^{58}Co	4.23 ± 0.07(-4)	2.22 ± 0.03(-5)	1.91 ± 0.04(1)
^{60}Co	4.65 ± 0.09(-5)	3.50 ± 0.02(-6)	1.33 ± 0.03(1)
^{65}Zn	<1.5(-6)	<4.2(-8)	
^{91}Sr	<1.3(-4)	5.2 ± 4.8(-5)	<2.5(0)
^{93}Y	<1.5(-5)	<4.9(-5)	
^{95}Zr	6.3 ± 0.7(-6)	1.1 ± 0.2(-6)	5.7 ± 1.2(0)
^{95}Nb	5.5 ± 0.4(-6)	5.4 ± 2.0(-7)	1.0 ± 0.4(1)
^{99}Mo	1.12 ± 0.03(-4)	<3.8(-7)	>2.9(2)
^{103}Ru	<6.9(-7)	<7.0(-7)	
^{110m}Ag	<1.5(-4)	<1.7(-4)	
^{124}Sb	6.9 ± 0.5(-6)	2.3 ± 0.2(-6)	3.0 ± 0.3(0)
^{125}Sb	<4.6(-7)	<1.7(-6)	
^{129m}Te	1.6 ± 0.9(-6)	<1.5(-7)	>1.1(1)
^{132}Te	<3.5(-7)	<4.5(-6)	
^{139}Ba	8.0 ± 0.4(-3)	5.9 ± 0.1(-3)	1.4 ± 0.1(0)
^{140}Ba	6.0 ± 0.3(-5)	1.7 ± 1.0(-5)	3.5 ± 0.6(0)
^{140}La	6.4 ± 1.2(-5)	<8.1(-7)	>7.9(1)
^{141}Ce	<1.6(-7)	1.0 ± 0.7(-6)	<1.6(-1)
^{143}Ce	4.9 ± 4.3(-5)	<4.1(-6)	>1.2(1)
^{144}Ce	<9.2(-7)	<2.3(-7)	
^{187}W	6.1 ± 2.0(-4)	<5.4(-6)	>1.1(2)
^{239}Np	<1.8(-6)	<5.0(-6)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
09:27; 5/9/78
Used for: 325 days
Bed Volumes Thru: 1.19(5)
Letdown Flow Rate: 55 gpm
Reactor Coolant Boron: 250 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	7.7 ± 0.1(-3)	<1.5(-6)	>5.1(3)
^{132}I	2.08 ± 0.02(-2)		
^{133}I	1.73 ± 0.03(-2)	2.2 ± 0.8(-5)	7.9 ± 2.9(2)
^{134}I	2.39 ± 0.05(-2)	<9.4(-5)	>2.5(2)
^{135}I	2.01 ± 0.03(-2)	<3.4(-5)	>5.9(2)
^{88}Rb	3.34 ± 0.06(-1)	3.41 ± 0.02(-1)	9.8 ± 0.2(-1)
^{89}Rb	1.5 ± 0.1(-2)	<6.8(-4)	>2.2(1)
^{134}Cs	1.19 ± 0.02(-3)	1.26 ± 0.01(-3)	9.4 ± 0.2(-1)
^{136}Cs	1.62 ± 0.06(-5)	3.7 ± 0.3(-6)	4.4 ± 0.4(0)
^{137}Cs	2.39 ± 0.03(-3)	2.39 ± 0.02(-3)	1.00 ± 0.02(0)
^{138}Cs	7.65 ± 0.08(-2)	1.20 ± 0.04(-2)	6.4 ± 0.2(0)
^{139}Cs	<9.8(-3)	<6.4(-3)	
^{24}Na	8.9 ± 0.1(-3)	2.9 ± 0.2(-5)	3.1 ± 0.2(2)
^{51}Cr	7.2 ± 0.5(-5)	<2.6(-6)	>2.8(1)
^{54}Mn	4.0 ± 0.1(-5)	1.7 ± 0.2(-6)	2.4 ± 0.3(1)
^{59}Fe	1.2 ± 0.1(-5)	1.3 ± 0.4(-6)	9.2 ± 2.9(0)
^{57}Co	<1.3(-6)	<7.6(-7)	
^{58}Co	3.14 ± 0.04(-4)	8.0 ± 0.2(-5)	3.9 ± 0.1(0)
^{60}Co	2.89 ± 0.08(-5)	3.8 ± 0.1(-6)	7.6 ± 0.3(0)
^{65}Zn	<1.6(-6)	<7.0(-7)	
^{91}Sr	<1.7(-4)	<3.4(-5)	
^{93}Y	<4.9(-3)	<2.0(-5)	
^{95}Zr	3.6 ± 0.7(-6)	6.5 ± 0.5(-6)	5.5 ± 1.2(-1)
^{95}Nb	4.9 ± 0.4(-6)	7.51 ± 0.4(-6)	6.5 ± 0.6(-1)
^{99}Mo	1.19 ± 0.01(-4)	<1.5(-6)	>7.9(1)
^{103}Ru	<1.3(-6)	<1.2(-6)	
^{110m}Ag	<1.2(-6)	<4.2(-7)	
^{124}Sb	5.1 ± 0.5(-6)	3.3 ± 0.2(-6)	1.5 ± 0.2(0)
^{125}Sb	<3.5(-6)	<3.7(-6)	
^{129m}Te	<3.4(-6)	<1.5(-6)	
^{132}Te	2.4 ± 1.1(-6)	<1.8(-6)	>1.3(0)
^{139}Ba	9.5 ± 0.2(-3)	4.79 ± 0.07(-3)	2.0 ± 0.1(0)
^{140}Ba	5.9 ± 0.3(-5)	<4.2(-6)	>1.4(1)
^{140}La	1.4 ± 0.3(-4)	<4.0(-7)	>3.5(2)
^{141}Ce	<1.8(-6)	<1.8(-6)	
^{143}Ce	<1.3(-5)	<9.0(-6)	
^{144}Ce	<3.0(-6)	<1.1(-6)	
^{187}W	1.1 ± 0.2(-3)	<2.0(-5)	>5.5(1)
^{239}Np	9.8 ± 4.4(-6)	5.9 ± 4.1(-5)	1.7 ± 1.4(-1)

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
10:05; 5/16/78
Used for: 332 days
Bed Volumes Thru: 1.21(5)
Letdown Flow Rate: 55 gpm
Reactor Coolant Boron: 233 ppm

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	7.50 ± 0.04(-3)	<2.2(-6)	>3.4(3)
^{132}I	2.10 ± 0.03(-2)	<2.8(-5)	>7.5(2)
^{133}I	1.74 ± 0.01(-2)	<3.2(-6)	>5.4(3)
^{134}I	2.33 ± 0.02(-2)	<5.4(-4)	>4.3(1)
^{135}I	2.02 ± 0.03(-2)	<2.8(-5)	>7.2(2)
^{88}Rb			
^{89}Rb	<9.4(-3)		
^{134}Cs	1.17 ± 0.02(-3)	1.13 ± 0.01(-3)	1.04 ± 0.02(0)
^{136}Cs	2.0 ± 0.2(-5)	3.7 ± 0.3(-6)	5.4 ± 0.7(0)
^{137}Cs	2.30 ± 0.03(-3)	2.11 ± 0.02(-3)	1.09 ± 0.02(0)
^{138}Cs	7.3 ± 0.1(-2)	<1.2(-2)	>6.1(0)
^{139}Cs	<5.6(-1)		
^{24}Na	8.4 ± 0.1(-3)	2.4 ± 0.1(-5)	3.5 ± 0.2(2)
^{51}Cr	<4.1(-5)	<7.5(-6)	
^{54}Mn	4.0 ± 0.1(-5)	7.8 ± 1.4(-7)	5.1 ± 0.9(1)
^{59}Fe	8.6 ± 1.2(-6)	<7.0(-7)	>1.2(1)
^{57}Co	<1.2(-6)	<4.4(-7)	
^{58}Co	2.11 ± 0.03(-4)	1.16 ± 0.02(-5)	1.82 ± 0.04(1)
^{60}Co	2.8 ± 0.1(-5)	2.0 ± 0.3(-6)	1.4 ± 0.2(1)
^{65}Zn	<1.9(-6)	<6.1(-7)	
^{91}Sr	<1.8(-4)	<1.3(-5)	
^{93}Y	<7.9(-4)	<7.6(-5)	
^{95}Zr	7.4 ± 3.3(-6)	<9.7(-7)	>7.6(0)
^{95}Nb	9.5 ± 1.1(-6)	<4.9(-7)	>1.9(1)
^{99}Mo	1.28 ± 0.04(-4)	<2.0(-6)	>6.4(1)
^{103}Ru	<2.1(-6)	<9.2(-7)	
^{110m}Ag	<1.2(-6)	<4.7(-7)	
^{124}Sb	3.7 ± 0.5(-6)	9.9 ± 1.0(-7)	3.7 ± 0.6(0)
^{125}Sb	<8.5(-6)	<3.7(-6)	
^{129m}Te	<4.6(-5)	<1.6(-5)	
^{132}Te	<5.0(-6)	<2.1(-6)	
^{139}Ba	1.00 ± 0.02(-2)	1.2 ± 0.1(-2)	8.3 ± 0.7(-1)
^{140}Ba	8.5 ± 0.5(-5)	<5.0(-6)	>1.7(1)
^{140}La	3.8 ± 0.1(-4)	<6.2(-7)	>6.1(2)
^{141}Ce	<2.5(-6)	<2.1(-6)	
^{143}Ce	<4.5(-5)	<5.2(-6)	
^{144}Ce	<1.4(-5)	<5.1(-6)	
^{187}W	1.3 ± 0.2(-3)	<1.2(-5)	>1.1(2)
^{239}Np	<2.4(-5)	<9.8(-6)	

TABLE B.13 (cont'd)

UNIT #4 CVCS PURIFICATION DEMINERALIZER

Demineralizer A
10:23; 5/23/78
Used for: 339 days
Bed Volumes Thru: 1.23(5)
Letdown Flow Rate: 47 gpm
Reactor Coolant Boron:

Nuclide	Inlet Activity (μCi/ml)	Outlet Activity (μCi/ml)	Decontamination Factor
^{131}I	6.49 ± 0.04(-3)	<6.4(-6)	>1.0(3)
^{132}I	2.04 ± 0.04(-2)	<5.0(-5)	>4.1(2)
^{133}I	1.60 ± 0.01(-2)	<1.0(-4)	>1.6(2)
^{134}I	2.41 ± 0.03(-2)	<7.5(-5)	>3.2(2)
^{135}I	2.03 ± 0.03(-2)	<1.9(-4)	>1.1(2)
^{88}Rb	1.93 ± 0.05(-1)	6.18 ± 0.09(-2)	3.12 ± 0.09(0)
^{89}Rb	1.31 ± 0.05(-2)	2.5 ± 0.8(-4)	5.2 ± 1.7(1)
^{134}Cs	1.07 ± 0.01(-3)	1.17 ± 0.03(-3)	9.1 ± 0.2(-1)
^{136}Cs	2.2 ± 0.2(-5)	4.1 ± 0.7(-6)	5.4 ± 1.0(0)
^{137}Cs	2.18 ± 0.02(-3)	2.23 ± 0.01(-3)	9.8 ± 0.1(-1)
^{138}Cs	6.67 ± 0.10(-2)	9.1 ± 0.1(-3)	7.3 ± 0.1(0)
^{139}Cs	<2.4(-2)	<3.5(-3)	
^{24}Na	8.3 ± 0.2(-3)	2.6 ± 0.8(-5)	3.2 ± 1.0(2)
^{51}Cr	6.8 ± 0.7(-5)	<3.0(-6)	>4.5(0)
^{54}Mn	4.6 ± 0.1(-5)	5.0 ± 0.6(-6)	9.2 ± 1.1(0)
^{59}Fe	8.7 ± 0.7(-6)	<1.8(-6)	>4.8(0)
^{57}Co	1.3 ± 0.5(-6)	<1.6(-6)	>8.1(-1)
^{58}Co	2.95 ± 0.03(-4)	5.9 ± 0.2(-5)	5.0 ± 0.2(0)
^{60}Co	2.8 ± 0.4(-5)	<3.8(-6)	>7.4(0)
^{65}Zn	<2.0(-6)	<1.4(-6)	
^{91}Sr	<2.2(-4)	<1.0(-4)	
^{93}Y	<1.4(-3)	<3.9(-4)	
^{95}Zr	5.7 ± 0.9(-6)	8.5 ± 0.2(-5)	6.7 ± 0.1(-1)
^{95}Nb	8.5 ± 0.05(-6)	8.9 ± 0.2(-5)	9.6 ± 0.2(-2)
^{99}Mo	1.24 ± 0.02(-4)	<7.3(-6)	>1.7(1)
^{103}Ru	3 ± 1(-6)	1.34 ± 0.08(-5)	2.2 ± 0.8(-1)
^{110m}Ag	<2.4(-6)	<1.3(-6)	
^{124}Sb	5.0 ± 0.4(-6)	2.0 ± 0.2(-6)	2.5 ± 0.3(0)
^{125}Sb	<4.0(-6)	<3.0(-6)	
^{129m}Te	<2.2(-6)	<2.6(-6)	
^{132}Te	<3.8(-6)	<9.9(-6)	
^{139}Ba	1.03 ± 0.02(-2)	5.1 ± 0.2(-3)	2.0 ± 0.1(0)
^{140}Ba	6.7 ± 0.3(-5)	5 ± 2(-6)	
^{140}La			
^{141}Ce	<2.8(-6)	4.4 ± 0.2(-5)	<6.4(-2)
^{143}Ce	<3.2(-5)	<4.4(-5)	
^{144}Ce	<1.4(-6)	7.1 ± 0.5(-5)	<7.5(-2)
^{187}W	7.7 ± 2.1(-4)	<1.1(-4)	>7.0(0)
^{239}Np	3.4 ± 1.1(-5)	<3.6(-5)	>9.4(-1)

TABLE B.14

RADIONUCLIDE CONCENTRATIONS IN BASE CATION DEMINERALIZER C INLET

Nuclide	2/16/78; 15:10 (μCi/ml)	2/17/78; 13:15 (μCi/ml)	2/20/78; 18:15 (μCi/ml)	2/22/78; 16:05 (μCi/ml)	5/2/78; 09:05 (μCi/ml)	5/3/78; 09:52 (μCi/ml)
^{131}I	3.47 ± 0.07(-4)	5.93 ± 0.10(-4)	1.00 ± 0.02(-2)	8.7 ± 0.1(-3)	1.12 ± 0.01(-4)	1.04 ± 0.02(-4)
^{134}Cs	9.83 ± 0.09(-4)	1.58 ± 0.01(-4)	2.02 ± 0.01(-3)	2.16 ± 0.02(-3)	3.5 ± 0.1(-5)	3.14 ± 0.06(-5)
^{136}Cs			6.0 ± 0.3(-4)	6.0 ± 0.3(-4)		
^{137}Cs	2.05 ± 0.02(-3)	2.98 ± 0.04(-4)	3.19 ± 0.03(-3)	3.24 ± 0.04(-3)	4.64 ± 0.09(-6)	4.2 ± 0.1(-5)
^{51}Cr	4.9 ± 0.3(-4)	1.93 ± 0.07(-6)	8.2 ± 0.5(-4)	7.9 ± 0.4(-4)	2.1 ± 0.4(-5)	7 ± 2(-6)
^{54}Mn	6.4 ± 0.1(-4)	8.2 ± 0.1(-5)	2.49 ± 0.03(-3)	2.57 ± 0.04(-3)	1.50 ± 0.09(-5)	5.8 ± 0.3(-6)
^{59}Fe	8.8 ± 1.0(-5)	4.30 ± 0.20(-5)	2.5 ± 0.1(-4)	2.44 ± 0.03(-4)	2.2 ± 0.8(-6)	1.0 ± 0.4(-6)
^{57}Co	9.1 ± 0.5(-5)	1.2 ± 0.1(-5)	5.6 ± 0.3(-5)	5.3 ± 0.2(-5)	8.5 ± 2.4(-7)	4 ± 1(-7)
^{58}Co	2.87 ± 0.04(-2)	3.39 ± 0.07(-3)	4.27 ± 0.07(-2)	4.29 ± 0.08(-2)	1.83 ± 0.03(-4)	7.4 ± 0.2(-5)
^{60}Co	1.35 ± 0.01(-2)	1.70 ± 0.02(-3)	6.08 ± 0.09(-3)	6.3 ± 0.1(-3)	1.17 ± 0.04(-4)	7.3 ± 0.1(-5)
^{65}Zn	5.1 ± 0.8(-5)	8.8 ± 1.2(-6)	3.5 ± 0.6(-5)	3.4 ± 0.3(-5)	<1.6(-6)	<9.1(-7)
^{95}Zr	1.15 ± 0.06(-4)	3.4 ± 0.2(-5)	5.4 ± 0.6(-5)	5.0 ± 0.2(-5)	5.0 ± 1.0(-6)	3.2 ± 0.4(-6)
^{95}Nb	2.02 ± 0.06(-4)	6.1 ± 0.2(-5)	8.5 ± 0.5(-5)	7.5 ± 0.3(-5)	9.7 ± 0.05(-6)	4.8 ± 0.5(-6)
^{99}Mo	<9.6(-6)	<1.5(-6)	6.13 ± 0.09(-4)	3.79 ± 0.02(-4)	1.5 ± 0.2(-5)	1.2 ± 0.2(-6)
^{103}Ru	2.1 ± 0.2(-6)	3.45 ± 0.08(-5)	8.2 ± 3.4(-6)	9.2 ± 1.8(-6)	<7.5(-7)	9 ± 2(-7)
^{106}RuD	<1.5(-5)	3.7 ± 1.2(-5)	<1.0(-5)	<9.4(-6)	<7.1(-6)	7 ± 2(-6)
^{110m}Ag	<5.8(-4)	2.6 ± 0.7(-5)	<5.5(-4)	<6.2(-4)	4.0 ± 0.8(-6)	2.4 ± 0.3(-6)
^{124}Sb	6.2 ± 0.1(-4)	4.17 ± 0.06(-4)	1.89 ± 0.05(-4)	1.89 ± 0.03(-4)	9.3 ± 0.8(-6)	8.1 ± 0.5(-6)
^{125}Sb	1.06 ± 0.02(-3)	5.55 ± 0.66(-4)	8.4 ± 0.8(-5)	1.14 ± 0.03(-4)	1.5 ± 0.2(-5)	1.44 ± 0.07(-5)
^{140}Ba			2.9 ± 0.1(-4)	2.87 ± 0.05(-4)	8.4 ± 1.4(-6)	1.34 ± 0.1(-5)
^{140}La	2.4 ± 0.2(-5)	4.7 ± 0.3(-6)	3.06 ± 0.03(-4)	3.77 ± 0.09(-4)	2.6 ± 0.3(-6)	4.9 ± 0.3(-6)
^{141}Ce	7.4 ± 3.4(-6)	3.0 ± 0.9(-6)	<9.1(-6)	<3.2(-6)	<9.1(-7)	<6.2(-7)
^{144}Ce	<7.7(-6)	<3.4(-6)	<2.9(-6)	<2.5(-6)	<4.9(-6)	2 ± 1(-6)

TABLE B.15

RADIONUCLIDE CONCENTRATIONS IN BASE CATION DEMINERALIZER A INLET

Nuclide	5/4/78; 14:36 (μCi/ml)	5/9/78; 14:47 (μCi/ml)	5/11/78; 11:55 (μCi/ml)	5/15/78; 10:30 (μCi/ml)	5/17/78; 14:45 (μCi/ml)
^{131}I	1.85 ± 0.04(-4)	1.55 ± 0.05(-5)	1.01 ± 0.01(-4)	4.7 ± 0.2(-5)	2.1 ± 0.2(-6)
^{134}Cs	2.07 ± 0.02(-4)	2.97 ± 0.07(-5)	7.5 ± 0.2(-5)	4.6 ± 0.1(-5)	2.26 ± 0.04(-4)
^{136}Cs	2.0 ± 0.5(-6)				4.0 ± 0.2(-6)
^{137}Cs	3.59 ± 0.03(-4)	4.2 ± 0.1(-5)	1.35 ± 0.05(-4)	6.6 ± 0.3(-5)	3.11 ± 0.03(-4)
^{3}H	**	**	3.5 ± 0.1(-2)	**	**
^{14}C	**	**	8.0 ± 0.8(-6)	**	**
^{32}P	**	**	3.2 ± 0.5(-5)	**	**
^{51}Cr	3.4 ± 0.6(-5)	2.0 ± 0.4(-5)	3.0 ± 0.2(-5)	1.5 ± 0.2(-5)	1.0 ± 0.3(-5)
^{54}Mn	9.3 ± 0.5(-6)	1.95 ± 0.05(-5)	1.10 ± 0.10(-5)	1.13 ± 0.05(-5)	6.8 ± 0.3(-6)
^{55}Fe	**	**	4.03 ± 0.02(-4)	**	**
^{59}Fe	3.7 ± 0.7(-6)	2.9 ± 0.6(-6)	3.6 ± 0.5(-6)	3.0 ± 0.6(-6)	7.7 ± 3.2(-7)
^{57}Co	<8.1(-7)	7.3 ± 2.5(-7)	4.9 ± 1.4(-7)	1.0 ± 0.2(-6)	2.5 ± 1.0(-7)
^{58}Co	2.51 ± 0.02(-4)	1.66 ± 0.03(-4)	1.97 ± 0.05(-4)	1.81 ± 0.04(-4)	4.27 ± 0.08(-5)
^{60}Co	5.0 ± 0.2(-5)	2.03 ± 0.05(-4)	8.6 ± 0.2(-5)	1.27 ± 0.02(-4)	8.32 ± 0.09(-5)
^{63}Ni	**	**	3.79 ± 0.03(-5)	**	**
^{65}Zn	<8.9(-7)	<1.1(-6)	<9.3(-7)	<1.3(-6)	6.1 ± 3.0(-7)
^{89}Sr	**	**	1.36 ± 0.02(-6)	**	**
^{90}Sr	**	**	8.8 ± 0.4(-8)	**	**
^{91}Y	**	**	3.71 ± 0.07(-7)	**	**
^{95}Zr	6.3 ± 0.7(-6)	8.6 ± 0.8(-6)	4.1 ± 0.4(-6)	5.5 ± 0.6(-6)	4.3 ± 0.3(-6)
^{95}Nb	8.9 ± 0.5(-6)	1.63 ± 0.07(-5)	8.1 ± 0.4(-6)	9.1 ± 0.5(-6)	6.6 ± 0.3(-6)
^{99}Mo	2.7 ± 0.8(-6)	<4.0(-7)	5.9 ± 2.1(-7)	<3.3(-7)	<3.3(-7)
^{103}Ru	1.7 ± 0.5(-6)	1.8 ± 0.3(-6)	1.1 ± 0.4(-6)	2.6 ± 0.4(-6)	8.0 ± 2.0(-7)
^{106}RuD	<1.2(-6)	9.2 ± 6.6(-7)	<4.5(-6)	1.4 ± 0.3(-5)	<3.3(-6)
^{110m}Ag	3.4 ± 0.7(-6)	4.4 ± 0.5(-6)	6.4 ± 0.7(-6)	5.7 ± 0.4(-6)	1.8 ± 0.2(-6)
^{124}Sb	1.1 ± 0.1(-5)	5.7 ± 0.5(-6)	7.8 ± 0.6(-6)	1.2 ± 0.1(-5)	1.5 ± 0.2(-6)
^{125}Sb	1.5 ± 0.2(-5)	1.06 ± 0.08(-5)	1.1 ± 0.2(-5)	3.3 ± 0.2(-5)	4.6 ± 0.6(-6)
^{140}La	2.0 ± 0.3(-6)	8.4 ± 1.7(-7)	2.0 ± 0.3(-6)	9.2 ± 0.6(-6)	1.8 ± 0.7(-7)
^{141}Ce	<9.1(-7)	1.0 ± 0.3(-6)	<5.1(-7)	<5.8(-7)	<3.6(-7)
^{144}Ce	<8.3(-7)	4.6 ± 1.7(-6)	<2.2(-6)	<3.2(-6)	2.1 ± 0.8(-6)

** Radionuclide not measured.

TABLE B.16

RADIONUCLIDE CONCENTRATIONS IN BAE FEED
(Base Cation Demineralizer Effluent)

Nuclide	2/16/78; 15:10 (μCi/ml)	2/17/78; 13:15 (μCi/ml)	2/20/78; 18:15 (μCi/ml)	2/22/78; 16:15 (μCi/ml)	5/2/78; 09:09 (μCi/ml)
^{131}I	3.24 ± 0.04(-4)	5.96 ± 0.09(-4)	5.2 ± 0.1(-3)	6.0 ± 0.4(-3)	2.92 ± 0.04(-4)
^{134}Cs	<6.4(-7)	<1.1(-6)	<1.3(-6)	<1.4(-7)	6 ± 3(-7)
^{137}Cs	<5.1(-6)	<2.9(-6)	<6.0(-6)	<7.2(-7)	<1.5(-6)
^{51}Cr	2.5 ± 0.1(-4)	1.39 ± 0.07(-4)	5.0 ± 0.2(-4)	2.37 ± 0.14(-4)	3.0 ± 0.3(-5)
^{54}Mn	1.47 ± 0.03(-5)	6.4 ± 0.3(-6)	2.03 ± 0.06(-5)	4.38 ± 0.16(-6)	3.9 ± 0.3(-6)
^{59}Fe	5.2 ± 0.1(-5)	3.36 ± 0.07(-5)	1.44 ± 0.02(-4)	1.10 ± 0.02(-4)	2.5 ± 0.6(-6)
^{57}Co	3.6 ± 0.2(-6)	2.8 ± 1.0(-6)	3.6 ± 0.7(-6)	3.9 ± 2.3(-7)	<3.7(-7)
^{58}Co	6.5 ± 0.2(-4)	3.53 ± 0.05(-4)	1.07 ± 0.02(-3)	2.66 ± 0.06(-4)	1.25 ± 0.02(-4)
^{60}Co	2.28 ± 0.05(-4)	1.18 ± 0.01(-4)	3.0 ± 0.04(-4)	4.83 ± 0.05(-5)	4.76 ± 0.08(-5)
^{65}Zn	8 ± 1(-6)	3.1 ± 0.6(-6)	7.8 ± 1.2(-6)	9.1 ± 1.9(-7)	<9.0(-7)
^{95}Zr	4.43 ± 0.06(-5)	2.17 ± 0.05(-5)	4.9 ± 0.1(-5)	9.5 ± 0.2(-6)	5.4 ± 0.6(-6)
^{95}Nb	7.5 ± 0.3(-5)	4.0 ± 0.15(-5)	8.4 ± 0.2(-5)	1.51 ± 0.05(-5)	1.40 ± 0.08(-5)
^{99}Mo	6.7 ± 1.5(-7)	<7.8(-7)	2.12 ± 0.03(-4)	1.96 ± 0.05(-4)	2.6 ± 0.3(-6)
^{103}Ru	4.18 ± 0.04(-5)	2.74 ± 0.04(-5)	3.93 ± 0.07(-5)	3.41 ± 0.17(-6)	2.1 ± 0.3(-6)
^{106}RuD	5.7 ± 0.4(-5)	3.8 ± 0.3(-5)	4.0 ± 0.8(-5)	<2(-7)	6 ± 3(-6)
^{110m}Ag	1.09 ± 0.03(-5)	7.1 ± 0.3(-6)	1.53 ± 0.06(-5)	6.74 ± 0.18(-6)	4.6 ± 0.3(-6)
^{124}Sb	5.5 ± 0.2(-4)	4.25 ± 0.08(-4)	1.94 ± 0.03(-4)	1.25 ± 0.02(-4)	9.9 ± 0.5(-6)
^{125}Sb	7.39 ± 0.08(-4)	5.65 ± 0.07(-4)	1.65 ± 0.02(-4)	8.2 ± 0.3(-5)	1.54 ± 0.07(-5)
^{140}La	4.1 ± 0.2(-6)	1.9 ± 0.2(-6)	1.10 ± 0.02(-4)	4.16 ± 0.04(-5)	1.08 ± 0.06(-5)
^{141}Ce	3.9 ± 0.5(-7)	1.9 ± 0.3(-6)	<6.8(-6)	<7.0(-7)	<6.8(-7)
^{144}Ce	1.3 ± 0.2(-5)	<2.8(-6)	<1.3(-6)	<2.4(-7)	<2.9(-6)

TABLE B.16 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN BAE FEED
(Base Cation Demineralizer Effluent)

Nuclide	5/3/78; 09:50 (μCi/ml)	5/4/78; 14:34 (μCi/ml)	5/9/78; 14:50 (μCi/ml)	5/11/78; 11:58 (μCi/ml)	5/15/78; 10:35 (μCi/ml)	5/17/78; 14:46 (μCi/ml)
^{131}I	1.36 ± 0.05(-4)	2.8 ± 0.2(-6)	1.47 ± 0.09(-6)	6.9 ± 0.1(-6)	2.57 ± 0.07(-6)	7.0 ± 3.0(-7)
^{134}Cs	<2.3(-6)	1.8 ± 0.4(-6)	1.1 ± 0.1(-6)	8.8 ± 0.1(-7)	9.3 ± 0.9(-7)	8.5 ± 0.8(-7)
^{136}Cs				1.6 ± 0.5(-7)		
^{137}Cs	<1.5(-5)	5.7 ± 0.3(-6)	3.0 ± 0.1(-6)	3.0 ± 0.2(-6)	3.0 ± 0.2(-6)	2.3 ± 0.2(-6)
^{51}Cr	4.9 ± 0.7(-4)	2.5 ± 0.2(-5)	8.8 ± 0.7(-6)	1.92 ± 0.06(-5)	6.5 ± 0.5(-6)	4.2 ± 1.6(-6)
^{54}Mn	1.13 ± 0.03(-4)	4.6 ± 0.2(-6)	7.2 ± 0.2(-6)	3.0 ± 0.1(-6)	2.5 ± 0.1(-6)	1.7 ± 0.3(-6)
^{59}Fe	3.0 ± 0.2(-5)	2.5 ± 0.4(-6)	9.3 ± 1.8(-7)	1.6 ± 0.1(-6)	1.9 ± 0.2(-6)	5.6 ± 1.4(-7)
^{57}Co	7.8 ± 0.4(-6)	6.2 ± 2.6(-7)	4.0 ± 0.6(-7)	2.4 ± 0.4(-7)	3.0 ± 0.5(-7)	1.4 ± 0.5(-7)
^{58}Co	2.5 ± 0.06(-3)	1.0 ± 0.1(-4)	5.9 ± 0.1(-5)	5.9 ± 0.2(-5)	5.0 ± 0.1(-5)	2.0 ± 0.1(-5)
^{60}Co	7.3 ± 0.1(-4)	2.28 ± 0.07(-5)	7.7 ± 0.2(-5)	2.5 ± 0.1(-5)	3.7 ± 0.1(-5)	2.5 ± 0.3(-5)
^{65}Zn	1.7 ± 0.2(-5)	8.1 ± 4.4(-7)	4.5 ± 3.8(-7)	3.7 ± 1.0(-7)	4.6 ± 1.4(-7)	5.5 ± 2.6(-7)
^{95}Zr	6.9 ± 0.1(-5)	3.1 ± 0.3(-6)	3.3 ± 0.2(-6)	2.0 ± 0.1(-6)	2.0 ± 0.1(-6)	1.6 ± 0.3(-6)
^{95}Nb	1.23 ± 0.10(-4)	5.1 ± 0.4(-6)	6.1 ± 0.5(-6)	3.6 ± 0.2(-6)	4.5 ± 0.3(-6)	3.1 ± 0.6(-6)
^{99}Mo	3.4 ± 0.2(-5)	4.9 ± 2.5(-7)	<1.5(-7)		<6.3(-8)	<1(-7)
^{103}Ru	1.9 ± 0.2(-5)	7.3 ± 1.7(-7)	6.5 ± 0.8(-7)	6.8 ± 0.6(-7)	1.09 ± 0.07(-6)	7.6 ± 1.5(-7)
^{106}RuD	4.2 ± 0.7(-5)	<6.1(-7)	6.1 ± 1.3(-6)	2.6 ± 0.6(-6)	3.6 ± 0.6(-6)	3.5 ± 1.0(-6)
^{110m}Ag	6.0 ± 0.3(-5)	1.3 ± 0.2(-6)	2.0 ± 0.3(-6)	2.27 ± 0.07(-6)	1.7 ± 0.1(-6)	1.2 ± 0.2(-6)
^{124}Sb	3.2 ± 0.2(-5)	1.9 ± 0.3(-6)	7.5 ± 1.1(-7)	1.1 ± 0.1(-6)	1.8 ± 0.1(-6)	4 ± 1(-7)
^{125}Sb	3.6 ± 0.2(-5)	1.5 ± 0.7(-6)	1.7 ± 0.2(-6)	1.1 ± 0.2(-6)	3.6 ± 0.2(-6)	8 ± 2(-7)
^{140}La	3.5 ± 0.3(-6)	1.0 ± 0.2(-6)	8.9 ± 0.7(-7)	7.3 ± 0.9(-7)	2.26 ± 0.09(-6)	7.9 ± 0.5(-7)
^{141}Ce	1.7 ± 0.6(-6)	1.2 ± 0.3(-6)	<1.6(-7)	2.1 ± 0.5(-7)	<1.1(-7)	1.1 ± 0.5(-7)
^{144}Ce	1.3 ± 0.5(-5)	<3.7(-7)	4.3 ± 0.6(-6)	1.4 ± 0.3(-6)	2.4 ± 0.3(-6)	1.5 ± 0.5(-6)

TABLE B.17

RADIONUCLIDE CONCENTRATIONS IN BAE DISTILLATE

Nuclide	2/16/78; 15:45 (μCi/ml)	2/17/78; 13:45 (μCi/ml)	2/20/78; 18:12 (μCi/ml)	2/22/78; 16:05 (μCi/ml)	5/2/78; 09:10 (μCi/ml)
^{131}I	2.61 ± 0.07(-5)	1.94 ± 0.05(-5)	7.5 ± 0.2(-6)*	1.64 ± 0.02(-4)	2.78 ± 0.07(-5)
^{134}Cs	8 ± 4(-8)	1.0 ± 0.5(-7)	5.7 ± 1.6(-9)*	<1.3(-7)	2.0 ± 0.7(-7)
^{136}Cs			6.6 ± 0.9(-9)*		
^{137}Cs	<7(-8)	6.7 ± 4.2(-8)	2.9 ± 0.1(-8)*	<1.4(-7)	<1.3(-7)
^{51}Cr	<6.4(-8)	1.0 ± 0.6(-7)	<3.7(-9)*	2.8 ± 2.4(-7)	<8.6(-7)
^{54}Mn	<7.2(-8)	6.5 ± 1.8(-8)	1.14 ± 0.09(-8)*	<1.3(-7)	5.9 ± 0.7(-7)
^{59}Fe	<6.8(-8)	<5.0(-8)	2.5 ± 0.2(-8)*	1.3 ± 0.2(-6)	<1.7(-7)
^{57}Co	<5.5(-8)	<4.1(-8)	<3.6(-9)*	<2.4(-7)	<8.5(-8)
^{58}Co	2.0 ± 0.5(-7)	2.0 ± 0.3(-7)	8.3 ± 0.2(-8)*	3.9 ± 0.2(-6)	1.7 ± 0.1(-6)
^{60}Co	<1.4(-7)	1.9 ± 1.3(-7)	1.21 ± 0.04(-7)*	1.3 ± 0.2(-6)	2.9 ± 0.2(-6)
^{65}Zn	<6.4(-8)	<4.7(-8)	<1.8(-9)*	<1.7(-7)	<2.1(-7)
^{95}Zr	<5.9(-8)	<4.5(-8)	7.0 ± 1.4(-9)*	1.3 ± 0.9(-7)	3 ± 1(-7)
^{95}Nb	<6.6(-8)	8.2 ± 5.6(-8)	2.1 ± 0.8(-8)*	2.6 ± 1.1(-7)	2.4 ± 0.6(-7)
^{99}Mo	<7.2(-8)	<5.2(-8)	2.5 ± 0.9(-9)*	2.1 ± 0.3(-6)	<8.1(-8)
^{103}Ru	<4.1(-8)	6.4 ± 2.1(-8)	7.6 ± 1.4(-9)*	<1.5(-7)	<1.0(-7)
^{106}RuD	<9.1(-8)	<4.8(-8)	<1.7(-9)*	1.2 ± 0.6(-6)	<1.0(-6)
^{110m}Ag	1.4 ± 0.7(-7)	1.1 ± 0.3(-7)	4.2 ± 0.1(-8)*	4.3 ± 0.5(-7)	<2.7(-7)
^{124}Sb	<5.7(-8)	1.0 ± 0.3(-7)	5.8 ± 0.3(-8)*	1.3 ± 0.2(-6)	2 ± 1(-7)
^{125}Sb	3.1 ± 0.8(-7)	2.3 ± 0.5(-7)	6.9 ± 0.5(-8)*	1.4 ± 0.1(-6)	<3.9(-7)
^{140}La	<5.8(-8)	8.0 ± 3.5(-8)	<1.0(-9)*	9.6 ± 0.7(-8)	<5.9(-8)
^{141}Ce	<6.0(-8)	<4.1(-8)	<2.3(-9)*	<2.9(-7)	<1.5(-7)
^{144}Ce	<5.8(-8)	5.3 ± 4.1(-8)	<6.4(-9)*	<2.0(-7)	<6.6(-7)

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* Resin Concentration Samples

TABLE B.17 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN BAE DISTILLATE

Nuclide	5/3/78; 12:00 (μCi/ml)	5/4/78; 14:45 (μCi/ml)	5/9/78; 15:21 (μCi/ml)	5/11/78; 12:57 (μCi/ml)	5/15/78; 11:00 (μCi/ml)	5/17/78; 15:12 (μCi/ml)
^{131}I	7.9 ± 0.2(-6)	9.0 ± 0.8(-6)	1.6 ± 0.1(-6)	3.6 ± 0.2(-6)	2.7 ± 0.8(-7)	2.6 ± 0.6(-7)
^{134}Cs	<2.2(-7)	<2(-7)	1.4 ± 0.1(-7)*	5.2 ± 2.4(-9)*	4.7 ± 3.6(-9)*	1.2 ± 0.4(-7)
^{136}Cs				3.9 ± 2.2(-9)*		
^{137}Cs	1.5 ± 0.4(-8)*	6.4 ± 0.8(-8)	3.1 ± 0.1(-7)*	5.6 ± 2.6(-8)*	1.4 ± 1.0(-7)	4.0 ± 2.8(-9)*
^{51}Cr	<1.0(-6)	4.3 ± 2.3(-7)	9.4 ± 1.4(-8)*	9.7 ± 1.7(-8)*	5.4 ± 2.0(-8)*	5.4 ± 1.4(-8)*
^{54}Mn	2.6 ± 0.6(-8)*	2.2 ± 0.6(-7)	1.2 ± 0.1(-7)*	1.4 ± 0.5(-7)	3.7 ± 0.3(-8)*	1.0 ± 0.4(-7)
^{59}Fe	4.6 ± 2.2(-8)*	<9.7(-8)	<1.7(-7)	1.7 ± 0.5(-8)*	<1.4(-7)	<1.2(-7)
^{57}Co	<7.9(-8)	<5.2(-8)	<1.3(-7)	1.9 ± 1.2(-9)*	<8.9(-8)	4.3 ± 1.3(-9)*
^{58}Co	3.2 ± 0.3(-7)	2.8 ± 0.4(-7)	3.8 ± 0.8(-7)	1.4 ± 0.6(-7)	2.2 ± 0.5(-7)	1.6 ± 0.4(-7)
^{60}Co	1.2 ± 0.3(-7)*	1.2 ± 0.2(-7)†	8.20 ± 0.05(-7)	3.0 ± 0.1(-7)*	3.8 ± 0.2(-7)*	3.3 ± 0.2(-7)†
^{65}Zn	<1.8(-7)	<8.0(-8)	<1.4(-7)	<2.7(-7)	<2.0(-7)	<1.9(-7)
^{95}Zr	7 ± 2(-8)*	7.5 ± 0.4(-8)*	3.9 ± 0.5(-8)*	3.0 ± 0.4(-8)*	2.5 ± 0.9(-8)*	2.1 ± 0.5(-8)*
^{95}Nb	5.5 ± 3.5(-8)*	1.0 ± 0.9(-7)	6.8 ± 0.6(-8)*	4.6 ± 0.4(-8)*	3.3 ± 0.4(-8)*	3.6 ± 0.4(-8)*
^{99}Mo	1.1 ± 0.5(-8)*	5.2 ± 2.3(-8)	<1.6(-7)	2.9 ± 2.0(-9)*	<8.3(-8)	1.5 ± 0.9(-8)*
^{103}Ru	1.9 ± 0.8(-8)*	<9.9(-8)	<1.1(-7)	1.9 ± 0.3(-8)*	6.9 ± 2.1(-9)*	9.4 ± 2.2(-9)*
^{106}RuD	<1.0(-6)	5.7 ± 1.6(-8)*	7.9 ± 4.0(-8)*	<8.3(-7)	<6.7(-7)	<7.3(-7)
^{110m}Ag	6 ± 1(-7)	3.0 ± 0.5(-7)	3.9 ± 0.4(-8)*	8.0 ± 0.6(-8)*	6.5 ± 0.7(-8)*	4.3 ± 0.8(-8)*
^{124}Sb	2 ± 1(-8)*	3.7 ± 0.5(-8)*	<9.3(-8)	1.9 ± 0.5(-8)*	1.2 ± 0.4(-8)*	1.7 ± 0.3(-8)*
^{125}Sb	1.1 ± 0.2(-7)*	7.4 ± 0.5(-8)*	6.6 ± 0.6(-8)*	7.7 ± 1.0(-8)*	4.5 ± 0.5(-8)*	5.3 ± 0.6(-8)*
^{140}La	2.3 ± 0.8(-8)*	<9.5(-8)	<1.2(-7)	<1.3(-7)	3.7 ± 2.2(-9)*	<6.6(-8)
^{141}Ce	<1.4(-7)	<7.0(-8)	<1.3(-7)	7.9 ± 2.1(-9)*	<1.4(-7)	<1.2(-7)
^{144}Ce	7 ± 3(-7)	<6.3(-8)	<1.3(-7)	1.1 ± 0.2(-7)*	<6.3(-7)	<5.4(-7)

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* - Resin Concentration Samples

† - Calculated from ^{58}Co ratios

TABLE B.18

RADIONUCLIDE CONCENTRATIONS IN BAE BOTTOMS

Nuclide	2/16/78; 16:00 (μCi/ml)	2/17/78; 14:00 (μCi/ml)	2/20/78; 18:45 (μCi/ml)	2/22/78; 16:00 (μCi/ml)	5/2/78; 09:06 (μCi/ml)
^{131}I	7.8 ± 0.1(-3)	7.5 ± 0.3(-3)	1.34 ± 0.02(-2)	1.14 ± 0.03(-1)	2.53 ± 0.06(-2)
^{134}Cs	1.0 ± 0.2(-4)	4.0 ± 0.8(-5)	<4.3(-5)	<3.6(-5)	<1.1(-5)
^{137}Cs	2.1 ± 0.2(-4)	1.1 ± 0.3(-4)	4.7 ± 0.9(-5)	<6.0(-5)	<3.6(-5)
^{51}Cr	3.5 ± 0.2(-3)	2.8 ± 0.1(-3)	2.2 ± 0.2(-3)	4.6 ± 0.5(-3)	9.0 ± 0.9(-4)
^{54}Mn	4.5 ± 0.2(-4)	2.9 ± 0.1(-4)	1.10 ± 0.09(-4)	2.3 ± 0.1(-4)	1.26 ± 0.07(-4)
^{59}Fe	4.3 ± 0.6(-4)	4.6 ± 0.6(-4)	7.7 ± 0.3(-4)	2.31 ± 0.05(-3)	1.1 ± 0.1(-4)
^{57}Co	8 ± 2(-5)	5 ± 2(-5)	7.0 ± 2.7(-5)	<4.4(-5)	<1.0(-5)
^{58}Co	8.22 ± 0.15(-3)	7.3 ± 0.3(-3)	7.25 ± 0.10(-3)	8.48 ± 0.06(-3)	2.46 ± 0.05(-3)
^{60}Co	5.03 ± 0.07(-3)	3.58 ± 0.18(-3)	2.01 ± 0.03(-3)	2.53 ± 0.05(-3)	1.20 ± 0.02(-3)
^{65}Zn	<4.9(-5)	7 ± 4(-5)	<2.7(-5)	<2.3(-5)	<2.1(-5)
^{95}Zr	6.0 ± 0.4(-4)	5.0 ± 0.2(-4)	2.4 ± 0.2(-4)	3.6 ± 0.2(-4)	1.3 ± 0.1(-4)
^{95}Nb	1.03 ± 0.03(-3)	8.6 ± 0.1(-4)	4.0 ± 0.3(-4)	6.1 ± 0.2(-4)	2.3 ± 0.1(-4)
^{99}Mo	<2.4(-5)	1.6 ± 0.3(-5)	1.3 ± 0.1(-4)	4.17 ± 0.07(-3)	2.12 ± 0.06(-4)
^{103}Ru	6.1 ± 0.2(-4)	4.84 ± 0.05(-4)	4.5 ± 0.1(-4)	2.9 ± 0.2(-4)	7.0 ± 0.6(-5)
^{106}RuD	9 ± 1(-4)	6.8 ± 0.1(-4)	4.9 ± 0.8(-4)	6.8 ± 2.9(-5)	2.6 ± 0.6(-4)
^{110m}Ag	2.0 ± 0.1(-4)	1.4 ± 0.3(-4)	1.3 ± 0.1(-4)	1.16 ± 0.11(-4)	1.7 ± 0.1(-4)
^{124}Sb	5.1 ± 0.1(-3)	5.3 ± 0.4(-3)	9.7 ± 0.1(-3)	4.56 ± 0.09(-3)	3.3 ± 0.2(-4)
^{125}Sb	6.62 ± 0.09(-3)	6.3 ± 0.8(-3)	1.32 ± 0.01(-2)	4.61 ± 0.06(-3)	5.0 ± 0.6(-4)
^{140}La	<2.5(-5)	1.6 ± 0.3(-5)	6.2 ± 1.0(-5)	6.9 ± 0.2(-4)	2.0 ± 0.1(-4)
^{141}Ce	<1.9(-5)	2.8 ± 0.5(-5)	<2.2(-5)	<2.6(-4)	<1.8(-5)
^{144}Ce	<5.1(-5)	<3.4(-5)	<6.8(-5)	<2.8(-5)	<9.4(-5)

TABLE B.18 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN BAE BOTTOMS

Nuclide	5/3/78; 11:55 (µCi/ml)	5/4/78; 14:57 (µCi/ml)	5/9/78; 14:40 (µCi/ml)	5/11/78; 12:50 (µCi/ml)	5/15/78; 11:25 (µCi/ml)	5/17/78; 14:29 (µCi/ml)
^{131}I	5.8 ± 0.2(-3)	4.23 ± 0.08(-3)	1.45 ± 0.06(-4)	1.61 ± 0.02(-4)	6.6 ± 0.2(-5)	2.49 ± 0.05(-5)
^{134}Cs	<2.4(-6)	1.5 ± 0.1(-5)	1.4 ± 0.3(-5)	7.0 ± 0.9(-6)	8.9 ± 0.5(-6)	7.0 ± 0.5(-6)
^{136}Cs		7.8 ± 1.2(-6)				
^{137}Cs	<2.2(-5)	5.4 ± 0.2(-5)	3.6 ± 0.4(-5)	2.6 ± 0.1(-5)	3.36 ± 0.05(-5)	2.33 ± 0.06(-5)
^{3}H	9.4 ± 0.3(-3)	4.4 ± 0.1(-2)	**	**	**	**
^{14}C	1.2 ± 0.1(-5)	1.3 ± 0.1(-5)	**	**	**	**
^{32}P	3.5 ± 0.5(-4)	2.3 ± 0.3(-4)	**	**	**	**
^{51}Cr	2.7 ± 0.3(-4)	2.15 ± 0.09(-4)	8.2 ± 2.0(-5)	7.7 ± 0.2(-4)	1.02 ± 0.06(-4)	4.9 ± 0.4(-5)
^{54}Mn	4.8 ± 0.3(-5)	4.2 ± 0.1(-5)	3.0 ± 0.4(-5)	2.37 ± 0.04(-4)	3.12 ± 0.08(-5)	1.75 ± 0.05(-5)
^{55}Fe	4.76 ± 0.01(-3)	2.31 ± 0.01(-3)	**	**	**	**
^{59}Fe	5.0 ± 0.3(-5)	4.4 ± 0.3(-5)	<8.6(-6)	4.9 ± 0.3(-5)	1.98 ± 0.08(-5)	1.01 ± 0.09(-5)
^{57}Co	4.1 ± 0.9(-6)	6.5 ± 1.3(-6)	<4.1(-6)	1.1 ± 0.1(-5)	2.9 ± 0.2(-6)	2.3 ± 0.5(-6)
^{58}Co	1.06 ± 0.02(-3)	1.11 ± 0.09(-3)	6.2 ± 0.2(-5)	1.86 ± 0.02(-3)	5.43 ± 0.07(-4)	3.29 ± 0.05(-4)
^{60}Co	4.6 ± 0.1(-4)	3.6 ± 0.1(-4)	2.9 ± 0.2(-4)	2.14 ± 0.02(-3)	3.71 ± 0.03(-4)	2.40 ± 0.03(-4)
^{63}Ni	1.78 ± 0.02(-4)	1.67 ± 0.02(-4)	**	**	**	**
^{65}Zn	<5.0(-6)	<2.5(-6)	<6.7(-6)	2.4 ± 0.2(-5)	7.5 ± 1.5(-6)	3.1 ± 0.9(-6)
^{89}Sr	3.3 ± 0.5(-7)	1.19 ± 0.04(-6)	**	**	**	**
^{90}Sr	1.9 ± 0.1(-7)	1.53 ± 0.08(-7)	**	**	**	**
^{91}Y	9.8 ± 0.1(-6)	6.47 ± 0.07(-6)	**	**	**	**
^{95}Zr	5.5 ± 0.3(-5)	2.4 ± 0.3(-5)	2.0 ± 0.5(-5)	2.00 ± 0.04(-4)	2.54 ± 0.07(-5)	1.52 ± 0.07(-5)
^{95}Nb	9.2 ± 0.3(-5)	5.4 ± 0.4(-5)	3.4 ± 0.4(-5)	3.53 ± 0.07(-4)	4.66 ± 0.07(-5)	3.0 ± 0.1(-5)
^{99}Mo	5.7 ± 0.1(-5)	2.49 ± 0.09(-5)	5.4 ± 1.6(-6)	3.6 ± 0.6(-6)	5.5 ± 1.6(-7)	<4.9(-7)
^{103}Ru	2.7 ± 0.1(-5)	1.8 ± 0.1(-5)	1.2 ± 0.4(-5)	3.9 ± 0.1(-5)	1.05 ± 0.04(-5)	6.8 ± 0.4(-6)
^{106}RuD	8 ± 1(-5)	<5.3(-6)	<5.8(-6)	1.5 ± 0.2(-4)	4.0 ± 0.4(-5)	2.7 ± 0.4(-5)
^{110m}Ag	9.1 ± 0.5(-5)	1.28 ± 0.06(-4)	1.7 ± 0.5(-5)	3.1 ± 0.1(-5)	1.09 ± 0.04(-4)	1.30 ± 0.06(-5)
^{124}Sb	1.45 ± 0.09(-4)	1.05 ± 0.06(-4)	1.3 ± 0.5(-5)	3.21 ± 0.08(-5)	1.73 ± 0.06(-5)	1.08 ± 0.10(-5)
^{125}Sb	2.15 ± 0.04(-4)	1.48 ± 0.03(-4)	4.7 ± 1.0(-5)	6.8 ± 0.2(-5)	4.2 ± 0.1(-5)	2.2 ± 0.1(-5)
^{140}La	5.5 ± 0.3(-5)	2.5 ± 0.2(-5)	1.1 ± 0.6(-5)	1.2 ± 0.2(-5)	1.33 ± 0.03(-5)	9.9 ± 0.5(-6)
^{141}Ce	<5.1(-6)	<1.6(-6)	<3.9(-6)	6.1 ± 0.6(-6)	9.6 ± 3.0(-7)	1.1 ± 0.4(-6)
^{144}Ce	1.8 ± 0.7(-5)	<1.9(-6)	<4.0(-6)	8.9 ± 0.3(-5)	1.5 ± 0.2(-5)	1.4 ± 0.3(-5)

** Radionuclide not measured.

TABLE B.19

RADIONUCLIDE CONCENTRATIONS IN BAE CONDENSATE DEMINERALIZER EFFLUENT

Nuclide	2/16/78; 15:45 (μCi/ml)	2/17/78; 13:35 (μCi/ml)	2/20/78; 18:30 (μCi/ml)	2/22/78; 15:15 (μCi/ml)	5/2/78; 09:14 (μCi/ml)
^{131}I	4.02 ± 0.09(-6)	4.12 ± 0.08(-6)	8.2 ± 0.1(-7)*	1.40 ± 0.03(-5)	2.1 ± 0.1(-6)
^{134}Cs	2.1 ± 0.6(-7)	9.6 ± 3.8(-8)	3.0 ± 0.3(-8)*	5.1 ± 3.9(-8)	<1.2(-7)
^{136}Cs	8 ± 5(-8)		1.34 ± 0.02(-8)*	2.1 ± 1.3(-8)	
^{137}Cs	3.1 ± 0.6(-7)	1.9 ± 0.4(-7)	8.0 ± 2.8(-8)*	5.0 ± 2.8(-8)	2.2 ± 0.9(-7)
^{51}Cr	<5.5(-8)	5.5 ± 3.8(-8)	4.0 ± 0.7(-8)*	5.8 ± 0.8(-7)	6 ± 3(-7)
^{54}Mn	1.3 ± 0.7(-7)	1.4 ± 0.3(-7)	2.2 ± 0.2(-8)*	7.0 ± 5.6(-8)	<8.5(-8)
^{59}Fe	<8.2(-8)	<6.6(-8)	1.1 ± 0.4(-8)*	1.0 ± 0.5(-7)	<1.3(-7)
^{57}Co	<8.7(-8)	<3.7(-8)	<5.5(-9)*	<4.1(-8)	<9.8(-8)
^{58}Co	8.3 ± 0.6(-7)	5.0 ± 0.5(-7)	7.8 ± 0.2(-7)*	4.8 ± 0.2(-6)	3.5 ± 0.6(-7)
^{60}Co	<1.9(-7)	3.0 ± 1.2(-7)	2.2 ± 0.1(-7)*	9.9 ± 1.0(-7)	<1.3(-7)
^{65}Zn	<7.0(-8)	<7.8(-8)	<3.5(-9)*	<4.2(-8)	<2.4(-7)
^{95}Zr	<7.2(-8)	<5.2(-8)	6.6 ± 2.4(-9)*	5.5 ± 4.8(-8)	<2.3(-7)
^{95}Nb	<8.7(-8)	<1.0(-7)	<1.5(-8)*	1.2 ± 0.5(-8)	<1.1(-7)
^{99}Mo	<8.3(-8)	4.8 ± 1.5(-8)	3.9 ± 0.9(-9)*	2.3 ± 0.4(-8)	<9.2(-8)
^{103}Ru	<6.4(-8)	9.0 ± 2.7(-8)	3.8 ± 3.0(-9)*	3.4 ± 4.2(-8)	<9.7(-8)
^{106}RuD	<6.0(-8)	3.8 ± 3.0(-7)	<3.1(-9)*	1.9 ± 4.3(-8)	<6.2(-7)
^{110m}Ag	4.9 ± 0.9(-7)	5.4 ± 0.7(-7)	1.5 ± 0.1(-7)*	2.4 ± 0.4(-7)	<1.2(-7)
^{124}Sb	<6.4(-8)	8.6 ± 2.9(-8)	1.7 ± 0.2(-8)*	2.5 ± 3.9(-8)	<1.5(-7)
^{125}Sb	<6.3(-8)	5.9 ± 0.5(-9)	2.4 ± 0.3(-8)*	6.9 ± 4.7(-8)	<2.1(-7)
^{140}La	<8.7(-8)	<4.4(-8)	2.1 ± 2.2(-9)*	2.3(-8)	<5.2(-7)
^{141}Ce	<5.5(-8)	<3.4(-8)	<1.1(-9)	<4.2(-8)	<1.5(-7)
^{144}Ce	<7.5(-8)	<3.4(-8)	<1.8(-9)*	<4.0(-8)	<5.4(-6)

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* Resin Concentration Samples

TABLE B.19 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN BAE CONDENSATE DEMINERALIZER EFFLUENT

Nuclide	5/3/78; 12:03 (μCi/ml)	5/4/78; 14:48 (μCi/ml)	5/9/78; 15:29 (μCi/ml)	5/11/78; 13:07 (μCi/ml)	5/15/78; 11:02 (μCi/ml)	5/17/78; 15:21 (μCi/ml)
^{131}I	2.1 ± 0.7(-7)*	6.7 ± 0.1(-7)*	2.0 ± 0.4(-7)	1.6 ± 0.3(-7)	8.5 ± 1.8(-9)*	9.8 ± 1.6(-8)*
^{134}Cs	1.8 ± 0.1(-7)*	9.5 ± 0.3(-8)*	5.9 ± 1.3(-9)*	6.9 ± 0.4(-8)*	3.1 ± 0.3(-8)*	1.1 ± 0.4(-7)
^{137}Cs	4.9 ± 0.1(-7)*	2.2 ± 0.1(-7)*	3.2 ± 0.2(-8)*	5.4 ± 3.7(-8)	6.4 ± 4.6(-8)	1.2 ± 1.1(-7)
^{51}Cr	<6.7(-8)*	<3.9(-9)*	1.5 ± 0.2(-7)*	4.6 ± 1.3(-8)*	<3.2(-7)	<6.9(-7)
^{54}Mn	<1.2(-8)*	5.4 ± 0.7(-9)*	<1.3(-7)	1.8 ± 0.2(-8)*	6.7 ± 3.8(-8)	3.0 ± 2.3(-9)*
^{59}Fe	<1.8(-8)*	<8.8(-9)*	1.4 ± 0.4(-8)*	<1.2(-7)	<8.4(-8)	<2.6(-7)
^{57}Co	<8.0(-8)*	<2.7(-9)*	<9.9(-8)	<4.4(-8)	<3.4(-8)	<7.9(-8)
^{58}Co	7.0 ± 0.4(-8)*	6.2 ± 0.2(-8)*	8.5 ± 0.1(-7)*	2.5 ± 0.6(-7)	6.1 ± 0.4(-8)*	8.6 ± 4.1(-8)
^{60}Co	8.8 ± 0.4(-8)*	9.4 ± 0.2(-8)*	4.8 ± 0.1(-7)*	6.0 ± 5.0(-8)	5.8 ± 1.0(-8)*	6.8 ± 1.0(-8)*
^{65}Zn	<2.2(-8)*	<8.2(-9)*	<1.5(-7)	<9.9(-8)	<9.6(-8)	<2.1(-7)
^{95}Zr	5 ± 2(-9)*	9.1 ± 3.7(-9)*	4.6 ± 0.5(-8)*	<1.0(-7)	4.3 ± 2.8(-9)*	<1.4(-7)
^{95}Nb	<1.1(-8)*	7.6 ± 5.3(-9)*	8.1 ± 0.5(-8)*	8.3 ± 2.4(-8)*	<6(-8)	5.1 ± 2.2(-8)*
^{99}Mo	<7.6(-9)	2.2 ± 0.8(-9)*	<1(-7)	2.9 ± 1.6(-9)*	<4.2(-8)	9.1 ± 3.1(-9)*
^{103}Ru	<1.0(-8)*	<4.9(-9)*	1.2 ± 0.2(-8)*	<4.8(-8)	<3.6(-8)	<6.9(-8)
^{106}RuD	1.0 ± 0.4(-7)*	<5.8(-9)*	<1.0(-7)	<4.4(-7)	<3.5(-7)	<7.4(-7)
^{110m}Ag	2.1 ± 0.2(-8)*	2.9 ± 0.3(-8)*	2.0 ± 0.1(-7)*	2.6 ± 0.4(-8)*	1.1 ± 0.3(-7)	1.8 ± 0.4(-8)*
^{124}Sb	<1.7(-8)*	2.4 ± 0.4(-8)*	4.0 ± 0.7(-8)*	7.2 ± 3.2(-9)*	6.4 ± 3.3(-9)*	6.5 ± 3.7(-9)*
^{125}Sb	<4.2(-8)*	6.1 ± 0.4(-8)*	7.0 ± 0.6(-8)*	1.8 ± 0.6(-7)	1.4 ± 0.5(-7)	2.7 ± 0.5(-8)*
^{140}La	3 ± 1(-9)*	<4.7(-9)*	<9.6(-8)	<3.5(-8)	<5.1(-8)	<7.8(-8)
^{141}Ce	<1.3(-8)*	<2.7(-9)*	<9.7(-8)	<7.4(-8)	<5.7(-8)	<2.2(-7)
^{144}Ce	<5.7(-8)*	<3.1(-9)*	<1.3(-7)	2.5 ± 2.0(-8)*	<3.6(-7)	<5.9(-7)

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* Resin Concentration Samples

TABLE B.20

RADIONUCLIDE CONCENTRATIONS IN BAE CONDENSATE DEMINERALIZER FILTER EFFLUENT

Nuclide	2/16/78; 15:30 (μCi/ml)	2/17/78; 13:25 (μCi/ml)	2/20/78; 18:05 (μCi/ml)	2/22/78; 13:55 (μCi/ml)	5/2/78; 09:20 (μCi/ml)
^{131}I	4.2 ± 0.1(-6)	3.85 ± 0.09(-6)	8.2 ± 0.1(-7)*	1.28 ± 0.03(-5)	2.25 ± 0.05(-6)
^{134}Cs	7.7 ± 3.7(-8)	8.7 ± 6.6(-8)	3.2 ± 0.3(-8)*	<1.7(-7)	<9.4(-8)
^{136}Cs	8.7 ± 3.4(-8)	6.5 ± 2.5(-8)	1.3 ± 0.2(-8)*		
^{137}Cs	2.5 ± 0.5(-7)	2.9 ± 0.4(-7)	8.8 ± 0.2(-8)*	8.5 ± 0.6(-8)	2.1 ± 0.5(-7)
^{51}Cr	<4.7(-8)	5.9 ± 3.6(-9)	1.0 ± 0.3(-8)*	<1.4(-7)	<3.9(-7)
^{54}Mn	<4.1(-8)	5.3 ± 3.5(-8)	4.7 ± 1.0(-9)*	<1.3(-7)	5 ± 2(-8)
^{59}Fe	<6.5(-8)	7.1 ± 5.6(-8)	2.7 ± 1.5(-9)*	1.7 ± 0.6(-7)	<9.1(-8)
^{57}Co	<7.8(-8)	<3.5(-8)	8.8 ± 2.4(-10)*	1.9 ± 1.0(-8)	<5.1(-8)
^{58}Co	1.7 ± 0.1(-6)	4.7 ± 0.5(-7)	1.8 ± 0.1(-7)*	5.44 ± 0.02(-6)	1.4 ± 0.3(-7)
^{60}Co	4.1 ± 1.2(-7)	1.9 ± 1.2(-7)	6.3 ± 0.4(-8)*	9.2 ± 0.9(-7)	1.8 ± (-6)
^{65}Zn	<8.5(-8)	<5.6(-8)	<2.7(-9)*	<9.9(-8)	<1.2(-7)
^{95}Zr	<5.7(-8)	8.4 ± 3.9(-9)	<2.5(-9)*	<9.8(-8)	<7.6(-8)
^{95}Nb	<1.1(-7)	1.3 ± 0.9(-8)	4.1 ± 1.2(-9)*	<8.3(-8)	<5.2(-8)
^{99}Mo	<6.7(-8)	<4.9(-9)	<1.5(-9)*	<1.1(-7)	<5.6(-8)
^{103}Ru	<5.0(-8)	7.9 ± 4.0(-9)	3.3 ± 3.0(-9)*	1.11 ± 0.3(-7)	<4.5(-8)
^{106}RuD	<5.6(-8)	<4.8(-8)	<4.7(-9)*	<6.7(-8)	<4.3(-6)
^{110m}Ag	4.9 ± 0.5(-7)	5.2 ± 0.4(-7)	1.8 ± 0.1(-7)*	3.0 ± 1.0(-7)	<8.0(-8)
^{124}Sb	<3.5(-8)	<4.3(-8)	3.1 ± 1.0(-9)*	<7.0(-8)	<8.2(-8)
^{125}Sb	<4.3(-8)	<4.2(-8)	8.5 ± 2.(-9)*	<1.3(-7)	<1.2(-7)
^{140}La	<6.1(-8)	<4.2(-8)	<1.9(-9)*	<6.5(-8)	<6.0(-8)
^{141}Ce	<4.0(-8)	<3.6(-8)	<1.6(-9)*	<1.1(-7)	<8.6(-8)
^{144}Ce	5.5 ± 3.7(-8)	<3.5(-8)	<1.2(-9)*	<1.0(-7)	<3.9(-7)

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* Resin Concentration Samples

TABLE B.20 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN BAE CONDENSATE DEMINERALIZER FILTER EFFLUENT

Nuclide	5/3/78; 11:59 (μCi/ml)	5/4/78; 14:40 (μCi/ml)	5/9/78; 15:01 (μCi/ml)	5/11/78; 12:10 (μCi/ml)	5/15/78; 10:45 (μCi/ml)	5/17/78; 14:54 (μCi/ml)
^{131}I	2.16 ± 0.06(-7)*	7.1 ± 0.8(-7)*	1.5 ± 0.5(-7)	1.3 ± 0.3(-7)	6.8 ± 2.4(-8)	1.8 ± 0.3(-8)*
^{134}Cs	2.2 ± 0.8(-8)*	4.6 ± 0.2(-8)*	7.6 ± 0.8(-8)	1.0 ± 0.5(-7)	7 ± 3(-8)†	7.1 ± 3.0(-8)
^{137}Cs	6.1 ± 0.8(-8)*	9.3 ± 0.9(-8)*	3.3 ± 2.8(-9)*	8.1 ± 4.1(-8)	1.5 ± 0.2(-8)*	1.1 ± 0.4(-8)*
^{3}H	**	**	**	2.26 ± 0.07(-2)	**	**
^{14}C	**	**	**	5.9 ± 0.6(-6)	**	**
^{32}P	**	**	**	7.3 ± 0.7(-7)	**	**
^{51}Cr	4 ± 3(-8)*	<4.3(-9)*	<4.4(-8)	1.8 ± 1.6(-8)*	<4.2(-7)	<3.7(-7)
^{54}Mn	7 ± 5(-9)*	<4(-9)*	7.8 ± 5.9(-8)	1.0 ± 0.2(-8)*	6.1 ± 0.6(-8)	6 ± 2(-9)*
^{55}Fe	**	**	**	1.7 ± 0.1(-6)	**	**
^{59}Fe	<1.9(-8)*	<1.3(-8)*	<9.5(-8)	<8.7(-8)	<9.7(-8)	<1.2(-7)
^{57}Co	3 ± 1(-8)*	<3.2(-9)*	<5.9(-8)	<5.1(-8)	<6.0(-8)	<7.1(-8)
^{58}Co	9.9 ± 1.3(-8)*	7.9 ± 0.4(-8)*	4.8 ± 0.6(-8)	1.4 ± 0.4(-7)	6.8 ± 0.4(-8)*	1.3 ± 0.3(-7)
^{59}Co	1.02 ± 0.10(-7)*	6.6 ± 0.2(-8)*	2.3 ± 1.0(-8)*	9.8 ± 1.0(-8)*	2.9 ± 0.9(-8)*	3.0 ± 1.3(-8)*
^{63}Ni	**	**	**	2.0 ± 0.3(-7)	**	**
^{65}Zn	<2(-8)*	<8(-9)*	<1.3(-7)	<1.1(-7)	<9.8(-8)	<1.2(-7)
^{89}Sr	**	**	**	<9(-8)	**	**
^{90}Sr	**	**	**	4 ± 1(-9)	**	**
^{91}Y	**	**	**	<1(-9)	**	**
^{95}Zr	<5.4(-9)*	<5.9(-9)*	<5.3(-8)	5.7 ± 3.6(-9)*	<1.2(-7)	<1.1(-7)
^{95}Nb	2.4 ± 0.6(-8)*	8.5 ± 6.9(-9)*	1.0 ± 0.8(-7)	1.3 ± 0.2(-8)*	4.4 ± 2.1(-9)*	6.9 ± 2.8(-9)*
^{99}Mo	<5.7(-9)*	<2.9(-9)*	<7.6(-8)	<7.8(-8)	<7.6(-8)	<5.4(-8)
^{103}Ru	<7.4(-9)*	<5.2(-9)*	<5.3(-8)	3.2 ± 1.7(-9)*	<4.4(-8)	2.9 ± 1.6(-9)*
^{106}RuD	<8.3(-8)*	3.7 ± 1.1(-8)*	<5.0(-8)	<6.7(-7)	<4.0(-7)	<4.0(-7)
^{110m}Ag	4.5 ± 0.6(-8)*	4.1 ± 0.9(-8)*	2.9 ± 0.7(-8)*	3.2 ± 0.6(-8)*	2.3 ± 0.4(-8)*	1.5 ± 0.4(-8)*
^{124}Sb	2.0 ± 0.6(-8)*	<6.4(-9)*	<4.3(-8)	1.2 ± 0.5(-8)*	5.7 ± 3.9(-9)*	1.0 ± 0.4(-8)*
^{125}Sb	4.1 ± 1.3(-8)*	6.1 ± 0.6(-8)*	2.9 ± 0.3(-8)*	3.4 ± 0.5(-8)*	4.0 ± 0.5(-8)*	2.5 ± 0.5(-8)*
^{140}La	<8.1(-9)*	<5.6(-9)*	<7.6(-8)	7.3 ± 3.6(-9)*	<4.0(-8)	<4.6(-8)
^{141}Ce	<1.0(-8)*	<2.6(-9)*	<6.7(-8)	<9.5(-8)	<8.8(-8)	<8.9(-8)
^{144}Ce	<4.4(-8)*	<3.8(-9)*	<6.0(-8)	<4.0(-7)	<5.6(-7)	<5.0(-7)

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* Resin Concentration Samples

** Radionuclide not measured.

† Calculated from ^{58}Co ratios

TABLE B.21

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR FEED

Nuclide	1/5/78; 13:15 (μCi/ml)	1/6/78; 16:31 (μCi/ml)	1/9/78; 09:46 (μCi/ml)	1/9/78; 12:35 (μCi/ml)
^{131}I	8.54 ± 0.07(-5)	8.0 ± 0.1(-5)	5.6 ± 0.1(-4)	4.82 ± 0.06(-4)
^{132}I	<1(-3)	*	7.4 ± 1.2(-6)	9.1 ± 1.4(-6)
^{133}I	2.49 ± 0.60(-6)	4.4 ± 0.4(-6)	2.1 ± 0.2(-5)	2.2 ± 0.1(-5)
^{134}I	*	1.2 ± 0.2(-5)	6.4 ± 1.8(-6)	1.2 ± 0.3(-5)
^{135}I	<5.6(-6)	<6.9(-7)	1.3 ± 0.2(-5)	1.5 ± 0.2(-5)
^{88}Rb	<3(-5)	*	6.1 ± 1.2(-5)	3.6 ± 1.0(-5)
^{134}Cs	4.7 ± 0.7(-5)	4.65 ± 0.06(-5)	7.3 ± 0.1(-5)	6.7 ± 0.2(-5)
^{136}Cs	2.5 ± 0.3(-6)	2.5 ± 0.2(-6)	3.0 ± 0.7(-6)	4.0 ± 0.9(-6)
^{137}Cs	2.4 ± 0.6(-5)	8.9 ± 0.2(-5)	1.33 ± 0.02(-4)	1.24 ± 0.02(-4)
^{138}Cs	*	5.3 ± 1.0(-6)	1.5 ± 0.2(-5)	6.4 ± 1.6(-6)
^{3}H	**	**	**	**
^{14}C	**	**	**	**
^{24}Na	1.7 ± 0.2(-6)	2.3 ± 0.2(-6)	6.3 ± 0.6(-6)	7.6 ± 0.7(-6)
^{51}Cr	4.5 ± 0.3(-5)	3.6 ± 0.2(-5)	<3(-6)	2.8 ± 0.5(-5)
^{54}Mn	2.28 ± 0.04(-5)	1.56 ± 0.07(-5)	1.1 ± 0.1(-5)	1.2 ± 0.1(-5)
^{55}Fe	**	**	**	**
^{59}Fe	2.8 ± 0.8(-6)	<1.3(-6)	<3(-6)	<3(-6)
^{57}Co	2.7 ± 0.2(-6)	2.5 ± 0.3(-6)	1.4 ± 0.5(-6)	2.4 ± 0.5(-6)
^{58}Co	1.16 ± 0.03(-3)	1.00 ± 0.03(-3)	6.2 ± 0.1(-4)	6.6 ± 0.1(-4)
^{60}Co	3.19 ± 0.09(-4)	2.72 ± 0.08(-4)	1.85 ± 0.02(-4)	1.92 ± 0.02(-4)
^{63}Ni	**	**	**	**
^{65}Zn	2.5 ± 0.1(-5)	2.76 ± 0.07(-5)	2.5 ± 0.2(-5)	2.4 ± 0.2(-5)
^{89}Sr	**	**	**	**
^{90}Sr	**	**	**	**
^{91}Sr	*	*	*	*
^{91}Y	**	**	**	**
^{95}Zr	5.9 ± 0.5(-6)	2.9 ± 0.4(-6)	*	<3(-6)
^{95}Nb	9.8 ± 0.7(-6)	4.7 ± 0.3(-6)	3.1 ± 0.6(-6)	2.2 ± 0.6(-6)
^{99}Mo	*	*	*	*
^{103}Ru	4.7 ± 0.3(-6)	3.4 ± 0.3(-6)	2.3 ± 0.6(-6)	2.6 ± 0.6(-6)
^{106}Ru	8.6 ± 2.8(-6)	<1(-7)	<3(-6)	<4(-6)
^{110m}Ag	*	2.9 ± 0.6(-6)	*	*
^{124}Sb	1.86 ± 0.06(-5)	2.04 ± 0.07(-5)	3.0 ± 0.2(-5)	2.6 ± 0.2(-5)
^{125}Sb	1.05 ± 0.11(-5)	1.11 ± 0.07(-5)	2.0 ± 0.2(-5)	2.0 ± 0.2(-5)
^{129m}Te	1.9 ± 0.9(-5)	<1.1(-6)	*	4.8 ± 1.5(-5)
^{129}Te	*	*	*	*
^{140}Ba	2.5 ± 1.0(-6)	<1.2(-6)	<3(-6)	*
^{140}La	1.9 ± 0.5(-6)	5.6 ± 0.9(-7)	1.1 ± 0.4(-6)	1.0 ± 0.3(-6)
^{141}Ce	*	*	*	*

TABLE B.21 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR FEED

Nuclide	1/9/78; 13:20 (μCi/ml)	1/9/78; 17:33 (μCi/ml)	1/10/78; 09:13 (μCi/ml)	1/11/78; 12:43 (μCi/ml)
^{131}I	4.86 ± 0.06(-4)	4.0 ± 0.1(-4)	2.32 ± 0.03(-4)	1.10 ± 0.02(-4)
^{132}I	4.8 ± 1.1(-6)	<6(-6)	<8(-6)	<2(-5)
^{133}I	2.1 ± 0.1(-5)	2.0 ± 0.1(-5)	1.3 ± 0.2(-5)	1.2 ± 0.1(-5)
^{134}I	5.6 ± 2.5(-6)	<1(-5)	2.35 ± 0.09(-4)	5.5 ± 0.7(-4)
^{135}I	1.0 ± 0.2(-5)	8.3 ± 1.4(-6)	5.0 ± 2.2(-6)	<3(-6)
^{88}Rb	3.9 ± 1.6(-5)	*	<2(-4)	*
^{134}Cs	6.6 ± 0.1(-5)	6.4 ± 0.2(-5)	8.8 ± 0.2(-5)	7.8 ± 0.2(-5)
^{136}Cs	<2(-6)	2.8 ± 0.6(-6)	4.6 ± 1.5(-6)	1.9 ± 0.7(-6)
^{137}Cs	1.29 ± 0.03(-4)	1.26 ± 0.03(-4)	<6.8(-3)	1.40 ± 0.02(-4)
^{138}Cs	<6(-5)	<1(-5)	2.0 ± 0.7(-5)	8.2 ± 1.9(-4)
^{3}H	**	**	**	2.9 ± 0.1(-2)
^{14}C	**	**	**	7.5 ± 0.8(-6)
^{24}Na	8.6 ± 0.6(-6)	6.7 ± 0.7(-6)	4.7 ± 0.6(-6)	4.0 ± 0.5(-6)
^{51}Cr	2.3 ± 0.7(-5)	2.3 ± 0.5(-5)	7.8 ± 0.8(-5)	4.0 ± 0.6(-5)
^{54}Mn	1.3 ± 0.1(-5)	1.1 ± 0.1(-5)	3.7 ± 0.2(-5)	2.9 ± 0.1(-5)
^{55}Fe	**	**	**	4.05 ± 0.02(-4)
^{59}Fe	<2(-6)	4.3 ± 1.2(-6)	1.1 ± 0.2(-5)	<4(-6)
^{57}Co	3.0 ± 0.5(-6)	*	5.1 ± 0.8(-6)	3.5 ± 0.5(-6)
^{58}Co	7.64 ± 0.05(-4)	6.2 ± 0.1(-4)	1.77 ± 0.02(-3)	1.1 ± 0.1(-3)
^{60}Co	2.16 ± 0.03(-4)	1.78 ± 0.02(-4)	5.04 ± 0.06(-4)	3.80 ± 0.03(-4)
^{63}Ni	**	**	**	1.66 ± 0.01(-4)
^{65}Zn	2.3 ± 0.2(-5)	2.1 ± 0.2(-5)	2.4 ± 0.2(-5)	3.3 ± 0.2(-5)
^{89}Sr	**	**	**	2.76 ± 0.08(-6)
^{90}Sr	**	**	**	6.2 ± 0.1(-7)
^{91}Sr	<4(-6)	<3(-6)	<6(-6)	<5(-6)
^{91}Y	**	**	**	1.04 ± 0.02(-6)
^{95}Zr	3.6 ± 1.1(-6)	*	2.4 ± 0.2(-5)	1.1 ± 0.2(-5)
^{95}Nb	2.7 ± 0.7(-6)	3.2 ± 0.7(-6)	5.3 ± 0.4(-5)	2.1 ± 0.1(-5)
^{99}Mo	*	*	*	*
^{103}Ru	<2(-6)	*	1.5 ± 0.1(-5)	5.6 ± 1.1(-6)
^{106}Ru	<2(-5)	*	5.6 ± 1.2(-5)	*
^{110m}Ag	<2(-6)	*	*	1.2 ± 0.3(-5)
^{124}Sb	2.8 ± 0.2(-5)	2.4 ± 0.2(-5)	3.1 ± 0.2(-5)	1.7 ± 0.1(-5)
^{125}Sb	1.6 ± 0.3(-5)	1.4 ± 0.3(-5)	4.5 ± 0.3(-5)	2.0 ± 0.3(-5)
^{129m}Te	<4(-5)	*	<4(-6)	<3(-6)
^{129}Te	*	*	*	*
^{140}Ba	*	*	*	*
^{140}La	1.0 ± 0.3(-6)	7.6 ± 2.5(-7)	<2(-6)	<1(-6)
^{141}Ce	*	*	*	*

TABLE B.21 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR FEED

Nuclide	2/1/78; 16:10 (μCi/ml)	2/5/78; 10:40 (μCi/ml)	2/18/78; 13:30 (μCi/ml)	4/28/78; 10:44 (μCi/ml)
^{131}I	2.7 ± 0.1(-3)	2.0 ± 0.1(-3)	8.3 ± 0.1(-4)	1.9 ± 0.1(-4)
^{132}I	<4(-5)	<2(-5)	*	1.4 ± 0.1(-5)
^{133}I	5.0 ± 0.8(-5)	2.4 ± 0.5(-5)	2.64 ± 0.04(-4)	5.1 ± 0.1(-5)
^{134}I	<6(-5)	7.6 ± 0.9(-5)	*	*
^{135}I	<1(-5)	1.9 ± 0.6(-5)	3.2 ± 0.1(-4)	3.4 ± 0.1(-5)
^{88}Rb	<1(-4)	<2(-5)	*	<8(-5)
^{134}Cs	6.0 ± 0.1(-4)	7.5 ± 0.1(-4)	1.7 ± 0.1(-4)	1.1 ± 0.1(-5)
^{136}Cs	<8(-5)	<5(-4)	2.3 ± 0.1(-5)	1.0 ± 0.4(-6)
^{137}Cs	8.1 ± 0.1(-4)	1.6 ± 0.1(-3)	2.7 ± 0.1(-4)	1.95 ± 0.01(-4)
^{138}Cs	*	<3(-5)	*	7.2 ± 2.8(-6)
^{3}H	**	**	**	**
^{14}C	**	**	**	**
^{24}Na	3.3 ± 0.8(-6)	6.9 ± 0.9(-6)	7.7 ± 0.4(-6)	7.8 ± 0.6(-6)
^{51}Cr	7.1 ± 0.6(-4)	5.3 ± 0.3(-4)	7.5 ± 0.2(-5)	3.6 ± 0.3(-5)
^{54}Mn	4.7 ± 0.1(-4)	1.9 ± 0.1(-4)	6.6 ± 0.2(-5)	2.2 ± 0.2(-5)
^{55}Fe	**	**	**	**
^{59}Fe	6.7 ± 0.9(-5)	7.9 ± 0.8(-5)	8.3 ± 0.4(-6)	2.8 ± 0.9(-6)
^{57}Co	9.6 ± 0.3(-5)	3.5 ± 0.2(-5)	2.5 ± 0.1(-6)	2.5 ± 0.3(-6)
^{58}Co	4.0 ± 0.1(-2)	1.3 ± 0.1(-2)	8.6 ± 0.2(-4)	4.1 ± 0.1(-4)
^{60}Co	9.3 ± 0.2(-3)	3.6 ± 0.1(-3)	3.4 ± 0.1(-4)	4.2 ± 0.1(-4)
^{63}Ni	**	**	**	**
^{65}Zn	6.2 ± 1.0(-5)	3.8 ± 0.7(-5)	3.4 ± 0.7(-6)	<2(-6)
^{89}Sr	**	**	**	**
^{90}Sr	**	**	**	**
^{91}Sr	<4(-4)	<2(-5)	7.0 ± 1.0(-5)	3.1 ± 1.5(-6)
^{91}Y	**	**	**	**
^{95}Zr	1.1 ± 0.1(-4)	8.2 ± 0.6(-5)	1.5 ± 0.1(-5)	9.2 ± 0.7(-6)
^{95}Nb	1.5 ± 0.1(-4)	1.38 ± 0.07(-4)	2.6 ± 0.1(-5)	1.6 ± 0.1(-5)
^{99}Mo	2.1 ± 0.3(-5)	7.4 ± 2.3(-6)	2.6 + 0.1(-5)	3.5 ± 0.2(-6)
^{103}Ru	1.20 ± 0.06(-4)	8.0 ± 0.4(-5)	8.0 ± 0.2(-6)	1.7 ± 0.9(-6)
^{106}Ru	<2(-5)	1.7 ± 0.4(-4)	6.2 ± 3.1(-6)	1.2 ± 0.4(-5)
^{110m}Ag	*	*	*	1.1 ± 0.1(-5)
^{124}Sb	9.1 ± 0.1(-4)	4.1 ± 0.1(-4)	4.2 ± 0.1(-5)	1.0 ± 0.1(-5)
^{125}Sb	1.0 ± 0.1(-3)	4.6 ± 0.1(-4)	5.6 ± 0.1(-5)	1.7 ± 0.1(-5)
^{129m}Te	<2(-5)	<2(-5)	*	<2(-5)
^{129}Te	4.2 ± 1.3(-4)	*	*	<3(-5)
^{140}Ba	<2(-5)	<2(-6)	1.9 ± 0.1(-5)	7.4 ± 1.3(-6)
^{140}La	7.7 ± 1.9(-6)	3.7 ± 0.9(-6)	5.3 ± 0.8(-6)	2.9 ± 0.2(-6)
^{141}Ce	<8(-6)	1.5 ± 0.4(-5)	8.4 ± 2.3(-7)	<8(-7)

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* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.22

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR DISTILLATE

Nuclide	1/5/78; 13:15 (μCi/ml)	1/6/78; 16:31 (μCi/ml)	1/9/78; 09:46 (μCi/ml)	1/9/78; 12:35 (μCi/ml)
^{131}I	5.4 ± 0.1(-5)	2.6 ± 0.1(-5)	2.2 ± 0.1(-5)	2.1 ± 0.1(-5)
^{132}I	*	<3(-7)	*	*
^{133}I	*	<1(-7)	8.6 ± 4.1(-8)	1.2 ± 0.4(-7)
^{134}I	8.8 ± 1.7(-7)	2.9 ± 0.7(-6)	*	*
^{135}I	<1(-7)	<1(-7)	<2(-7)	<1(-7)
^{88}Rb	<2(-7)	*	<1(-6)	*
^{134}Cs	6.1 ± 0.5(-7)	1.7 ± 0.6(-7)	*	<2(-7)
^{136}Cs	1.8 ± 0.4(-7)	<1(-7)	<2(-7)	<2(-7)
^{137}Cs	9.7 ± 0.8(-7)	<2(-7)	9.0 ± 5.6(-8)	6.3 ± 5.1(-8)
^{138}Cs	<6(-7)	*	<4(-7)	*
^{3}H	**	**	**	**
^{14}C	**	**	**	**
^{24}Na	<1(-7)	*	<3(-7)	*
^{51}Cr	<1(-7)	<2(-7)	*	*
^{54}Mn	6.3 ± 0.6(-7)	3.5 ± 0.5(-7)	2.2 ± 0.5(-7)	3.0 ± 0.5(-7)
^{55}Fe	**	**	**	**
^{59}Fe	<2(-7)	<1(-7)	<2(-7)	<2(-7)
^{57}Co	<1(-7)	4.3 ± 2.0(-8)	*	8.4 ± 3.4(-8)
^{58}Co	2.3 ± 0.1(-5)	1.87 ± 0.06(-5)	1.30 ± 0.04(-5)	1.11 ± 0.05(-5)
^{60}Co	5.0 ± 0.2(-6)	4.9 ± 0.3(-6)	2.5 ± 0.2(-6)	2.6 ± 0.2(-6)
^{63}Ni	**	**	**	**
^{65}Zn	<1(-7)	<1(-7)	<2(-7)	<2(-7)
^{89}Sr	**	**	**	**
^{90}Sr	**	**	**	**
^{91}Sr	<2(-7)	*	<2(-6)	<2(-7)
^{91}Y	**	**	**	**
^{95}Zr	1.9 ± 0.6(-7)	<1(-7)	*	<2(-7)
^{95}Nb	1.9 ± 0.4(-7)	<1(-7)	<2(-7)	<2(-7)
^{103}Ru	*	6.1 ± 2.6(-8)	<2(-7)	<2(-7)
^{106}Ru	*	*	*	*
^{110m}Ag	1.4 ± 0.4(-7)	*	*	*
^{124}Sb	2.0 ± 0.4(-7)	<6(-8)	<1(-7)	<1(-7)
^{125}Sb	2.3 ± 0.8(-7)	*	<2(-7)	*
^{129m}Te	*	<1(-7)	3.6 ± 1.5(-6)	<3(-7)
^{129}Te	<4(-7)	*	<5(-7)	<2(-7)
^{140}Ba	1.9 ± 0.9(-7)	*	<2(-7)	*
^{140}La	*	<8(-8)	<1(-7)	<1(-7)

TABLE B.22 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR DISTILLATE

Nuclide	1/9/78; 13:20 (μCi/ml)	1/9/78; 17:33 (μCi/ml)	1/10/78; 09:13 (μCi/ml)	1/11/78; 12:43 (μCi/ml)
^{131}I	2.07 ± 0.04(-5)	2.7 ± 0.1(-5)	1.8 ± 0.1(-5)	1.14 ± 0.02(-5)
^{132}I	<2(-7)	*	<2(-6)	<8(-7)
^{133}I	<1(-7)	<2(-7)	<3(-7)	8.6 ± 7.0(-8)
^{134}I	<3(-7)	<2(-7)	<8(-5)	<1(-5)
^{135}I	<2(-7)	<1(-7)	<3(-7)	<2(-7)
^{88}Rb	<3(-6)	<6(-5)	*	*
^{134}Cs	<2(-7)	*	<2(-7)	1.4 ± 0.5(-7)
^{136}Cs	<9(-8)	*	<3(-7)	<2(-7)
^{137}Cs	1.2 ± 0.7(-7)	1.1 ± 0.7(-7)	6.2 ± 6.0(-8)	<2(-7)
^{138}Cs	<2(-7)	*	*	<1(-4)
^{3}H	**	**	**	3.2 ± 0.1(-2)
^{14}C	**	**	**	5.8 ± 0.6(-7)
^{24}Na	<1(-7)	*	<4(-7)	*
^{51}Cr	<8(-7)	*	<3(-7)	<2(-7)
^{54}Mn	3.6 ± 0.7(-7)	2.8 ± 0.6(-7)	5.0 ± 1.1(-7)	5.3 ± 3.6(-8)
^{55}Fe	**	**	**	<2(-7)
^{59}Fe	<2(-7)	*	*	<2(-7)
^{57}Co	<1(-7)	*	1.7 ± 0.4(-7)	*
^{58}Co	1.60 ± 0.03(-5)	1.06 ± 0.04(-5)	2.5 ± 0.1(-5)	4.8 ± 0.3(-6)
^{60}Co	3.7 ± 0.2(-6)	2.9 ± 0.3(-6)	5.2 ± 0.3(-6)	9.8 ± 1.3(-7)
^{63}Ni	**	**	**	<7(-8)
^{65}Zn	<2(-7)	<2(-8)	<2(-7)	<2(-7)
^{89}Sr	**	**	**	6 ± 2(-8)
^{90}Sr	**	**	**	2.5 ± 0.2(-8)
^{91}Sr	<6(-7)	*	<4(-7)	<2(-7)
^{91}Y	**	**	**	<6(-8)
^{95}Zr	<2(-6)	<2(-7)	<3(-7)	<2(-7)
^{95}Nb	<8(-8)	*	<3(-7)	<2(-7)
^{103}Ru	<1(-7)	<2(-7)	<3(-7)	<2(-7)
^{106}Ru	*	*	*	*
^{110m}Ag	<1(-7)	*	*	<1(-7)
^{124}Sb	<1(-7)	<1(-7)	<1(-7)	<1(-7)
^{125}Sb	<3(-7)	*	<2(-7)	*
^{129m}Te	<2(-6)	*	<2(-5)	*
^{129}Te	<2(-6)	*	*	*
^{140}Ba	*	*	*	<1(-7)
^{140}La	<5(-8)	*	<2(-7)	<1(-7)

TABLE B.22 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR DISTILLATE

Nuclide	2/1/78; 16:10 (μCi/ml)	2/5/78; 10:40 (μCi/ml)	2/18/78; 13:30 (μCi/ml)	4/28/78; 10:44 (μCi/ml)
^{131}I	3.0 ± 0.1(-5)	5.5 ± 0.1(-5)	3.8 ± 0.1(-5)	2.7 ± 0.1(-5)
^{132}I	<4(-7)	*	*	<3(-7)
^{133}I	<3(-7)	<3(-7)	2.2 ± 0.2(-6)	2.4 ± 0.2(-6)
^{134}I	<1(-6)	5.0 ± 1.8(-7)	*	<6(-7)
^{135}I	<1(-6)	*	*	2.3 ± 0.2(-7)
^{88}Rb	<1(-4)	*	*	<7(-6)
^{134}Cs	<2(-7)	<4(-7)	1.5 ± 0.3(-7)	9.6 ± 0.7(-8)
^{136}Cs	<2(-7)	<3(-7)	1.1 ± 0.3(-7)	<9(-8)
^{137}Cs	<3(-7)	*	5.5 ± 0.4(-7)	9.2 ± 7.7(-8)
^{138}Cs	<4(-6)	<9(-7)	*	<4(-7)
^{3}H	**	**	**	**
^{14}C	**	**	**	**
^{24}Na	<8(-7)	*	*	<1(-7)
^{51}Cr	<3(-6)	<3(-7)	2.0 ± 0.4(-6)	<9(-7)
^{54}Mn	<2(-7)	9.7 ± 3.6(-8)	9.2 ± 0.5(-7)	3.6 ± 1.6(-7)
^{55}Fe	**	**	**	**
^{59}Fe	<5(-7)	*	2.7 ± 0.8(-7)	<2(-7)
^{57}Co	<3(-7)	*	1.5 ± 0.3(-7)	<9(-8)
^{58}Co	1.0 ± 0.6(-6)	1.9 ± 0.2(-6)	3.2 ± 0.1(-5)	1.1 ± 0.1(-6)
^{60}Co	6.3 ± 4.6(-7)	4.2 ± 0.5(-7)	1.3 ± 0.1(-5)	2.3 ± 0.2(-6)
^{63}Ni	**	**	**	**
^{65}Zn	<6(-7)	<3(-7)	*	<2(-7)
^{89}Sr	**	**	**	**
^{90}Sr	**	**	**	**
^{91}Sr	<9(-7)	<3(-7)	<6(-6)	<5(-7)
^{91}Y	**	**	**	**
^{95}Zr	<4(-7)	<2(-7)	4.9 ± 0.8(-7)	4.2 ± 0.9(-8)
^{95}Nb	<2(-7)	<2(-7)	9.5 ± 1.4(-7)	1.1 ± 0.3(-7)
^{103}Ru	<2(-7)	*	2.1 ± 0.4(-7)	<9(-8)
^{106}Ru	<2(-6)	*	<2(-7)	<9(-7)
^{110m}Ag	<3(-7)	*	7.5 ± 0.9(-7)	7.2 ± 1.0(-8)
^{124}Sb	<9(-7)	*	2.6 ± 0.4(-7)	4.0 ± 1.0(-8)
^{125}Sb	<5(-7)	*	3.6 ± 1.1(-7)	1.4 ± 0.2(-7)
^{129m}Te	*	*	*	*
^{129}Te	*	*	*	*
^{140}Ba	<7(-7)	*	*	<3(-7)
^{140}La	<5(-7)	*	1.1 ± 0.5(-7)	<7(-8)

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* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.23

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR BOTTOMS

Nuclide	1/5/78; 13:15 (μCi/ml)	1/6/78; 16:31 (μCi/ml)	1/9/78; 09:46 (μCi/ml)	1/9/78; 12:35 (μCi/ml)
^{131}I	6.4 ± 0.1(-3)	8.3 ± 0.1(-3)	8.5 ± 0.2(-3)	9.4 ± 0.1(-3)
^{132}I	*	*	*	*
^{133}I	4.9 ± 1.4(-5)	<6(-5)	8.1 ± 0.7(-5)	1.2 ± 0.1(-4)
^{134}I	7.6 ± 1.8(-5)	8.4 ± 1.7(-5)	4.9 ± 1.7(-5)	5.8 ± 1.3(-5)
^{135}I	*	5.5 ± 1.7(-5)	<1(-5)	5.3 ± 1.5(-5)
^{88}Rb	*	<4(-5)	<2(-5)	<2(-5)
^{134}Cs	1.9 ± 0.1(-3)	2.7 ± 0.1(-3)	2.18 ± 0.02(-3)	2.39 ± 0.02(-3)
^{136}Cs	1.7 ± 0.1(-4)	2.0 ± 0.1(-4)	1.24 ± 0.05(-4)	1.31 ± 0.06(-4)
^{137}Cs	3.8 ± 0.1(-3)	5.1 ± 0.1(-3)	4.01 ± 0.06(-3)	4.37 ± 0.04(-3)
^{138}Cs	7.3 ± 1.4(-5)	9.1 ± 1.6(-5)	3.7 ± 0.7(-5)	*
^{3}H	**	**	**	**
^{14}C	**	**	**	**
^{24}Na	2.2 ± 0.3(-5)	1.2 ± 0.3(-5)	2.5 ± 0.2(-5)	2.9 ± 0.3(-5)
^{51}Cr	5.5 ± 0.7(-4)	4.2 ± 0.7(-4)	3.4 ± 0.6(-4)	3.4 ± 0.8(-4)
^{54}Mn	6.6 ± 0.1(-4)	9.8 ± 0.2(-4)	5.7 ± 0.1(-4)	6.1 ± 0.1(-4)
^{55}Fe	**	**	**	**
^{59}Fe	<4(-5)	<5(-5)	<1(-5)	<2(-5)
^{57}Co	5.8 ± 0.6(-5)	8.2 ± 0.4(-5)	6.1 ± 0.4(-5)	6.2 ± 0.5(-5)
^{58}Co	2.6 ± 0.1(-2)	4.1 ± 0.1(-2)	2.24 ± 0.03(-2)	2.39 ± 0.03(-2)
^{60}Co	6.6 ± 0.2(-3)	1.1 ± 0.1(-2)	5.98 ± 0.07(-3)	6.37 ± 0.04(-3)
^{63}Ni	**	**	**	**
^{65}Zn	2.7 ± 0.4(-4)	2.9 ± 0.2(-4)	3.2 ± 0.1(-4)	2.4 ± 0.2(-4)
^{89}Sr	**	**	**	**
^{90}Sr	**	**	**	**
^{91}Sr	<4(-5)	<4(-5)	<2(-5)	<2(-5)
^{91}Y	**	**	**	**
^{95}Zr	*	<4(-5)	<2(-5)	<2(-5)
^{95}Nb	5.1 ± 1.2(-5)	8.8 ± 1.3(-5)	5.0 ± 0.6(-5)	3.6 ± 0.6(-5)
^{99}Mo	*	*	*	*
^{103}Ru	4.5 ± 1.0(-5)	3.7 ± 0.9(-5)	2.2 ± 0.5(-5)	<2(-5)
^{106}Ru	*	*	*	*
^{110m}Ag	*	*	*	*
^{124}Sb	6.8 ± 0.3(-4)	9.2 ± 0.4(-4)	7.5 ± 0.2(-4)	7.7 ± 0.3(-4)
^{125}Sb	3.9 ± 0.3(-4)	4.8 ± 0.3(-4)	3.9 ± 0.2(-4)	4.9 ± 0.2(-4)
^{129m}Te	<3.2(-5)	<4.6(-5)	<2(-5)	*
^{129}Te	*	*	*	*
^{140}Ba	<3.6(-5)	<4(-5)	*	*
^{140}La	1.7 ± 0.4(-5)	1.7 ± 0.4(-5)	1.0 ± 2.2(-6)	1.2 ± 0.2(-5)

TABLE B.23 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR BOTTOMS

Nuclide	1/9/78; 13:20 (μCi/ml)	1/9/78; 17:33 (μCi/ml)	1/10/78; 09:13 (μCi/ml)	1/11/78; 12:43 (μCi/ml)
^{131}I	9.5 ± 0.2(-3)	8.6 ± 0.1(-3)	9.5 ± 0.1(-3)	6.6 ± 0.1(-3)
^{132}I	*	<3(-5)	*	*
^{133}I	1.2 ± 0.1(-4)	1.3 ± 0.1(-4)	1.6 ± 0.1(-4)	1.5 ± 0.1(-4)
^{134}I	*	<6(-5)	9.8 ± 1.9(-5)	4.2 ± 0.3(-3)
^{135}I	*	<1(-6)	<1.6(-5)	<1.7(-5)
^{88}Rb	<4(-3)	<8(-5)	<8(-5)	2.5 ± 0.1(-3)
^{134}Cs	2.44 ± 0.02(-3)	2.17 ± 0.02(-3)	2.5 ± 0.1(-3)	2.5 ± 0.1(-3)
^{136}Cs	1.27 ± 0.07(-4)	1.07 ± 0.07(-4)	1.1 ± 0.1(-4)	1.0 ± 0.1(-4)
^{137}Cs	4.41 ± 0.04(-3)	4.00 ± 0.05(-3)	4.6 ± 0.1(-3)	4.8 ± 0.1(-3)
^{138}Cs	7.1 ± 1.3(-4)	*	1.0 ± 0.2(-4)	2.4 ± 0.5(-3)
^{3}H	**	**	**	3.2 ± 0.1(-2)
^{14}C	**	**	**	5.9 ± 0.6(-6)
^{24}Na	3.0 ± 0.3(-5)	4.0 ± 0.3(-5)	4.6 ± 0.3(-5)	3.5 ± 0.3(-5)
^{51}Cr	4.9 ± 0.8(-4)	5.0 ± 0.9(-4)	3.5 ± 0.5(-4)	7.6 ± 1.1(-4)
^{54}Mn	6.2 ± 0.1(-4)	5.5 ± 0.1(-4)	6.1 ± 0.1(-4)	6.2 ± 0.1(-4)
^{55}Fe	**	**	**	6.29 ± 0.01(-3)
^{59}Fe	<3(-5)	<1(-5)	*	6.0 ± 1.1(-5)
^{57}Co	9.2 ± 1.2(-5)	6.4 ± 0.6(-5)	6.0 ± 0.7(-5)	8.6 ± 0.5(-5)
^{58}Co	2.41 ± 0.03(-2)	2.23 ± 0.04(-2)	2.5 ± 0.1(-2)	2.8 ± 0.1(-2)
^{60}Co	6.43 ± 0.05(-3)	5.91 ± 0.06(-3)	6.7 ± 0.1(-3)	7.6 ± 0.1(-3)
^{63}Ni	**	**	**	5.26 ± 0.01(-3)
^{65}Zn	2.5 ± 0.1(-4)	2.1 ± 0.2(-4)	3.6 ± 0.3(-4)	4.0 ± 0.3(-4)
^{89}Sr	**	**	**	1.48 ± 0.05(-5)
^{90}Sr	**	**	**	4.98 ± 0.05(-6)
^{91}Sr	*	*	<2(-5)	4.8 ± 0.1(-3)
^{91}Y	**	**	**	6.90 ± 0.08(-6)
^{95}Zr	<2(-5)	*	<2(-5)	1.7 ± 0.1(-4)
^{95}Nb	3.5 ± 0.7(-5)	4.2 ± 0.8(-5)	6.6 ± 0.8(-5)	3.0 ± 0.2(-4)
^{99}Mo	*	*	*	<1(-5)
^{103}Ru	2.7 ± 0.8(-5)	3.0 ± 0.7(-5)	4.7 ± 1.1(-5)	9.9 ± 0.9(-5)
^{106}Ru	<2(-5)	<2(-5)	<3(-5)	2.4 ± 0.9(-4)
^{110m}Ag	<2(-3)	*	*	*
^{124}Sb	8.0 ± 0.2(-4)	7.4 ± 0.2(-4)	8.2 ± 0.2(-4)	8.2 ± 0.2(-4)
^{125}Sb	4.3 ± 0.2(-4)	4.8 ± 0.2(-4)	4.4 ± 0.2(-4)	5.6 ± 0.3(-4)
^{129m}Te	*	*	<2(-5)	<2(-5)
^{129}Te	*	*	*	*
^{140}Ba	*	*	*	*
^{140}La	1.0 ± 0.2(-5)	1.3 ± 0.3(-5)	1.4 ± 0.2(-5)	1.6 ± 0.3(-5)

TABLE B.23 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR BOTTOMS

Nuclide	2/1/78; 16:10 (μCi/ml)	2/5/78; 10:40 (μCi/ml)	2/18/78; 13:30 (μCi/ml)	4/28/78; 10:44 (μCi/ml)
^{131}I	2.9 ± 0.1(-2)	4.4 ± 0.1(-2)	2.3 ± 0.1(-2)	2.5 ± 0.1(-3)
^{132}I	*	*	*	*
^{133}I	1.5 ± 0.2(-4)	3.4 ± 0.5(-4)	1.9 ± 0.1(-3)	2.9 ± 0.2(-4)
^{134}I	<1(-4)	*	2.2 ± 0.5(-2)	*
^{135}I	<4(-3)	<8(-5)	1.1 ± 0.1(-3)	9.2 ± 2.7(-5)
^{88}Rb	<1(-5)	*	*	*
^{134}Cs	4.7 ± 0.1(-3)	1.20 ± 0.01(-2)	5.1 ± 0.1(-3)	2.6 ± 0.1(-3)
^{136}Cs	<1.7(-4)	<5(-4)	5.4 ± 0.2(-4)	*
^{137}Cs	8.1 ± 0.1(-3)	2.4 ± 0.1(-2)	8.9 ± 0.1(-3)	4.3 ± 0.1(-3)
^{138}Cs	2.0 ± 0.3(-4)	5.3 ± 0.6(-3)	*	*
^{3}H	**	**	**	**
^{14}C	**	**	**	**
^{24}Na	2.4 ± 0.4(-5)	4.9 ± 0.6(-5)	4.0 ± 0.2(-5)	4.3 ± 0.8(-5)
^{51}Cr	1.3 ± 0.1(-3)	3.3 ± 0.3(-3)	7.8 ± 1.2(-4)	<2(-4)
^{54}Mn	2.1 ± 0.1(-3)	3.8 ± 0.1(-3)	1.5 ± 0.1(-3)	4.8 ± 0.2(-4)
^{55}Fe	**	**	**	**
^{59}Fe	1.2 ± 0.3(-4)	3.6 ± 0.5(-4)	1.1 ± 0.2(-4)	<4(-5)
^{57}Co	4.3 ± 0.2(-4)	6.3 ± 0.2(-4)	1.0 ± 0.1(-4)	4.8 ± 0.9(-5)
^{58}Co	1.80 ± 0.04(-1)	2.5 ± 0.1(-1)	3.5 ± 0.1(-2)	9.2 ± 0.1(-3)
^{60}Co	3.7 ± 0.1(-2)	6.6 ± 0.1(-2)	1.4 ± 0.1(-2)	6.6 ± 0.1(-3)
^{63}Ni	**	**	**	**
^{65}Zn	4.6 ± 0.7(-4)	1.1 ± 0.1(-3)	7.3 ± 1.0(-5)	<4(-5)
^{89}Sr	**	**	**	**
^{90}Sr	**	**	**	**
^{91}Sr	<7(-5)	<1(-4)	3.2 ± 0.6(-4)	<1(-4)
^{91}Y	**	**	**	**
^{95}Zr	1.9 ± 0.2(-4)	4.3 ± 0.5(-4)	9.4 ± 1.2(-5)	<4(-5)
^{95}Nb	3.1 ± 0.2(-4)	6.2 ± 0.4(-4)	1.6 ± 0.1(-4)	6.2 ± 0.9(-5)
^{99}Mo	2.8 ± 0.1(-4)	1.7 ± 0.1(-4)	4.2 ± 0.1(-4)	4.7 ± 0.6(-5)
^{103}Ru	3.1 ± 0.2(-4)	5.0 ± 0.3(-4)	6.1 ± 0.5(-5)	<2(-5)
^{106}Ru	<1(-4)	<1(-4)	<4(-5)	<2(-4)
^{110m}Ag	*	*	<4(-3)	*
^{124}Sb	3.7 ± 0.1(-3)	7.7 ± 0.2(-3)	1.2 ± 0.2(-3)	2.3 ± 0.2(-4)
^{125}Sb	3.6 ± 0.1(-3)	7.7 ± 0.2(-3)	1.5 ± 0.1(-3)	4.8 ± 0.4(-4)
^{129m}Te	1.5 ± 0.6(-3)	<2(-5)	<7(-5)	<6(-4)
^{129}Te	*	2.8 ± 1.2(-3)	*	<2(-3)
^{140}Ba	<7(-5)	<8(-5)	1.1 ± 0.2(-4)	<8(-5)
^{140}La	<3(-5)	<4(-5)	5.1 ± 0.3(-5)	*

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* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.24

RADIONUCLIDE CONCENTRATIONS IN RADWASTE EVAPORATOR DISTILLATE AND BOTTOMS FEED SHUT OFF AND BOTTOMS CONCENTRATING DURING SAMPLE PERIOD

	Distillate Activity			Bottoms Activity		
Nuclide	1/10/78; 10:05 (μCi/ml)	1/10/78; 10:10 (μCi/ml)	1/10/78; 10:15 (μCi/ml)	1/10/78; 10:07 (μCi/ml)	1/10/78; 10:11 (μCi/ml)	1/10/78; 10:16 (μCi/ml)
^{131}I	1.9 ± 0.1(-5)	1.8 ± 0.1(-5)	2.0 ± 0.1(-5)	1.82 ± 0.02(-2)	2.15 ± 0.02(-2)	2.48 ± 0.03(-2)
^{133}I	1.2 ± 0.4(-7)	<2(-7)	*	3.7 ± 0.4(-4)	4.5 ± 0.8(-4)	4.1 ± 0.6(-4)
^{134}Cs	9.2 ± 4.5(-8)	1.7 ± 0.6(-7)	<4(-7)	4.8 ± 0.1(-3)	5.8 ± 0.1(-3)	6.4 ± 0.1(-3)
^{136}Cs	<2(-7)	*	<4(-7)	2.7 ± 0.3(-4)	3.9 ± 0.6(-4)	4.3 ± 0.4(-4)
^{137}Cs	<2(-7)	*	*	8.6 ± 0.1(-3)	1.03 ± 0.01(-2)	1.17 ± 0.02(-2)
^{138}Cs	<2(-5)	<1(-5)	<2(-5)	2.1 ± 1.6(-2)	*	*
^{24}Na	<3(-7)	*	*	5.6 ± 1.4(-5)	<1(-4)	9.8 ± 1.9(-5)
^{51}Cr	<2(-7)	*	<3(-7)	7.2 ± 2.2(-4)	1.2 ± 0.3(-3)	3.1 ± 0.6(-3)
^{54}Mn	6.7 ± 4.5(-8)	5.4 ± 5.3(-8)	<3(-7)	1.16 ± 0.03(-3)	1.52 ± 0.05(-3)	1.8 ± 0.1(-3)
^{57}Co	<1(-7)	<2(-7)	<4(-7)	1.4 ± 0.1(-4)	1.6 ± 0.3(-4)	2.1 ± 0.3(-4)
^{58}Co	5.6 ± 0.3(-6)	2.3 ± 0.1(-6)	4.1 ± 0.2(-6)	4.8 ± 0.1(-2)	5.9 ± 0.1(-2)	7.4 ± 0.1(-2)
^{60}Co	1.2 ± 0.2(-6)	1.6 ± 0.2(-6)	8.5 ± 1.6(-7)	1.32 ± 0.02(-2)	1.62 ± 0.02(-2)	2.08 ± 0.02(-2)
^{65}Zn	<2(-7)	*	*	5.3 ± 0.7(-4)	7.2 ± 1.1(-4)	1.0 ± 0.1(-3)
^{95}Zr	<2(-7)	*	*	<1(-4)	<2(-4)	<2(-4)
^{95}Nb	<2(-7)	*	<3(-7)	1.2 ± 0.2(-4)	2.2 ± 0.6(-4)	4.4 ± 0.4(-4)
^{103}Ru	*	*	*	<1(-4)	8.5 ± 3.4(-5)	2.2 ± 0.6(-4)
^{124}Sb	<2(-7)	*	*	1.6 ± 0.1(-3)	1.9 ± 0.1(-3)	2.0 ± 0.1(-3)
^{125}Sb	<2(-7)	*	*	8.2 ± 1.3(-4)	1.2 ± 0.1(-3)	1.3 ± 0.1(-3)
^{140}Ba	<2(-7)	<2(-7)	<2(-7)	<1(-4)	2.6 ± 1.3(-4)	<2(-4)
^{140}La	<1(-7)	<1(-7)	*	2.3 ± 0.9(-5)	<6(-5)	6.6 ± 1.3(-5)

* Radionuclide not detected.

TABLE B.25

RADIONUCLIDE CONCENTRATIONS IN INLET AND OUTLET FOR RADWASTE CONDENSATE DEMINERALIZER

	1/6/78 (μCi/ml)		1/10/78 (μCi/ml)		1/11/78 (μCi/ml)	
Nuclide	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
^{131}I	2.6 ± 0.1(-5)	4.3 ± 0.1(-6)	1.8 ± 0.1(-5)	4.9 ± 0.1(-6)	1.14 ± 0.02(-5)	2.4 ± 0.1(-6)
^{133}I	*	*	*	*	8.6 ± 7.0(-8)	<2(-7)
^{134}I	2.9 ± 0.7(-6)	*	*	*	*	*
^{134}Cs	1.7 ± 0.6(-7)	7.5 ± 3.8(-7)	<2(-7)	5.2 ± 0.5(-7)	1.4 ± 0.5(-7)	6.8 ± 0.7(-7)
^{137}Cs	<2(-7)	1.3 ± 1.6(-6)	6.2 ± 6.0(-8)	1.03 ± 0.10(-6)	<2(-7)	1.0 ± 0.1(-6)
^{3}H	**	**	**	**	3.2 ± 0.1(-2)	3.1 ± 0.1(-2)
^{14}C	**	**	**	**	5.8 ± 0.6(-7)	5.6 ± 0.6(-7)
^{54}Mn	3.5 ± 0.5(-7)	<1(-7)	5.0 ± 1.1(-7)	<1(-7)	5.3 ± 3.6(-8)	<2(-7)
^{55}Fe	**	**	**	**	**	1.22 ± 0.04(-5)
^{57}Co	4.3 ± 2.0(-8)	<8(-8)	1.7 ± 0.4(-7)	<8(-8)	*	*
^{58}Co	1.87 ± 0.06(-5)	5.2 ± 3.1(-8)	2.5 ± 0.1(-5)	2.3 ± 2.5(-8)	4.8 ± 0.3(-6)	<2(-7)
^{60}Co	4.9 ± 0.3(-6)	<1(-6)	5.2 ± 0.3(-6)	<1(-7)	9.8 ± 1.3(-7)	<2(-7)
^{63}Ni	**	**	**	**	<7(-8)	5 ± 1(-7)
^{89}Sr	**	**	**	**	6 ± 2(-8)	<1(-8)
^{90}Sr	**	**	**	**	2.5 ± 0.2(-8)	1.1 ± 0.2(-8)
^{91}Y	**	**	**	**	<6(-8)	1.36 ± 0.07(-8)
^{103}Ru	5.1 ± 2.6(-8)	<1(-7)	*	*	*	*

TABLE B.25 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN INLET AND OUTLET FOR RADWASTE CONDENSATE DEMINERALIZER

Nuclide	2/1/78† (µCi/ml) Inlet	Outlet	4/28/78† (µCi/ml) Inlet	Outlet
^{131}I	3.0 ± 0.1(-5)	1.80 ± 0.03(-6)	2.7 ± 0.1(-5)	1.09 ± 0.03(-5)
^{133}I	*	*	2.4 ± 0.2(-6)	9.5 ± 1.0(-7)
^{135}I	*	*	2.3 ± 0.2(-7)	<5(-8)
^{134}Cs	<2(-7)	5.8 ± 0.2(-7)	9.6 ± 0.7(-8)	4.2 ± 1.3(-7)
^{137}Cs	<3(-7)	1.30 ± 0.04(-6)	9.2 ± 7.7(-8)	8.4 ± 1.0(-7)
^{54}Mn	<2(-7)	6.8 ± 3.5(-9)	3.6 ± 1.6(-7)	1.9 ± 0.6(-7)
^{58}Co	1.0 ± 0.6(-6)	5.6 ± 0.6(-8)	1.1 ± 0.1(-6)	5.7 ± 0.7(-8)
^{60}Co	6.3 ± 4.6(-7)	5.3 ± 1.0(-8)	2.3 ± 0.2(-6)	1.0 ± 0.2(-7)
^{95}Zr	*	*	4.2 ± 0.9(-8)	<1(-8)
^{110m}Ag	*	*	7.2 ± 1.0(-8)	<2(-8)
^{124}Sb	*	*	4.0 ± 1.0(-8)	1.2 ± 0.5(-8)
^{125}Sb	*	*	1.4 ± 0.2(-7)	5.0 ± 0.1(-8)

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* Radionuclide not detected.
** Radionuclide not measured.
† Includes data obtained using resin concentration techniques.

TABLE B.26

RADIONUCLIDE CONCENTRATIONS IN WASTE HOLDUP TANK NO. 2

Nuclide	4/25/78; 11:30 (μCi/ml)	4/26/78; 14:34 (μCi/ml)	4/29/78; 11:43 (μCi/ml)	5/2/78; 14:24 (μCi/ml)	5/10/78; 10:44 (μCi/ml)
^{131}I	1.85 ± 0.01(-4)	2.79 ± 0.04(-4)	1.92 ± 0.02(-4)	4.6 ± 0.1(-4)	7.3 ± 0.4(-5)
^{132}I	*	5.2 ± 0.6(-6)	<1(-5)	6.2 ± 0.8(-6)	<2(-6)
^{133}I	1.24 ± 0.03(-5)	5.13 ± 0.06(-5)	1.8 ± 0.2(-5)	1.31 ± 0.02(-4)	6.7 ± 0.3(-5)
^{134}I	*	1.58 ± 0.06(-5)	*	*	4.5 ± 1.7(-6)
^{135}I	*	2.6 ± 0.1(-5)	<8(-6)	4.0 ± 0.1(-5)	1.2 ± 0.1(-5)
^{134}Cs	9.15 ± 0.09(-5)	1.96 ± 0.02(-4)	1.74 ± 0.03(-4)	8.8 ± 0.2(-5)	1.28 ± 0.06(-4)
^{136}Cs	2.5 ± 0.3(-6)	3.8 ± 0.4(-6)	<5(-6)	1.4 ± 0.6(-6)	9.3 ± 4.2(-7)
^{137}Cs	1.60 ± 0.02(-4)	3.63 ± 0.05(-4)	3.10 ± 0.03(-4)	1.62 ± 0.04(-4)	1.94 ± 0.09(-4)
^{138}Cs	*	*	*	*	*
^{139}Cs	*	*	*	*	*
^{24}Na	1.1 ± 0.1(-6)	8.9 ± 0.4(-6)	3.3 ± 0.4(-6)	1.3 ± 0.1(-5)	8.5 ± 0.5(-6)
^{51}Cr	2.1 ± 0.4(-5)	7.8 ± 0.3(-5)	1.3 ± 0.1(-4)	2.3 ± 0.3(-5)	1.1 ± 0.3(-5)
^{54}Mn	1.84 ± 0.05(-5)	3.2 ± 0.1(-5)	1.01 ± 0.02(-4)	2.6 ± 0.2(-5)	2.0 ± 0.1(-5)
^{59}Fe	2.6 ± 0.6(-6)	8.2 ± 0.8(-6)	3.1 ± 0.4(-5)	4.0 ± 0.7(-6)	<2(-6)
^{57}Co	8.3 ± 1.2(-6)	2.7 ± 0.3(-6)	9.1 ± 1.0(-6)	1.5 ± 0.2(-6)	8.4 ± 2.5(-7)
^{58}Co	2.57 ± 0.01(-4)	5.2 ± 0.1(-4)	1.35 ± 0.01(-3)	2.4 ± 0.4(-6)	2.4 ± 0.1(-4)
^{60}Co	2.40 ± 0.02(-4)	3.87 ± 0.09(-4)	1.20 ± 0.08(-3)	2.7 ± 0.1(-4)	2.46 ± 0.08(-4)
^{65}Zn	<2(-6)	*	*	1.7 ± 0.7(-6)	<2(-6)
^{95}Zr	4.6 ± 0.5(-6)	1.4 ± 0.1(-4)	4.6 ± 0.3(-5)	6.0 ± 0.6(-6)	2.6 ± 0.5(-6)
^{95}Nb	8.1 ± 0.4(-6)	2.3 ± 0.2(-5)	7.7 ± 0.2(-5)	1.00 ± 0.04(-5)	6.6 ± 0.5(-6)
^{99}Mo	1.5 ± 0.2(-6)	7.9 ± 0.2(-6)	2.1 ± 0.6(-6)	3.4 ± 0.2(-5)	1.7 ± 0.2(-6)
^{103}Ru	1.1 ± 0.3(-6)	5.0 ± 0.4(-6)	6.1 ± 1.1(-6)	1.9 ± 0.4(-6)	<9(-7)
^{106}Ru	<1(-5)	1.5 ± 0.4(-5)	4.7 ± 2.0(-5)	<6(-6)	<1(-5)
^{110m}Ag	6.8 ± 0.4(-6)	*	3.4 ± 0.2(-5)	5.9 ± 0.5(-6)	1.7 ± 0.6(-6)
^{124}Sb	1.23 ± 0.05(-5)	1.89 ± 0.07(-5)	2.8 ± 0.2(-5)	1.4 ± 0.1(-5)	5.0 ± 0.5(-6)
^{125}Sb	2.2 ± 0.1(-5)	3.1 ± 0.1(-5)	6.1 ± 0.7(-5)	3.0 ± 0.1(-5)	1.5 ± 0.1(-5)
^{140}Ba	8.3 ± 1.0(-6)	*	<2(-5)	8.3 ± 1.2(-6)	4.2 ± 1.7(-6)
^{140}La	4.3 ± 0.2(-6)	5.1 ± 0.3(-6)	5.6 ± 0.6(-6)	2.2 ± 0.3(-6)	2.0 ± 0.2(-6)

TABLE B.26 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN WASTE HOLDUP TANK NO. 2

Nuclide	5/16/78; 16:11 (μCi/ml)	5/16/78; 17:55 (μCi/ml)	5/20/78; 11:10 (μCi/ml)	5/23/78; 12:50 (μCi/ml)	5/25/78; 08:58 (μCi/ml)
^{131}I	1.59 ± 0.03(-4)	1.46 ± 0.03(-4)	7.6 ± 0.5(-5)	2.14 ± 0.02(-4)	1.31 ± 0.06(-4)
^{132}I	8.1 ± 0.7(-6)	6.6 ± 0.4(-6)	<1.5(-6)	<1.8(-6)	<5.6(-6)
^{133}I	1.41 ± 0.01(-4)	1.45 ± 0.02(-4)	8.8 ± 0.6(-5)	3.73 ± 0.08(-5)	1.5 ± 0.1(-5)
^{134}I	*	*	*	*	*
^{135}I	6.2 ± 0.2(-5)	6.38 ± 0.09(-5)	8.3 ± 1.1(-6)	7.6 ± 1.4(-6)	<4.2(-6)
^{134}Cs	9.6 ± 0.2(-5)	9.1 ± 0.2(-5)	1.09 ± 0.04(-4)	1.98 ± 0.02(-4)	1.50 ± 0.03(-4)
^{136}Cs	3.9 ± 0.7(-6)	2.6 ± 0.4(-6)	<7.6(-7)	7.2 ± 0.7(-6)	4.5 ± 0.9(-6)
^{137}Cs	1.58 ± 0.03(-4)	1.48 ± 0.02(-4)	1.78 ± 0.08(-4)	3.10 ± 0.05(-4)	2.6 ± 0.1(-4)
^{138}Cs	<2.5(-6)	<1.4(-6)	<2.3(-6)	<3.2(-6)	<5(-6)
^{139}Cs	<2.8(-3)	<2.4(-4)	<3.0(-3)	<4.9(-3)	<9(-3)
^{24}Na	1.54 ± 0.06(-5)	1.61 ± 0.04(-5)	6.9 ± 0.5(-6)	3.4 ± 0.4(-6)	1.4 ± 0.3(-6)
^{51}Cr	1.7 ± 0.3(-5)	1.5 ± 0.1(-5)	1.6 ± 0.3(-5)	2.0 ± 0.6(-5)	6.0 ± 0.8(-5)
^{54}Mn	3.4 ± 0.3(-5)	3.6 ± 0.3(-5)	2.4 ± 0.2(-5)	2.13 ± 0.09(-5)	7.3 ± 0.3(-5)
^{59}Fe	<1.3(-6)	7.4 ± 3.6(-7)	2.6 ± 0.9(-6)	<1.9(-6)	6.0 ± 2.3(-6)
^{57}Co	1.8 ± 0.2(-6)	1.36 ± 0.09(-6)	2.0 ± 0.3(-6)	1.3 ± 0.3(-6)	7.7 ± 0.9(-6)
^{58}Co	2.21 ± 0.03(-4)	2.02 ± 0.03(-4)	2.69 ± 0.08(-4)	1.64 ± 0.07(-4)	7.8 ± 0.3(-4)
^{60}Co	3.4 ± 0.1(-4)	3.62 ± 0.08(-4)	2.94 ± 0.07(-4)	3.16 ± 0.03(-4)	1.6 ± 0.06(-3)
^{65}Zn	1.9 ± 0.7(-6)	2.4 ± 0.5(-6)	<2.1(-6)	2.0 ± 1.0(-6)	1.3 ± 0.3(-5)
^{95}Zr	4.9 ± 0.5(-6)	5.8 ± 0.4(-6)	5.3 ± 0.9(-6)	3.5 ± 1.0(-6)	4.0 ± 0.3(-5)
^{95}Nb	1.11 ± 0.04(-5)	1.06 ± 0.06(-5)	8.2 ± 0.5(-6)	5.7 ± 0.5(-6)	8.6 ± 0.2(-5)
^{99}Mo	2.4 ± 0.2(-6)	2.8 ± 0.1(-6)	1.4 ± 0.3(-6)	1.36 ± 0.03(-5)	5.9 ± 0.5(-6)
^{103}Ru	1.5 ± 0.3(-6)	1.5 ± 0.2(-6)	<7.6(-7)	<9.1(-7)	4.7 ± 0.9(-6)
^{106}Ru	1.2 ± 0.3(-5)	9.7 ± 2.1(-6)	<7.1(-6)	<1.2(-5)	1.5 ± 0.2(-4)
^{110m}Ag	4.3 ± 1.2(-6)	3.6 ± 0.3(-6)	3.1 ± 0.9(-6)	2.6 ± 0.8(-6)	9.6 ± 0.3(-5)
^{124}Sb	5.6 ± 0.4(-6)	5.6 ± 0.2(-6)	4.7 ± 0.5(-6)	7.5 ± 0.6(-6)	1.39 ± 0.09(-5)
^{125}Sb	1.55 ± 0.08(-5)	1.51 ± 0.05(-5)	1.3 ± 0.2(-5)	1.5 ± 0.2(-5)	5.2 ± 0.3(-5)
^{139}Ba	<2.8(-6)	<1.8(-6)	<3.6(-6)	<4.9(-6)	*
^{140}Ba	6.2 ± 1.2(-6)	5.1 ± 0.9(-6)	3.4 ± 1.4(-6)	2.7 ± 0.3(-5)	1.8 ± 0.4(-5)
^{140}La	2.8 ± 0.2(-6)	2.6 ± 0.1(-6)	2.0 ± 0.3(-6)	1.71 ± 0.06(-5)	1.31 ± 0.05(-5)

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* Radionuclide not detected.

TABLE B.27

RADIONUCLIDE CONCENTRATIONS IN RADWASTE BUILDING MONITOR TANK A

Nuclide	4/25/78; 10:30 (μCi/ml)	4/26/78; 13:30 (μCi/ml)	4/29/78; 11:28 (μCi/ml)	5/20/78; 11:10 (μCi/ml)	5/23/78; 13:55 (μCi/ml)	5/25/78; 15:45 (μCi/ml)
^{131}I	4.6 ± 2.2(-8)	<2(-7)	<2(-7)	<1(-7)	<1.1(-7)	<9(-8)
^{132}I	*	<4(-7)	<3(-7)	*	<3.7(-7)	<3(-7)
^{133}I	<1(-7)	<2(-7)	<2(-7)	<2(-7)	<1.0(-7)	<1(-7)
^{135}I	*	<6(-7)	<3(-7)	<2(-7)	<3.8(-7)	<3(-7)
^{134}Cs	1.1 ± 0.5(-7)	2.3 ± 0.9(-7)	6.3 ± 1.3(-7)	1.6 ± 0.6(-7)	1.9 ± 0.8(-7)	<2(-7)
^{136}Cs	<1(-7)	<2(-7)	<2(-6)	<2(-7)	<1.2(-7)	<9(-8)
^{137}Cs	7.0 ± 3.8(-8)	7.1 ± 1.0(-7)	1.0 ± 0.1(-6)	9.8 ± 4.5(-8)	1.5 ± 1.0(-7)	<3(-7)
^{138}Cs	*	*	<3(-7)	*	<1.8(-6)	<9(-8)
^{139}Cs	*	*	<1(-6)	*	<6.0(-3)	<3(-5)
^{24}Na	<1(-7)	<4(-7)	<2(-7)	<1(-7)	<1.1(-7)	<8(-8)
^{51}Cr	<8(-7)	<2(-6)	<1(-7)	<1(-7)	<7.5(-7)	<7(-7)
^{54}Mn	4.6 ± 0.6(-7)	<5(-7)	7.8 ± 0.8(-7)	2.9 ± 0.1(-7)	3.2 ± 0.7(-7)	4.9 ± 1.5(-7)
^{59}Fe	<2(-7)	<4(-7)	<4(-7)	*	<3.0(-7)	<2(-7)
^{57}Co	3.8 ± 1.8(-8)	<3(-7)	6.2 ± 2.9(-8)	<1(-7)	<9.9(-8)	<6.3(-8)
^{58}Co	8.2 ± 0.6(-7)	3.4 ± 0.9(-7)	1.1 ± 0.1(-6)	4.3 ± 0.5(-7)	5.8 ± 1.0(-7)	9.5 ± 1.0(-7)
^{60}Co	<2(-7)	1.9 ± 0.2(-6)	3.9 ± 0.2(-6)	1.5 ± 0.1(-6)	2.4 ± 0.2(-6)	2.6 ± 0.1(-6)
^{65}Zn	*	*	<4(-7)	*	<4.2(-7)	<3(-7)
^{95}Zr	<2(-7)	<4(-7)	<3(-7)	<2(-7)	<1.6(-7)	<2(-7)
^{95}Nb	1.6 ± 0.3(-7)	<4(-7)	<2(-7)	*	<9.3(-8)	<1(-7)
^{99}Mo	<6(-7)	<2(-7)	<1(-7)	*	<9.2(-8)	<9(-8)
^{103}Ru	<1(-7)	<2(-7)	<2(-7)	*	<9.4(-8)	<8(-8)
^{106}Ru	*	<4(-6)	<2(-6)	<1(-7)	<8.3(-7)	1.2 ± 0.3(-6)
^{110m}Ag	1.1 ± 0.4(-7)	*	<3(-7)	*	<1.5(-7)	<1(-7)
^{124}Sb	<1(-7)	<4(-7)	<4(-7)	<1(-7)	<1.5(-7)	1.9 ± 0.4(-7)
^{125}Sb	<4(-5)	<8(-7)	6.3 ± 2.4(-7)	5.4 ± 0.8(-7)	3.1 ± 1.3(-7)	6.8 ± 1.3(-7)
^{139}Ba	*	*	<6(-7)	<2(-7)	<1.2(-6)	<1(-6)
^{140}Ba	<3(-7)	*	<8(-7)	<1(-7)	<3.3(-7)	<3(-7)
^{140}La	<6(-7)	<2(-7)	<1(-7)	<1(-7)	<8.0(-8)	<5(-8)

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* Radionuclide not detected.

TABLE B.28

RADIONUCLIDE CONCENTRATIONS IN RADWASTE BUILDING MONITOR TANKS B AND C

	Tank B			Tank C		
Nuclide	5/2/78; 14:14 (µCi/ml)	5/8/78; 17:43 (µCi/ml)	5/16/78; 21:35 (µCi/ml)	5/7/78; 15:13 (µCi/ml)	5/10/78; 15:44 (µCi/ml)	5/25/78; 10:20 (µCi/ml)
^{131}I	<6(-8)	<4(-8)	1.1 ± 0.2(-7)	<1(-7)	<6(-8)	<1(-7)
^{132}I	<3(-7)	<4(-7)	<2(-7)	<4(-7)	<1(-7)	<5(-7)
^{133}I	<7(-8)	<5(-8)	<5(-8)	<1(-7)	*	<2(-7)
^{134}I	*	<1(-6)	<3(-6)	<5(-7)	<6(-7)	*
^{135}I	<3(-7)	<3(-7)	<2(-7)	<3(-7)	<1(-7)	<5(-7)
^{134}Cs	<1(-7)	6.5 ± 5.7(-8)	<1.4(-7)	<7(-8)	<8(-8)	<3(-7)
^{136}Cs	<7(-8)	<6(-7)	<4.5(-8)	<1(-7)	<9(-8)	<2(-7)
^{137}Cs	2.7 ± 0.7(-7)	<8(-8)	<1(-7)	5.2 ± 3.6(-8)	<7(-8)	<4(-7)
^{138}Cs	*	<9(-7)	<1.2(-6)	<6(-7)	<1(-6)	<2(-6)
^{139}Cs	*	<8(-5)	*	<5(-5)	<5(-6)	*
^{24}Na	<5(-8)	<3(-8)	<3(-8)	<4(-8)	<8(-8)	<1(-7)
^{51}Cr	<5(-7)	<4(-7)	<4(-7)	<3(-7)	<1(-7)	<1(-6)
^{54}Mn	4.2 ± 0.4(-7)	7.4 ± 0.4(-7)	<1(-7)	6.6 ± 0.4(-7)	6.8 ± 0.3(-7)	7.9 ± 1.3(-7)
^{59}Fe	<1(-7)	<1(-7)	<1(-7)	<2(-7)	<1(-7)	<4(-7)
^{57}Co	<6(-7)	<4(-8)	<5(-8)	<8(-8)	<6(-8)	<1(-7)
^{58}Co	5.4 ± 0.5(-7)	8.9 ± 0.7(-7)	5.0 ± 0.4(-7)	8.8 ± 0.9(-7)	9.0 ± 0.5(-7)	2.7 ± 0.2(-6)
^{60}Co	2.2 ± 0.1(-6)	4.8 ± 0.2(-6)	9.9 ± 1.0(-7)	4.8 ± 0.2(-6)	5.3 ± 0.3(-6)	6.1 ± 1.5(-6)
^{65}Zn	<2(-7)	<2(-7)	<2(-7)	1.3 ± 0.6(-7)	*	<4(-7)
^{95}Zr	<1(-7)	<8(-8)	<1(-7)	<2(-7)	<1(-7)	<3(-7)
^{95}Nb	<6(-8)	<5(-8)	<1(-7)	<2(-7)	<1(-7)	<2(-7)
^{99}Mo	<6(-8)	4.9 ± 2.1(-8)	<5(-8)	<6(-8)	<6(-8)	<2(-7)
^{103}Ru	<6(-8)	<4(-8)	<4.4(-8)	<1(-7)	<7(-8)	<2(-7)
^{106}Ru	<6(-7)	<4(-7)	<4.1(-7)	<8(-7)	<8(-8)	2.4 ± 0.9(-6)
^{110m}Ag	<9(-8)	<7(-8)	3.3 ± 0.5(-7)	<2(-7)	7.1 ± 2.3(-8)	8.8 ± 1.7(-7)
^{124}Sb	<2(-7)	1.3 ± 0.5(-7)	<1.2(-7)	4.4 ± 0.7(-8)	1.4 ± 0.3(-7)	<1(-7)
^{125}Sb	<2(-7)	4.6 ± 1.2(-7)	3.2 ± 1.1(-7)	7.8 ± 0.7(-8)	5.4 ± 0.5(-7)	9.0 ± 2.4(-7)
^{139}Ba	<2(-6)	<1(-6)	<1.0(-6)	<5(-7)	<5(-6)	<2(-6)
^{140}Ba	<2(-7)	<2(-7)	<1.6(-7)	<3(-7)	1.4 ± 0.8(-7)	<6(-7)
^{140}La	<6(-8)	<4(-8)	<5.7(-8)	<6(-8)	<8(-8)	<8(-8)

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* Radionuclide not detected.

TABLE B.29

RADIONUCLIDE CONCENTRATIONS IN AUXILIARY BUILDING MONITOR TANKS

	Tank A			Tank B		
Nuclide	4/29/78; 11:24 (μCi/ml)	5/16/78; 14:48 (μCi/ml)	5/18/78; 11:16 (μCi/ml)	5/02/78; 11:17 (μCi/ml)	5/8/78; 18:13 (μCi/ml)	5/10/78; 14:00 (μCi/ml)
^{131}I	1.70 ± 0.02(-5)	1.1 ± 0.3(-7)	<9.7(-8)	5.0 ± 0.1(-5)	5.9 ± 0.1(-7)	1.5 ± 0.3(-7)
^{133}I	1.4 ± 0.6(-7)	<8(-8)	<1.0(-7)	<5(-7)	<2(-8)	<1(-7)
^{134}Cs	5.7 ± 5.0(-8)	9.8 ± 0.5(-9)	1.3 ± 0.3(-8)	8.1 ± 4.5(-8)	<5(-8)	<1(-7)
^{136}Cs	<7(-8)	<6(-8)	<9(-8)	<6(-8)	<2(-8)	<1(-7)
^{137}Cs	2.3 ± 0.5(-7)	<1(-6)	1.5 ± 1.7(-7)	<1(-7)	<4(-8)	<1(-7)
^{51}Cr	<8(-7)	<5(-7)	<6(-7)	<4(-6)	7.8 ± 0.8(-7)	<1(-7)
^{54}Mn	<6(-8)	8.2 ± 4.1(-8)	3.8 ± 1.4(-9)	<7(-8)	2.1 ± 0.2(-7)	<1(-7)
^{58}Co	1.0 ± 0.4(-7)	9.4 ± 0.6(-7)	7.0 ± 0.5(-8)	1.6 ± 0.5(-7)	1.62 ± 0.07(-6)	9.1 ± 4.2(-8)
^{60}Co	<2(-7)	8.9 ± 1.2(-7)	8.8 ± 0.8(-8)	2.5 ± 1.3(-7)	1.8 ± 0.1(-6)	<3(-7)
^{65}Zn	<2(-7)	<2.8(-7)	<1.9(-7)	<1(-6)	<7(-8)	*
^{95}Zr	<2(-7)	1.9 ± 0.7(-7)	<1(-7)	<9(-7)	2.0 ± 0.2(-7)	<1(-7)
^{95}Nb	<8(-8)	2.3 ± 0.7(-7)	<9(-8)	<6(-7)	3.2 ± 0.2(-7)	<1(-7)
^{99}Mo	<1(-7)	<6(-8)	<1(-7)	<4(-7)	3.0 ± 1.2(-8)	8.7 ± 3.7(-8)
^{103}Ru	<7(-8)	<6(-8)	<8(-8)	<5(-7)	2.8 ± 1.1(-8)	<1(-7)
^{106}Ru	<8(-7)	<7(-7)	<7(-7)	<4(-6)	3.4 ± 1.6(-7)	<1(-7)
^{110m}Ag	1.4 ± 0.3(-7)	1.2 ± 0.4(-7)	<1(-7)	<1(-6)	6.0 ± 1.0(-8)	*
^{125}Sb	<2(-7)	6.2 ± 1.3(-7)	<2(-7)	1.5 ± 0.7(-7)	1.8 ± 0.4(-7)	<1(-7)

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* Radionuclide not detected.

TABLE B.30

CONCENTRATIONS OF BETA-ONLY-EMITTING RADIONUCLIDES IN WASTE HOLDUP AND MONITOR TANKS

	Waste Holdup Tank #1		Waste Holdup Tank #2		
Nuclide	16:30,12/5/77	12:29,1/11/78	14:35,4/26/78	11:40,4/29/78	16:11,5/16/78
^{3}H	6.85 ± 0.03(-3)	2.9 ± 0.1(-2)	6.3 ± 0.2(-2)	4.6 ± 0.1(-2)	3.2 ± 0.1(-2)
^{14}C	3.69 ± 0.04(-6)	1.5 ± 0.8(-6)	3.5 ± 0.4(-5)	1.5 ± 0.2(-5)	1.2 ± 0.1(-5)
^{32}P	2.17 ± 0.07(-5)	**	1.9 ± 0.1(-5)	2.7 ± 0.4(-5)	1.20 ± 0.05(-5)
^{55}Fe	5.49 ± 0.02(-5)	4.06 ± 0.02(-4)	7.51 ± 0.02(-4)	5.22 ± 0.02(-4)	9.53 ± 0.02(-4)
^{63}Ni	7.34 ± 0.03(-5)	1.66 ± 0.01(-4)	1.24 ± 0.01(-4)	2.29 ± 0.01(-4)	9.96 ± 0.07(-5)
^{89}Sr	1.22 ± 0.06(-5)	2.76 ± 0.08(-6)	3.76 ± 0.04(-6)	1.80 ± 0.02(-5)	4.7 ± 0.4(-6)
^{90}Sr	3.3 ± 0.9(-7)	6.2 ± 0.1(-7)	3.22 ± 0.08(-7)	2.41 ± 0.03(-6)	5.58 ± 0.08(-7)
^{91}Y	4.9 ± 0.6(-7)	1.04 ± 0.02(-6)	6.4 ± 0.1(-7)	7.4 ± 0.1(-7)	2.6 ± 0.6(-7)

	Monitor Tank A in Auxiliary Building			Monitor Tank B in Aux. Bldg.
	11:25, 4/29/78	14:48,5/16/78	11:16,5/18/78	14:00,5/10/78
^{3}H	1.00 ± 0.03(-1)	1.59 ± 0.05(-2)	8.6 ± 0.3(-2)	7.5 ± 0.2(-3)
^{14}C	2.4 ± 0.2(-7)	4.1 ± 0.4(-6)	4.3 ± 0.4(-6)	5.1 ± 0.5(-7)
^{32}P	<9(-7)	4 ± 2(-7)	<4(-7)	<6(-7)
^{55}Fe	2.1 ± 0.1(-6)	1.11 ± 0.01(-5)	2.4 ± 0.2(-6)	1.9 ± 0.1(-6)
^{63}Ni	3.7 ± 0.4(-7)	7.8 ± 0.7(-7)	6.5 ± 0.6(-7)	9.1 ± 0.7(-7)
^{89}Sr	<3(-9)	<4(-9)	2.7 ± 0.5(-8)	<4(-9)
^{90}Sr	2.8 ± 0.9(-9)	8 ± 2(-9)	1.2 ± 0.2(-8)	1.3 ± 0.2(-8)
^{91}Y	2.7 ± 0.2(-8)	8 ± 1(-9)	2.2 ± 0.9(-9)	2.4 ± 0.2(-8)

** Radionuclide not measured.

TABLE B.30 (cont'd)

CONCENTRATIONS OF BETA-ONLY-EMITTING RADIONUCLIDES IN WASTE HOLDUP AND MONITOR TANKS

	Monitor Tank A in Radwaste Building			Monitor Tank B in Radwaste Building	
Nuclide	13:30,4/25/78	10:32,4/25/78	11:28,4/29/78	14:14,5/2/78	21:35,5/16/78
^{3}H	4.5 ± 0.1(-2)	4.0 ± 0.1(-2)	4.9 ± 0.2(-2)	4.2 ± 0.1(-2)	3.3 ± 0.1(-2)
^{14}C	1.1 ± 0.1(-6)	2.9 ± 0.3(-7)	2.8 ± 0.3(-7)	8.2 ± 0.8(-7)	6.3 ± 0.6(-6)
^{32}P	3.1 ± 0.4(-7)	1.1 ± 0.3(-7)	<1.5(-6)	<9(-7)	<4(-7)
^{55}Fe	6.5 ± 0.8(-7)	6.0 ± 0.2(-6)	9.7 ± 0.3(-6)	4.4 ± 0.2(-6)	1.22 ± 0.03(-5)
^{63}Ni	1.8 ± 0.4(-7)	5.8 ± 0.2(-6)	1.76 ± 0.08(-6)	8.5 ± 0.5(-7)	1.03 ± 0.02(-5)
^{89}Sr	<4(-9)	<9(-9)	3.8 ± 0.6(-8)	<6(-9)	<7(-9)
^{90}Sr	8 ± 2(-9)	1.5 ± 0.3(-8)	3.6 ± 0.2(-8)	2.8 ± 0.2(-8)	3.6 ± 0.4(-8)
^{91}Y	<2(-9)	<3(-9)	5 ± 2(-9)	4 ± 2(-9)	2.1 ± 0.2(-9)

	Monitor Tank C in Radwaste Building	
	15:13,5/7/78	15:44,5/10/78
^{3}H	2.98 ± 0.09(-3)	4.0 ± 0.1(-2)
^{14}C	5.5 ± 0.6(-7)	8.4 ± 0.8(-7)
^{32}P	<9(-7)	<5(-7)
^{55}Fe	1.14 ± 0.03(-5)	1.28 ± 0.03(-5)
^{63}Ni	1.94 ± 0.08(-6)	2.6 ± 0.1(-6)
^{89}Sr	1.3 ± 0.6(-8)	<5(-9)
^{90}Sr	3.9 ± 0.3(-8)	3.8 ± 0.2(-8)
^{91}Y	4 ± 1(-9)	1.1 ± 0.2(-8)

TABLE B.31

UNIT #3 SPENT FUEL PIT DEMINERALIZER INLET AND OUTLET RADIONUCLIDE CONCENTRATIONS

	2/6/78		2/7/78		4/1/78	
Nuclide	Inlet [1] (μCi/ml)	Outlet [2] (μCi/ml)	Inlet [1] (μCi/ml)	Outlet [2] (μCi/ml)	Inlet [3] (μCi/ml)	Outlet [4] (μCi/ml)
^{131}I	5.3 ± 0.7(-8)	2.5 ± 0.1(-8)	5.3 ± 1.0(-8)	1.8 ± 0.4(-8)	4.7 ± 0.3(-6)	1.22 ± 0.09(-10)
^{134}Cs	1.1 ± 0.1(-6)	3.7 ± 0.9(-9)	1.3 ± 0.1(-6)	7.0 ± 1.4(-9)	5.2 ± 0.2(-5)	6.9 ± 0.2(-10)
^{137}Cs	2.5 ± 0.2(-6)	8.6 ± 0.9(-9)	2.2 ± 0.1(-6)	1.8 ± 0.2(-8)	7.0 ± 0.3(-5)	9.9 ± 0.2(-10)
^{51}Cr	1.29 ± 0.05(-5)	7.6 ± 0.2(-7)	3.3 ± 0.1(-5)	7.7 ± 0.3(-7)	2.9 ± 0.3(-5)	3.6 ± 0.1(-9)
^{54}Mn	2.1 ± 0.2(-6)	3.6 ± 0.2(-8)	2.1 ± 0.1(-6)	4.1 ± 0.3(-8)	2.8 ± 0.1(-5)	2.04 ± 0.03(-10)
^{59}Fe	1.7 ± 0.3(-7)	2.5 ± 0.2(-8)	5.5 ± 1.5(-7)	3.8 ± 0.9(-8)	5.5 ± 0.7(-6)	1.66 ± 0.07(-10)
^{57}Co	2.15 ± 0.04(-6)	1.13 ± 0.06(-8)	2.11 ± 0.03(-6)	1.5 ± 0.2(-8)	6.5 ± 0.4(-6)	1.62 ± 0.05(-10)
^{58}Co	5.1 ± 0.1(-4)	3.14 ± 0.04(-6)	5.8 ± 0.2(-4)	4.4 ± 0.1(-6)	1.6 ± 0.1(-3)	8.8 ± 0.1(-9)
^{60}Co	5.5 ± 0.1(-4)	1.05 ± 0.01(-6)	5.7 ± 0.2(-4)	1.60 ± 0.03(-6)	9.7 ± 0.4(-4)	2.41 ± 0.07(-9)
^{65}Zn	3.6 ± 0.6(-6)	1.2 ± 0.3(-8)	1.5 ± 0.4(-6)	*	*	3.7 ± 0.3(-11)
^{95}Zr	1.2 ± 0.1(-7)	7.7 ± 0.2(-8)	8.2 ± 2.3(-8)	7.9 ± 0.6(-8)	7.1 ± 0.8(-6)	4.3 ± 0.1(-10)
^{95}Nb	9.3 ± 0.9(-7)	1.33 ± 0.04(-7)	8.0 ± 0.6(-7)	1.38 ± 0.06(-7)	1.32 ± 0.07(-5)	8.9 ± 0.1(-10)
^{103}Ru	1.08 ± 0.01(-6)	5.2 ± 0.1(-8)	9.5 ± 0.6(-7)	5.5 ± 0.4(-8)	6.4 ± 0.8(-6)	5.11 ± 0.03(-10)
^{106}Ru	1.2 ± 0.1(-6)	6.4 ± 1.0(-8)	1.3 ± 0.1(-6)	7.3 ± 1.7(-8)	*	8.3 ± 1.3(-10)
^{110m}Ag	6.1 ± 0.1(-7)	9.1 ± 0.9(-9)	6.7 ± 1.0(-7)	1.6 ± 0.3(-8)	6.2 ± 0.6(-6)	7.1 ± 0.2(-11)
^{124}Sb	5.3 ± 0.2(-6)	1.64 ± 0.05(-6)	5.4 ± 0.1(-6)	1.76 ± 0.03(-6)	3.3 ± 0.3(-5)	6.2 ± 0.2(-10)
^{125}Sb	*	*	3.16 ± 0.04(-6)	1.19 ± 0.05(-6)	6.0 ± 0.3(-5)	2.79 ± 0.04(-9)
^{129m}Te	3.3 ± 0.2(-6)	1.66 ± 0.04(-6)	3.4 ± 0.5(-6)	1.98 ± 0.04(-6)	*	*
^{129}Te	9.8 ± 1.8(-6)	1.03 ± 0.10(-6)	*	1.5 ± 0.6(-6)	*	*
^{141}Ce	5.2 ± 0.5(-7)	3.5 ± 0.1(-8)	5.8 ± 0.7(-7)	2.5 ± 0.2(-8)	1.8 ± 0.5(-6)	*
^{144}Ce	3.7 ± 0.5(-6)	1.47 ± 0.05(-7)	1.9 ± 0.3(-6)	9.3 ± 0.5(-8)	7.3 ± 2.7(-6)	1.1 ± 0.3(-10)

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* Radionuclide not detected

[1] 450 ml sample

[2] 100 liter sample collected on ion exchange resin

[3] Average value of duplicate samples of 450 ml which were collected at the beginning, middle and end of 24 sampling period.

[4] 215 liter sample collected on ion exchange resin

TABLE B.31 (cont'd)

UNIT #3 SPENT FUEL PIT DEMINERALIZER INLET AND OUTLET RADIONUCLIDE CONCENTRATIONS

	4/15/78		4/16/78	
Nuclide	Inlet[5] (μCi/ml)	Outlet[5] (μCi/ml)	Inlet[5] (μCi/ml)	Outlet[5] (μCi/ml)
^{131}I	*	*	*	*
^{134}Cs	1.10 ± 0.08(-5)	1.16 ± 0.02(-5)	1.07 ± 0.05(-5)	1.22 ± 0.07(-5)
^{137}Cs	1.34 ± 0.08(-5)	1.57 ± 0.04(-5)	1.30 ± 0.04(-5)	1.65 ± 0.04(-5)
^{51}Cr	*	*	*	*
^{54}Mn	1.5 ± 0.3(-6)	4.4 ± 0.8(-7)	1.9 ± 0.3(-6)	3.8 ± 0.6(-7)
^{59}Fe	*	*	*	*
^{57}Co	1.8 ± 0.2(-6)	*	*	*
^{58}Co	2.74 ± 0.04(-4)	5.8 ± 0.2(-6)	2.49 ± 0.03(-4)	5.8 ± 0.3(-6)
^{60}Co	3.86 ± 0.09(-4)	6.6 ± 0.2(-6)	3.55 ± 0.09(-4)	6.1 ± 0.4(-6)
^{65}Zn	*	*	*	*
^{95}Zr	*	*	*	*
^{95}Nb	1.9 ± 0.3(-6)	5.9 ± 1.8(-7)	9.6 ± 3.3(-7)	8.3 ± 1.1(-7)
^{103}Ru	*	*	*	*
^{106}Ru	*	*	*	*
^{110m}Ag	*	*	*	*
^{124}Sb	7.8 ± 0.5(-6)	7.0 ± 0.4(-6)	8.0 ± 0.4(-6)	7.5 ± 0.4(-6)
^{125}Sb	9.1 ± 0.7(-6)	8.9 ± 0.5(-6)	1.1 ± 0.1(-5)	8.7 ± 0.3(-6)
^{129m}Te	*	*	*	*
^{129}Te	*	*	*	*
^{141}Ce	*	*	*	*
^{144}Ce	*	*	*	*

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* Radionuclide not detected

[5] 450 ml grab sample.

TABLE B.32

BETA-ONLY-EMITTING RADIONUCLIDES FOR SPENT FUEL PIT AND ASSOCIATED WATERS (μCi/ml)

Sample	Date	Radionuclide ^{3}H	^{14}C	^{91}Y	^{89}Sr
Inlet SFP Demin.	11/21/77	2.29 ± 0.07(-3)	1.6 ± 0.02(-8)	3.2 ± 0.2(-7)	1.86 ± 0.05(-5)
Outlet SFP Demin	11/21/77	2.34 ± 0.07(-3)	5.4 ± 0.8(-8)	1 ± 1(-8)	<2(-8)
Unit #3 RWST	11/21/77	4.3 ± 0.1(-3)	9.1 ± 0.9(-7)	1.1 ± 0.2(-7)	<7(-8)
Unit #3 SFP and Transfer Canal (Demin. Inlet)	12/30/77	2.98 ± 0.09(-3)	3.6 ± 0.5(-8)	1.8 ± 0.1(-7)	1.2 ± 0.1(-6)
Unit #3 SFP and Transfer Canal (Demin. Outlet)	12/30/77	3.06 ± 0.09(-3)	4.4 ± 0.7(-8)	<8(-9)	<1(-8)
Unit #3 RWST	12/30/77	4.4 ± 0.1(-3)	9.3 ± 0.9(-7)	1.6 ± 0.8(-8)	<2(-8)
Unit #3 SFP (Dip Sample)	1/3/78	2.77 ± 0.08(-3)	2.2 ± 0.4(-8)	1.70 ± 0.09(-7)	1.2 ± 0.1(-6)
Unit #3 RWST	1/3/78	3.7 ± 0.1(-3)	1.0 ± 0.1(-6)	<7(-9)	<2(-8)
Unit #3 Reactor Cavity (Dip Sample)	1/3/78	5.1 ± 0.2(-3)	2.7 ± 0.3(-7)	2.06 ± 0.02(-5)	8.1 ± 0.2(-6)
Unit #3 SFP (Demin Inlet)	1/11/78	3.2 ± 0.1(-3)	7.7 ± 0.8(-8)	3.47 ± 0.05(-6)	2.3 ± 0.2(-6)
Unit #3 RWST	1/11/78	3.7 ± 0.1(-3)	9.1 ± 0.9(-7)	1.1 ± 0.6(-8)	<2(-8)
Unit #3 Reactor Cavity (Dip Sample)	1/11/78	4.4 ± 0.1(-3)	8.5 ± 0.9(-8)	9.9 ± 0.1(-6)	1.26 ± 0.02(-5)
Unit #3 SFP (Demin Inlet)	1/25/78	3.3 ± 0.1(-3)	5.3 ± 0.8(-8)	2.62 ± 0.03(-6)	8.3 ± 0.2(-6)
Unit #3 SFP (Demin Outlet)	1/25/78	3.16 ± 0.09(-3)	5.5 ± 0.8(-8)	2.0 ± 0.1(-7)	<1(-8)

TABLE B.32 (cont'd)

BETA-ONLY-EMITTING RADIONUCLIDES FOR SPENT FUEL PIT AND ASSOCIATED WATERS
(μCi/ml)

Sample	Date	^{90}Sr	^{55}Fe	^{63}Ni
Inlet SFP Demin.	11/21/77	2.92 ± 0.03(-6)	5.20 ± 0.07(-5)	9.9 ± 0.1(-4)
Outlet SFP Demin.	11/21/77	9 ± 2(-9)	4.2 ± 0.6(-6)	<6(-7)
Unit #3 RWST	11/21/77	8.5 ± 0.9(-8)	1.04 ± 0.01(-4)	1.0 ± 0.9(-6)
Unit #3 SFP and Transfer Canal (Demin. Inlet)	12/30/77	1.02 ± 0.02(-6)	4.24 ± 0.07(-5)	2.76 ± 0.08(-4)
Unit #3 SFP and Transfer Canal (Demin. Outlet)	12/30/77	1.0 ± 0.2(-8)	8.3 ± 0.3(-6)	<4(-8)
Unit #3 RWST	12/30/77	2.6 ± 0.2(-8)	1.09 ± 0.01(-4)	2.1 ± 0.6(-6)
Unit #3 SFP (Dip Sample)	1/3/78	1.82 ± 0.02(-6)	2.43 ± 0.08(-5)	4.5 ± 0.1(-4)
Unit #3 RWST	1/3/78	6.5 ± 0.4(-8)	1.55 ± 0.02(-4)	1 ± 1(-6)
Unit #3 Reactor Cavity (Dip Sample)	1/3/78	8.0 ± 0.1(-7)	4.67 ± 0.01(-3)	1.200 ± 0.003(-3)
Unit #3 SFP (Demin Inlet)	1/11/78	2.15 ± 0.03(-6)	9.1 ± 0.1(-5)	5.1 ± 0.1(-4)
Unit #3 RWST	1/11/78	4.8 ± 0.4(-8)	9.9 ± 0.1(-5)	9 ± 3(-7)
Unit #3 Reactor Cavity (Dip Sample)	1/11/78	2.53 ± 0.03(-6)	5.21 ± 0.03(-4)	7.4 ± 0.3(-4)
Unit #3 SFP (Demin Inlet)	1/25/78	2.33 ± 0.02(-6)	2.96 ± 0.04(-5)	7.63 ± 0.02(-4)
Unit #3 SFP (Demin Outlet)	1/25/78	4.0 ± 0.3(-8)	2.18 ± 0.09(-5)	6 ± 2(-6)

TABLE B.33

UNIT #3 SPENT FUEL PIT AND ASSOCIATED WATER SAMPLES

Nuclide	Reactor Coolant [1] 12/30/77; 11:30 (μCi/ml)	RWST [2] 12/30/77; 11:50 (μCi/ml)	SFP [3] 12/30/77; 13:20 (μCi/ml)	SFP [4] 12/30/77; 13:15 (μCi/ml)
^{131}I	0.68 ± 0.14(-5)	0.41 ± 0.08(-5)	*	*
^{134}Cs	0.37 ± 0.06(-4)	0.62 ± 0.04(-6)	0.93 ± 0.2 (-5)	*
^{136}Cs	0.55 ± 0.15(-5)	*	*	*
^{137}Cs	0.41 ± 0.02(-4)	0.14 ± 0.06(-5)	0.15 ± 0.03(-4)	*
^{51}Cr	0.57 ± 0.08(-3)	*	*	*
^{54}Mn	0.24 ± 0.03(-4)	0.55 ± 0.04(-6)	0.31 ± 0.10(-5)	0.48 ± 0.19(-7)
^{59}Fe	0.17 ± 0.04(-4)	*	*	*
^{57}Co	0.74 ± 0.23(-5)	*	0.31 ± 0.05(-5)	*
^{58}Co	0.536 ± 0.005(-2)	0.39 ± 0.10(-5)	0.50 ± 0.07(-4)	0.14 ± 0.02(-6)
^{60}Co	0.73 ± 0.08(-3)	0.72 ± 0.03(-5)	0.25 ± 0.03(-2)	0.174 ± 0.006(-5)
^{65}Zn	0.65 ± 0.22(-5)	*	*	*
^{95}Zr	0.23 ± 0.04(-4)	0.13 ± 0.05(-5)	*	*
^{95}Nb	0.43 ± 0.06(-4)	*	*	0.55 ± 0.20(-7)
^{103}Ru	0.35 ± 0.03(-4)	*	*	0.43 ± 0.21(-7)
^{110m}Ag	0.52 ± 0.06(-4)	*	*	*
^{124}Sb	0.55 ± 0.07(-4)	0.21 ± 0.02(-5)	*	0.11 ± 0.04(-6)
^{125}Sb	0.23 ± 0.08(-4)	0.13 ± 0.02(-5)	*	*
^{129m}Te	0.16 ± 0.04(-3)	*	*	0.25 ± 0.10(-6)

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* - Radionuclide not detected.

[1] Reactor coolant-inlet to letdown demineralizer.

[2] Refueling Water Storage Tank

[3] Spent fuel pit demineralizer inlet.

[4] Spent fuel pit demineralizer effluent.

TABLE B.33 (cont'd)

UNIT #3 SPENT FUEL PIT AND ASSOCIATED WATER SAMPLES

Nuclide	Reactor Coolant [1] 1/3/78; 11:10 (μCi/ml)	Reactor Cavity [2] 1/3/78; 14:40 (μCi/ml)	RWST [3] 1/3/78; 10:50 (μCi/ml)	SFP [4] 1/3/78; 10:30 (μCi/ml)
^{131}I	0.49 ± 0.02(-4)	0.62 ± 0.01(-4)	0.479 ± 0.008(-4)	*
^{134}Cs	*	*	0.76 ± 0.07(-6)	0.15 ± 0.03(-4)
^{136}Cs	0.73 ± 0.20(-5)	*	*	*
^{137}Cs	*	*	0.167 ± 0.007(-5)	0.27 ± 0.01(-4)
^{51}Cr	0.21 ± 0.01(-3)	0.26 ± 0.01(-3)	0.58 ± 0.5 (-5)	*
^{54}Mn	0.20 ± 0.01(-4)	0.62 ± 0.01(-4)	0.57 ± 0.60(-6)	0.44 ± 0.21(-5)
^{59}Fe	0.56 ± 0.19(-5)	0.20 ± 0.01(-4)	0.26 ± 0.2 (-5)	*
^{57}Co	0.75 ± 0.09(-5)	*	*	0.61 ± 0.05(-5)
^{58}Co	0.43 ± 0.01(-2)	0.427 ± 0.006(-2)	0.123 ± 0.002(-4)	0.77 ± 0.02(-4)
^{60}Co	0.61 ± 0.02(-3)	0.91 ± 0.02(-3)	0.59 ± 0.02(-5)	0.396 ± 0.003(-2)
^{95}Zr	0.13 ± 0.03(-4)	0.53 ± 0.02(-4)	0.27 ± 0.13(-6)	*
^{95}Nb	0.27 ± 0.08(-5)	0.87 ± 0.02(-4)	0.64 ± 0.16(-6)	*
^{103}Ru	0.15 ± 0.04(-4)	0.53 ± 0.01(-4)	0.70 ± 0.10(-6)	*
^{110m}Ag	0.80 ± 0.03(-4)	0.21 ± 0.01(-4)	0.45 ± 0.07(-6)	*
^{124}Sb	0.79 ± 0.05(-4)	0.75 ± 0.03(-4)	0.136 ± 0.003(-4)	*
^{125}Sb	0.33 ± 0.05(-4)	0.38 ± 0.02(-4)	0.76 ± 0.02(-5)	*
^{140}Ba	0.14 ± 0.06(-4)	*	*	*
^{141}Ce	0.11 ± 0.02(-4)	0.137 ± 0.008(-4)	*	*

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* - Radionuclide not detected.

[1] Reactor coolant-inlet to letdown demineralizer.

[2] Dip sample from reactor cavity

[3] Refueling Water Storage Tank

[4] Spent fuel pit dip sample

TABLE B.33 (cont'd)

UNIT #3 SPENT FUEL PIT AND ASSOCIATED WATER SAMPLES

Nuclide	Reactor Coolant [1] 1/11/78; 11:36 (μCi/ml)	Reactor Cavity [2] 1/11/78; 17:25 (μCi/ml)	SFP [3] 1/11/78; 18:53 (μCi/ml)	RWST [4] 1/11/78; 11:34 (μCi/ml)
^{131}I	2.7 ± 0.2(-5)	1.6 ± 0.1(-5)	1.9 ± 0.9(-6)	1.3 ± 0.1(-6)
^{134}Cs	5.3 ± 0.3(-5)	7.1 ± 0.1(-5)	2.3 ± 0.2(-5)	5.3 ± 1.5(-7)
^{136}Cs	*	*	*	2.0 ± 0.5(-6)
^{137}Cs	6.0 ± 0.3(-5)	8.4 ± 0.1(-5)	3.4 ± 0.1(-5)	1.5 ± 0.2(-6)
^{51}Cr	4.4 ± 0.2(-4)	3.74 ± 0.08(-4)	8.4 ± 1.5(-5)	*
^{54}Mn	3.9 ± 0.2(-5)	3.1 ± 0.2(-5)	8.5 ± 1.4(-6)	*
^{59}Fe	*	1.6 ± 0.2(-5)	*	*
^{57}Co	1.7 ± 0.2(-5)	1.6 ± 0.1(-5)	9.5 ± 1.5(-6)	*
^{58}Co	7.31 ± 0.04(-3)	7.51 ± 0.07(-3)	1.46 ± 0.08(-3)	2.0 ± 0.2(-6)
^{60}Co	1.56 ± 0.01(-3)	1.89 ± 0.03(-3)	3.99 ± 0.03(-3)	3.8 ± 0.4(-6)
^{95}Zr	3.3 ± 0.4(-5)	2.9 ± 0.2(-5)	*	*
^{95}Nb	5.2 ± 0.3(-5)	5.4 ± 0.1(-5)	1.3 ± 0.1(-5)	5.3 ± 1.3(-7)
^{103}Ru	2.4 ± 0.4(-5)	2.2 ± 0.1(-5)	5.9 ± 0.9(-6)	*
^{110m}Ag	8.6 ± 0.4(-5)	4.3 ± 0.2(-5)	2.4 ± 0.2(-5)	*
^{124}Sb	1.12 ± 0.04(-4)	1.20 ± 0.02(-4)	2.4 ± 0.2(-5)	8.8 ± 0.2(-7)
^{125}Sb	5.5 ± 0.6(-5)	5.2 ± 0.3(-5)	1.3 ± 0.3(-5)	*
^{140}La	2.7 ± 0.8(-5)	*	*	*
^{141}Ce	2.1 ± 0.3(-4)	*	5.1 ± 0.8(-6)	*
^{144}Ce	3.3 ± 0.9(-5)	5.0 ± 0.7(-5)	*	*

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* - Radionuclide not detected.

[1] Reactor coolant-letdown demineralizer inlet.

[2] Reactor cavity dip sample.

[3] Spent fuel pit dip sample.

[4] Refueling water storage tank.

TABLE B.33 (cont'd)

UNIT #3 SPENT FUEL PIT AND ASSOCIATED WATER SAMPLES

Nuclide	SFP Filter 1/11/78; 18:53 (μCi/ml)	SFP Filtrate 1/11/78; 18:53 (μCi/ml)	SFP Filter & Filtrate 1/11/78; 18:53 (μCi/ml)	SFP Dip Sample 1/11/78; 18:53 (μCi/ml)
^{131}I	6.9 ± 0.4(-7)	*	6.9 ± 0.4(-7)	1.9 ± 0.9(-6)
^{134}Cs	*	1.9 ± 0.1(-5)	1.9 ± 0.1(-5)	2.3 ± 0.2(-5)
^{137}Cs	1.5 ± 0.4(-7)	3.01 ± 0.07(-5)	3.02 ± 0.07(-5)	3.4 ± 0.1(-5)
^{51}Cr	8.10 ± 0.09(-5)	2.6 ± 0.3(-5)	1.07 ± 0.03(-4)	8.4 ± 1.5(-5)
^{54}Mn	2.98 ± 0.08(-6)	7.7 ± 1.3(-6)	1.07 ± 0.13(-5)	8.5 ± 1.4(-6)
^{59}Fe	2.6 ± 0.1(-6)	*	2.6 ± 0.1(-6)	*
^{57}Co	1.5 ± 0.1(-7)	*	1.5 ± 0.1(-7)	9.5 ± 1.5(-6)
^{58}Co	4.44 ± 0.04(-5)	1.32 ± 0.01(-3)	1.36 ± 0.01(-3)	1.46 ± 0.08(-3)
^{60}Co	3.20 ± 0.03(-5)	3.76 ± 0.09(-3)	3.79 ± 0.09(-3)	3.99 ± 0.03(-3)
^{95}Zr	*	*		*
^{95}Nb	*	*		1.3 ± 0.1(-5)
^{103}Ru	2.79 ± 0.05(-6)	*	2.79 ± 0.05(-6)	5.9 ± 0.9(-6)
^{106}RuD	1.1 ± 0.8(-6)	*	1.1 ± 0.8(-6)	*
^{110m}Ag	*	9 ± 1(-6)	9 ± 1(-6)	2.4 ± 0.2(-5)
^{124}Sb	7.5 ± 0.6(-7)	2.31 ± 0.07(-5)	2.38 ± 0.07(-5)	2.4 ± 0.2(-5)
^{125}Sb	7.3 ± 1.2(-7)	*	7.3 ± 1.2(-7)	1.3 ± 0.3(-5)
^{141}Ce	5.5 ± 0.6(-7)	3.5 ± 0.5(-6)	4.0 ± 0.5(-6)	5.1 ± 0.8(-6)
^{144}Ce	1.7 ± 0.2(-6)	2.1 ± 0.3(-5)	2.3 ± 0.3(-5)	*

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* Radionuclide not detected.

TABLE B.33 (cont'd)

UNIT #3 SPENT FUEL PIT AND ASSOCIATED WATER SAMPLES

Nuclide	SFP Demin. Inlet 2/4/78; 10:10 (µCi/ml)	SFP Demin. Outlet [1] 2/4/78; 10:20 (µCi/ml)	SFP Demin. Outlet [2] 2/4/78; 10:20 (µCi/ml)
^{131}I	*	1.3 ± 0.1(-8)	*
^{134}Cs	2.1 ± 0.8(-6)	*	*
^{137}Cs	1.5 ± 0.5(-6)	*	1.30 ± 0.09(-8)
^{51}Cr	1.5 ± 0.4(-5)	7.8 ± 0.2(-7)	4.9 ± 0.6(-8)
^{54}Mn		3.5 ± 0.2(-8)	4.6 ± 0.7(-9)
^{59}Fe	*	2.8 ± 0.3(-8)	4.5 ± 2.1(-9)
^{57}Co	1.1 ± 0.2(-6)	5.4 ± 0.3(-9)	6.5 ± 0.5(-9)
^{58}Co	3.05 ± 0.08(-4)	1.89 ± 0.04(-6)	2.57 ± 0.07(-6)
^{60}Co	3.7 ± 0.1(-4)	4.5 ± 0.1(-7)	1.06 ± 0.04(-6)
^{95}Zr	*	9.2 ± 0.2(-8)	*
^{95}Nb	*	1.6 ± 0.4(-7)	*
^{103}Ru	1.6 ± 0.6(-6)	5.1 ± 0.2(-8)	3.6 ± 0.9(-9)
^{106}RuD	*	5.6 ± 0.9(-8)	4.8 ± 0.5(-8)
^{110m}Ag	*	9.1 ± 1.7(-9)	*
^{124}Sb	3.3 ± 0.4(-6)	7.1 ± 0.2(-7)	*
^{125}Sb	3.1 ± 0.9(-6)	4.3 ± 0.9(-7)	*
^{141}Ce	*	*	7.4 ± 0.4(-8)
^{144}Ce	*	*	3.1 ± 0.1(-7)
^{154}Eu	*	*	3.0 ± 1.4(-9)
^{187}W	*	*	3.2 ± 0.6(-9)

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* - Radionuclide not detected.

[1] Anion resin

[2] Cation resin

TABLE B.34

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS UNIT #3, 11/8-9/77

Nuclide	Steam Generator Blowdown 3A 11/8/77; 12:30 (μCi/ml)
^{82}Br	7.1 ± 2.6(-8)
^{131}I	9.9 ± 0.1(-6)
^{132}I	*
^{133}I	3.5 ± 0.1(-5)
^{134}I	*
^{135}I	3.4 ± 0.2(-5)
^{88}Rb	*
^{89}Rb	*
^{134}Cs	1.4 ± 0.1(-6)
^{136}Cs	1.5 ± 0.3(-7)
^{137}Cs	2.5 ± 0.1(-6)
^{138}Cs	*
^{24}Na	1.5 ± 0.1(-6)
^{41}Ar	*
^{51}Cr	<5.9(-8)
^{54}Mn	<1.7(-7)
^{56}Mn	<7.2(-6)
^{59}Fe	<9.0(-8)
^{57}Co	<1.9(-8)
^{58}Co	<6.1(-8)
^{60}Co	<1.2(-7)
^{65}Zn	<5.2(-8)
^{91}Sr	<2.6(-8)
^{93}Y	<5.2(-7)
^{95}Zr	<2.4(-8)
^{95}Nb	<1.2(-7)
^{99}Mo	<5.1(-9)
^{103}Ru	<8.4(-10)
^{106}RuD	<8.2(-8)
^{110m}Ag	<9.4(-7)
^{124}Sb	<2.1(-8)
^{125}Sb	<4.2(-8)
^{129}Te	*
^{129m}Te	<6.0(-8)
^{131m}Te	<2.4(-7)
^{132}Te	<4.6(-8)
^{139}Ba	<1.7(-7)
^{140}Ba	<6.0(-8)
^{140}La	1.1 ± 0.3(-7)
^{141}Ce	<3.4(-8)
^{143}Ce	<3.9(-8)
^{144}Ce	<3.4(-8)
^{152}Eu	<5.6(-8)
^{154}Eu	<7.4(-8)
^{187}W	<6.4(-8)
^{239}Np	<3.9(-8)

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* Radionuclide not detected.

TABLE B.34 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
Unit #3, 11/8-9/77

Nuclide	Steam Generator Blowdown 3A 11/9/77; 16:51 (μCi/ml)	Steam Generator Blowdown 3B 11/9/77; 18:06 (μCi/ml)	Steam Generator Blowdown 3C 11/9/77; 16:55 (μCi/ml)	Main Steam 3A 11/9/77; 19:29 (μCi/ml)	Main Steam 3B 11/9/77; 20:41 (μCi/ml)
^{82}Br	*	<1.0(-8)	<1.3(-6)	<4.5(-7)	<9.4(-8)
^{131}I	2.8 ± 0.2(-6)	2.9 ± 0.2(-6)	1.8 ± 0.1(-4)	<3.1(-7)	8.4 ± 3.3(-8)
^{132}I	1.3 ± 0.2(-6)	6.1 ± 1.7(-7)	1.8 ± 0.1(-4)	*	<1.9(-8)
^{133}I	2.8 ± 0.3(-6)	2.4 ± 0.2(-6)	3.4 ± 0.1(-4)	<1.3(-9)	<2.4(-7)
^{134}I	4.2 ± 1.9(-7)	<6.0(-8)	7.2 ± 0.3(-5)	<4.2(-8)	<1.1(-6)
^{135}I	1.4 ± 0.4(-6)	8.1 ± 2.9(-7)	2.2 ± 0.1(-4)	<7.6(-7)	<2.5(-8)
^{88}Rb	<1.1(-6)	<1.9(-8)	<6.24(-6)	<4.2(-7)	*
^{89}Rb	<2.8(-7)	<3.0(-7)	<1.78(-7)	<1.3(-7)	<4.1(-6)
^{134}Cs	3.1 ± 1.1(-7)	3.8 ± 0.9(-7)	8.0 ± 0.4(-6)	<5.5(-7)	<1.9(-7)
^{136}Cs	<4.5(-8)	<1.8(-8)	1.06 ± 0.24(-6)	<4.6(-7)	<2.3(-8)
^{137}Cs	6.1 ± 1.1(-7)	7.0 ± 0.8(-7)	1.5 ± 0.1(-5)	<3.2(-7)	<1.3(-7)
^{138}Cs	8.13 ± 2.47(-7)	8.6 ± 2.7(-7)	4.64 ± 0.32(-5)	<2.1(-7)	<3.6(-7)
^{24}Na	<4.0(-7)	*	7.69 ± 0.98(-6)	*	<8.1(-7)
^{41}Ar	<7.0(-8)	<4.0(-7)	*	<8.8(-7)	<2.6(-7)
^{51}Cr	<1.4(-8)	<2.1(-7)	<1.62(-7)	<3.5(-7)	<1.4(-8)
^{54}Mn	*	<1.3(-7)	<1.40(-7)	<1.2(-7)	<1.6(-7)
^{56}Mn	<1.6(-7)	<3.2(-8)	<2.00(-6)	<1.4(-7)	<1.3(-6)
^{59}Fe	<2.5(-8)	<5.5(-9)	<2.85(-7)	<6.3(-7)	<1.4(-8)
^{57}Co	<1.6(-8)	<1.8(-7)	<6.53(-7)	<1.5(-7)	<8.6(-8)
^{58}Co	<1.4(-7)	<1.3(-7)	<4.40(-7)	<1.7(-7)	1.6 ± 0.7(-7)
^{60}Co	<3.1(-7)	<3.6(-7)	<3.7(-7)	<2.4(-7)	<2.4(-7)
^{65}Zn	<2.6(-7)	<1.8(-7)	<4.06(-7)	*	<2.6(-7)
^{91}Sr	<2.0(-9)	<2.7(-7)	<9.44(-7)	<2.0(-7)	<1.1(-7)
^{93}Y	*	<4.0(-8)	<4.32(-8)	<1.1(-7)	1.3 ± 0.8(-6)
^{95}Zr	<2.8(-7)	<1.4(-7)	<2.50(-7)	<4.3(-7)	<1.1(-7)
^{95}Nb	<2.3(-8)	<4.8(-8)	*	*	<2.1(-8)
^{99}Mo	<2.3(-7)	<3.6(-8)	<9.12(-7)	<1.5(-7)	<3.5(-8)

TABLE B.34 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/8-9/77

Nuclide	Steam Generator Blowdown 3A 11/9/77; 16:51 (μCi/ml)	Steam Generator Blowdown 3B 11/9/77; 18:06 (μCi/ml)	Steam Generator Blowdown 3C 11/9/77; 16:55 (μCi/ml)	Main Steam 3A 11/9/77; 19:29 (μCi/ml)	Main Steam 3B 11/9/77; 20:41 (μCi/ml)
^{103}Ru	<2.6(-7)	<1.5(-7)	<3.36(-6)	<1.6(-8)	<1.5(-7)
^{106}RuD	<4.2(-8)	1.2 ± 0.4(-6)	8.52 ± 1.06(-5)	<2.1(-7)	<5.1(-8)
^{110m}Ag	*	*	*	1.9 ± 1.0(-7)	<1.6(-7)
^{124}Sb	<8.1(-8)	<5.8(-8)	<4.9(-7)	*	<6.5(-9)
^{125}Sb	<3.1(-8)	<2.4(-9)	<1.1(-6)	<1.4(-7)	<5.4(-9)
^{129}Te	*	<1.4(-5)	<1.2(-4)	<1.3(-7)	<1.9(-5)
^{129m}Te	<2.5(-8)	<1.8(-7)	<3.2(-7)	<4.8(-7)	<1.4(-7)
^{131m}Te	<1.8(-7)	<3.1(-8)	<3.5(-6)	<2.1(-7)	<4.3(-8)
^{132}Te	<9.7(-9)	<1.2(-7)	<6.9(-7)	<5.1(-9)	<1.2(-8)
^{139}Ba	<1.2(-8)	<1.2(-7)	6.1 ± 3.6(-6)	<1.8(-10)	<2.2(-8)
^{140}Ba	<1.6(-7)	5.8 ± 2.2(-7)	5.4 ± 0.8(-6)	<2.4(-7)	<1.2(-7)
^{140}La	<2.6(-8)	<1.4(-7)	8.0 ± 1.0(-6)	*	<1.3(-8)
^{141}Ce	<6.6(-9)	<3.3(-8)	<8.2(-7)	<7.0(-7)	<1.4(-8)
^{143}Ce	<2.3(-7)	2.7 ± 1.1(-7)	<1.8(-6)	<1.5(-8)	<2.4(-8)
^{144}Ce	<7.9(-8)	<1.2(-7)	<4.5(-9)	<3.4(-8)	<9.2(-8)
^{152}Eu	<1.4(-7)	1.5 ± 0.6(-7)	<6.4(-7)	<2.6(-7)	<4.4(-8)
^{154}Eu	<7.7(-8)	<3.1(-7)	<4.8(-7)	<7.3(-7)	<3.0(-7)
^{187}W	<9.4(-8)	<1.3(-7)	<1.1(-6)	*	<1.5(-7)
^{239}Np	<1.9(-7)	<1.1(-7)	<2.8(-7)	<2.3(-7)	*

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* Radionuclide not detected.

TABLE B.34 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/8-9/77

Nuclide	Main Steam 3C 11/9/77; 20:14 (μCi/ml)	Unit 3 Blowdown Flash Tank 11/9/77; 14:55 (μCi/ml)	Unit 3 Main Feed 11/9/77; 18:06 (μCi/ml)	Unit 3 Main Condensate 11/9/77; 19:23 (μCi/ml)
^{82}Br	<1.1(-8)	<6.1(-7)	<2.5(-7)	<7.2(-7)
^{131}I	2.9 ± 0.2(-6)	8.6 ± 0.3(-5)	<9.9(-8)	<8.0(-8)
^{132}I	6.1 ± 1.7(-7)	8.1 ± 0.2(-5)	<5.6(-7)	<1.3(-9)
^{133}I	2.4 ± 0.2(-6)	1.7 ± 0.1(-4)	<2.9(-8)	<3.5(-7)
^{134}I	<6.0(-8)	3.0 ± 0.2(-5)	<5.1(-8)	<3.1(-7)
^{135}I	<4.5(-8)	1.2 ± 0.1(-4)	<1.3(-7)	<6.4(-8)
^{88}Rb	<9.4(-7)	7.2 ± 5.6(-6)	1.1 ± 0.8(-6)	<1.6(-6)
^{89}Rb	<9.9(-7)	*	<5.4(-7)	<3.0(-7)
^{134}Cs	<2.2(-7)	4.9 ± 0.2(-6)	<2.2(-8)	<2.0(-7)
^{136}Cs	<4.7(-9)	<1.1(-7)	<5.5(-8)	<6.6(-8)
^{137}Cs	<1.8(-7)	9.1 ± 0.4(-6)	<1.1(-7)	1.3 ± 1.0(-7)
^{138}Cs	1.4 ± 0.30(-6)	1.7 ± 0.2(-5)	<5.5(-8)	<7.2(-8)
^{24}Na	<1.1(-7)	4.6 ± 0.8(-6)	<9.9(-8)	<3.0(-6)
^{41}Ar	<1.8(-7)	*	<4.9(-7)	<1.4(-7)
^{51}Cr	<9.5(-8)	<4.8(-7)	<9.8(-8)	<6.5(-8)
^{54}Mn	<3.4(-7)	*	1.0 ± 0.3(-7)	1.2 ± 0.6(-7)
^{56}Mn	<3.4(-8)	*	<4.0(-7)	<1.3(-7)
^{59}Fe	<3.1(-7)	<1.9(-8)	<1.7(-7)	<1.4(-7)
^{57}Co	<1.9(-7)	<4.0(-8)	<7.6(-8)	1.1 ± 0.5(-7)
^{58}Co	<4.1(-9)	<3.4(-7)	<6.2(-8)	<2.3(-7)
^{60}Co	2.4 ± 1.6(-7)	<2.9(-7)	<2.1(-7)	<3.2(-7)
^{65}Zn	<2.5(-7)	<7.8(-7)	<1.2(-7)	<4.2(-8)
^{91}Sr	<2.5(-7)	<1.1(-6)	<3.2(-9)	<1.6(-7)
^{93}Y	<1.1(-7)	<3.9(-7)	<9.0(-8)	<8.8(-8)
^{95}Zr	<2.1(-7)	<3.5(-7)	<1.8(-7)	<8.8(-8)
^{95}Nb	<5.0(-8)	<4.9(-7)	<1.6(-8)	<1.8(-7)
^{99}Mo	<5.9(-7)	<5.1(-7)	<3.4(-8)	<6.5(-7)

TABLE B.34 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/8-9/77

Nuclide	Main Steam 3C 11/9/77; 20:14 (μCi/ml)	Unit 3 Blowdown Flash Tank 11/9/77; 14:55 (μCi/ml)	Unit 3 Main Feed 11/9/77; 18:06 (μCi/ml)	Unit 3 Main Condensate 11/9/77; 19:23 (μCi/ml)
^{103}Ru	<2.5(-7)	<2.2(-6)	<3.8(-8)	<1.5(-7)
^{106}RuD	*	5.3 ± 0.7(-5)	<1.1(-8)	<1.9(-7)
^{110m}Ag	*	*	<1.3(-7)	<7.0(-8)
^{124}Sb	<3.2(-8)	<1.5(-7)	<1.4(-7)	<9.0(-8)
^{125}Sb	<2.0(-7)	<2.6(-6)	<3.2(-8)	<5.4(-8)
^{129}Te	*	<3.5(-6)	<7.2(-6)	*
^{129m}Te	<1.9(-7)	<2.0(-7)	<4.9(-8)	<9.9(-8)
^{131m}Te	<1.9(-7)	*	<4.6(-8)	<1.7(-7)
^{132}Te	<4.9(-7)	<5.2(-7)	<9.7(-8)	<1.0(-7)
^{139}Ba	<7.6(-8)	<1.4(-7)	<1.5(-7)	<9.7(-6)
^{140}Ba	<1.6(-7)	2.9 ± 0.3(-6)	2.6 ± 1.2(-7)	<6.7(-8)
^{140}La	<5.8(-8)	5.8 ± 0.5(-6)	<4.3(-7)	<4.0(-7)
^{141}Ce	<4.2(-8)	<1.2(-6)	<1.5(-7)	<3.1(-7)
^{143}Ce	<1.0(-7)	<1.2(-6)	<4.1(-7)	<1.7(-7)
^{144}Ce	<2.0(-7)	<6.5(-7)	<2.4(-8)	<1.2(-7)
^{152}Eu	<4.7(-8)	<1.3(-7)	<9.8(-8)	<2.4(-7)
^{154}Eu	<2.7(-7)	<1.5(-7)	<1.5(-7)	<1.2(-7)
^{187}W	<2.5(-6)	<4.4(-7)	<3.2(-8)	<5.8(-7)
^{239}Np	<2.1(-7)	<3.2(-6)	<8.2(-7)	<7.7(-7)

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* Radionuclide not detected.

TABLE B.35

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/14/77

Nuclide	Steam Generator Blowdown 3A 11/14/77; 11:34 (μCi/ml)	Steam Generator Blowdown 3B 11/14/77; 11:31 (μCi/ml)	Main Steam 3A 11/14/77; 16:32 (μCi/ml)	Main Steam 3B 11/14/77; 16:37 (μCi/ml)	Main Steam 3C 11/14/77; 16:40 (μCi/ml)
^{82}Br	<2.1(-7)	2.5 ± 0.8(-7)	<6.1(-8)	<7.3(-8)	<3.2(-7)
^{131}I	9.2 ± 0.1(-6)	1.5 ± 0.1(-5)	1.7 ± 0.3(-7)	1.5 ± 0.3(-7)	5.7 ± 0.4(-7)
^{132}I	*	*	*	*	*
^{133}I	3.3 ± 0.1(-5)	4.6 ± 0.2(-5)	5.6 ± 1.8(-7)	6.9 ± 1.4(-7)	2.8 ± 0.2(-6)
^{134}I	*	*	*	*	*
^{135}I	6.8 ± 2.6(-5)	*	<8.0(-6)	<7.1(-6)	<1.5(-5)
^{88}Rb	*	*	*	*	*
^{89}Rb	*	*	*	*	*
^{134}Cs	2.9 ± 0.9(-7)	3.7 ± 0.5(-7)	<7.2(-7)	<6.6(-8)	<1.1(-7)
^{136}Cs	<7.9(-8)	<6.1(-8)	<4.7(-9)	<4.0(-9)	<8.8(-8)
^{137}Cs	3.9 ± 0.6(-7)	7.8 ± 0.9(-7)	<9.0(-7)	<6.0(-8)	1.0 ± 0.5(-7)
^{138}Cs	*	*	*	*	*
^{24}Na	<2.3(-6)	<3.5(-6)	<7.8(-7)	<1.1(-6)	<4.5(-8)
^{41}Ar	*	*	*	*	*
^{51}Cr	<1.6(-8)	<4.7(-8)	<2.3(-9)	<3.4(-10)	<1.3(-8)
^{54}Mn	<4.7(-8)	<4.5(-8)	<4.6(-8)	<4.3(-8)	<5.6(-8)
^{56}Mn	*	*	*	*	*
^{59}Fe	<4.5(-8)	<4.3(-8)	<1.8(-8)	<5.1(-8)	<1.2(-7)
^{57}Co	<1.9(-8)	<6.7(-8)	<4.5(-9)	<3.6(-8)	<5.2(-8)
^{58}Co	<8.6(-8)	<5.2(-8)	<7.3(-9)	1.2 ± 0.4(-7)	<5.2(-8)
^{60}Co	<1.8(-7)	<1.7(-7)	<1.9(-7)	<2.2(-7)	<2.0(-7)
^{65}Zn	<5.1(-8)	<6.6(-8)	<6.4(-8)	<2.9(-8)	<9.9(-8)
^{91}Sr	<4.2(-6)	<6.8(-6)	<6.2(-7)	<1.6(-7)	<1.6(-6)
^{93}Y	<3.5(-6)	<1.6(-5)	<3.1(-7)	<1.2(-6)	<3.4(-6)
^{95}Zr	<1.8(-8)	<1.6(-8)	<1.5(-8)	<5.5(-8)	<8.9(-8)
^{95}Nb	<1.1(-7)	<9.1(-10)	<3.8(-9)	<3.5(-8)	<3.5(-8)
^{99}Mo	<4.4(-9)	<2.5(-7)	<5.7(-8)	<1.2(-8)	<1.2(-7)

TABLE B.35 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/14/77

Nuclide	Steam Generator Blowdown 3A 11/14/77; 11:34 (μCi/ml)	Steam Generator Blowdown 3B 11/14/77; 11:31 (μCi/ml)	Main Steam 3A 11/14/77; 16:32 (μCi/ml)	Main Steam 3B 11/14/77; 16:37 (μCi/ml)	Main Steam 3C 11/14/77; 16:40 (μCi/ml)
^{103}Ru	<5.3(-8)	<1.7(-8)	<5.5(-8)	<8.8(-9)	<4.8(-8)
^{106}RuD	<7.9(-9)	<5.3(-10)	<3.3(-8)	<3.8(-8)	<2.7(-8)
^{110m}Ag	<3.1(-7)	<4.2(-7)	<1.3(-7)	<1.2(-7)	<1.0(-7)
^{124}Sb	<1.3(-8)	<2.5(-8)	<3.6(-8)	<3.7(-9)	<1.9(-8)
^{125}Sb	<5.0(-8)	<8.5(-8)	<4.1(-8)	<8.1(-8)	<3.0(-9)
^{129}Te	*	*	*	*	*
^{129m}Te	<3.3(-8)	<4.0(-10)	8.8 ± 5.2(-7)	<1.2(-7)	<4.3(-8)
^{131m}Te	<8.2(-8)	<5.2(-7)	<1.3(-7)	<2.8(-7)	<1.4(-7)
^{132}Te	<2.8(-8)	<1.6(-7)	<2.6(-8)	<3.6(-8)	<5.0(-8)
^{139}Ba	<2.6(-6)	<2.5(-7)	<3.4(-7)	<9.7(-7)	<7.8(-7)
^{140}Ba	4.2 ± 1.1(-7)	<1.5(-7)	<2.9(-8)	<8.9(-9)	<9.2(-8)
^{140}La	3.4 ± 0.7(-7)	<7.1(-7)	<9.7(-8)	<4.5(-8)	<3.5(-7)
^{141}Ce	<4.0(-8)	<3.2(-8)	<6.3(-9)	<3.6(-8)	<3.1(-8)
^{143}Ce	<5.5(-8)	<5.3(-7)	<3.0(-7)	<2.1(-7)	<2.3(-7)
^{144}Ce	<1.1(-7)	<7.4(-8)	2.9 ± 1.2(-7)	<2.4(-9)	<5.1(-8)
^{152}Eu	<3.3(-8)	<5.1(-8)	<2.1(-8)	<8.1(-9)	<5.1(-8)
^{154}Eu	<2.6(-8)	<5.5(-9)	1.6 ± 0.5(-7)	<1.6(-8)	<3.7(-8)
^{187}W	<9.5(-8)	<5.7(-7)	<2.2(-9)	<2.1(-7)	<1.6(-7)
^{239}Np	<4.9(-8)	<3.0(-7)	<1.9(-7)	<3.9(-8)	<2.1(-8)

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* Radionuclide not detected.

TABLE B.35 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/14/77

Nuclide	Unit 3 Blowdown Flash Tank 11/14/77; 11:38 (μCi/ml)	Unit 3 Main Feed 11/14/77; 16:27 (μCi/ml)	Unit 3 Main Condensate 11/14/77; 16:30 (μCi/ml)
^{82}Br	<1.4(-5)	<3.7(-7)	<2.0(-8)
^{131}I	2.4 ± 0.1(-5)	1.1 ± 0.3(-7)	<7.8(-8)
^{132}I	4.2 ± 0.2(-5)	*	*
^{133}I	9.5 ± 0.2(-5)	3.2 ± 2.0(-7)	4.7 ± 1.6(-7)
^{134}I	3.5 ± 0.2(-5)	*	*
^{135}I	1.1 ± 0.1(-4)	<1.2(-5)	<9.1(-7)
^{88}Rb	<3.4(-6)	*	*
^{89}Rb	<2.0(-6)	*	*
^{134}Cs	6.2 ± 0.6(-7)	<3.8(-8)	6.7 ± 3.2(-8)
^{136}Cs	<7.2(-7)	<3.8(-8)	<1.2(-7)
^{137}Cs	1.3 ± 0.1(-6)	<5.1(-8)	<6.3(-8)
^{138}Cs	2.0 ± 0.1(-5)	*	*
^{24}Na	1.7 ± 0.3(-6)	<1.9(-7)	<2.1(-7)
^{41}Ar	<1.3(-6)	*	*
^{51}Cr	<2.7(-7)	<4.0(-8)	<1.0(-7)
^{54}Mn	<6.4(-6)	<7.8(-8)	8.1 ± 4.7(-8)
^{56}Mn	<9.7(-7)	*	*
^{59}Fe	<2.2(-6)	<6.1(-9)	<5.0(-8)
^{57}Co	<3.6(-7)	<2.5(-8)	<2.8(-8)
^{58}Co	3.8 ± 2.9(-8)	<5.2(-8)	<4.2(-8)
^{60}Co	<1.8(-7)	<2.0(-7)	<1.9(-7)
^{65}Zn	<1.6(-7)	<6.5(-9)	<1.9(-8)
^{91}Sr	<7.2(-6)	<4.0(-7)	<2.4(-6)
^{93}Y	<4.7(-7)	<1.6(-6)	<6.8(-8)
^{95}Zr	<4.2(-7)	<6.9(-9)	<5.3(-8)
^{95}Nb	<2.3(-6)	<5.7(-8)	<1.5(-8)
^{99}Mo	<5.1(-7)	<3.3(-8)	<7.0(-8)

TABLE B.35 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/14/77

Nuclide	Unit 3 Blowdown Flash Tank 11/14/77; 11:38 (μCi/ml)	Unit 3 Main Feed 11/14/77; 16:27 (μCi/ml)	Unit 3 Main Condensate 11/14/77; 16:30 (μCi/ml)
^{103}Ru	<2.1(-7)	<2.7(-8)	<4.2(-8)
^{106}RuD	<3.7 ± 0.4(-5)	<8.2(-8)	<8.6(-8)
^{110m}Ag	<1.0(-6)	<9.4(-8)	<1.1(-7)
^{124}Sb	<3.3(-7)	<5.1(-9)	<2.5(-8)
^{125}Sb	<1.0(-6)	<1.1(-7)	<5.8(-8)
^{129}Te	<4.2(-6)	*	*
^{129m}Te	<1.2(-6)	<5.6(-8)	<4.1(-8)
^{131m}Te	<6.0(-6)	<1.8(-7)	<2.5(-8)
^{132}Te	<2.9(-7)	<1.3(-7)	<7.4(-8)
^{139}Ba	3.5 ± 0.6(-6)	<1.4(-6)	<2.4(-7)
^{140}Ba	<2.2(-6)	<5.7(-8)	<1.4(-7)
^{140}La	<3.8(-7)	<1.3(-8)	<1.2(-7)
^{141}Ce	<2.1(-7)	<3.1(-8)	<1.8(-8)
^{143}Ce	<1.4(-8)	<2.6(-7)	<3.2(-8)
^{144}Ce	<1.5(-6)	<6.8(-8)	<6.8(-9)
^{152}Eu	<1.5(-6)	<7.5(-8)	4.4 ± 1.8(-8)
^{154}Eu	<6.3(-7)	<5.1(-8)	<2.8(-8)
^{187}W	<7.0(-7)	<6.0(-7)	<4.2(-7)
^{239}Np	<3.2(-7)	<3.1(-8)	<1.2(-8)

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* Radionuclide not detected.

TABLE B.36

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/16/77

Nuclide	Main Steam 3A 11/16/77; 16:10 (μCi/ml)
^{82}Br	<8.6(-9)
^{131}I	1.2 ± 0.2(-7)
^{132}I	7.6 ± 4.8(-6)
^{133}I	3.8 ± 0.5(-7)
^{134}I	*
^{135}I	<8.4(-8)
^{88}Rb	*
^{89}Rb	*
^{134}Cs	1.2 ± 0.8(-7)
^{136}Cs	<5.7(-9)
^{137}Cs	<6.6(-8)
^{138}Cs	*
^{24}Na	<3.9(-8)
^{41}Ar	<2.2(-5)
^{51}Cr	<5.2(-8)
^{54}Mn	<6.1(-8)
^{56}Mn	<2.0(-7)
^{59}Fe	<7.0(-9)
^{57}Co	<2.2(-8)
^{58}Co	<1.8(-7)
^{60}Co	<1.8(-7)
^{65}Zn	<6.5(-8)
^{91}Sr	<2.4(-8)
^{93}Y	<4.2(-8)
^{95}Zr	<5.2(-8)
^{95}Nb	<2.6(-8)
^{99}Mo	<3.1(-8)
^{103}Ru	<1.0(-9)
^{106}RuD	<1.1(-7)
^{110m}Ag	<1.6(-7)
^{124}Sb	<1.7(-8)
^{125}Sb	<5.3(-9)
^{129}Te	*
^{129m}Te	<9.2(-8)
^{131m}Te	<1.2(-8)
^{132}Te	<1.1(-8)
^{139}Ba	<2.0(-8)
^{140}Ba	<7.9(-8)
^{140}La	<1.7(-8)
^{141}Ce	<6.8(-9)
^{143}Ce	<1.0(-7)
^{144}Ce	<3.7(-8)
^{152}Eu	<6.6(-9)
^{154}Eu	2.1 ± 0.6(-7)
^{187}W	<2.2(-8)
^{239}Np	1.8 ± 0.6(-7)

* Radionuclide not detected.

TABLE B.37

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/17-18/77

Nuclide	Steam Generator Blowdown 3A 11/17/77; 13:21 (μCi/ml)	Steam Generator Blowdown 3B 11/17/77; 12:46 (μCi/ml)	Steam Generator Blowdown 3C 11/17/77; 12:46 (μCi/ml)
^{82}Br	<3.5(-6)	<5.8(-6)	<5.1(-5)
^{131}I	7.4 ± 0.3(-6)	1.3 ± 0.1(-5)	4.3 ± 0.1(-5)
^{132}I	9.5 ± 0.7(-6)	3.9 ± 0.3(-4)	1.8 ± 0.1(-4)
^{133}I	7.7 ± 0.2(-6)	2.0 ± 0.2(-5)	<6.0(-5)
^{134}I	5.1 ± 0.5(-6)	*	1.5 ± 0.1(-4)
^{135}I	3.3 ± 0.2(-5)	1.6 ± 0.1(-4)	3.4 ± 0.1(-4)
^{88}Rb	<5.7(-7)	*	1.2 ± 0.4(-5)
^{89}Rb	<6.6(-7)	*	6.7 ± 1.7(-6)
^{134}Cs	6.3 ± 0.6(-7)	8.6 ± 0.8(-7)	3.5 ± 0.2(-6)
^{136}Cs	<1.6(-7)	<3.7(-8)	<2.2(-7)
^{137}Cs	1.1 ± 0.1(-6)	1.8 ± 0.1(-6)	6.2 ± 0.2(-6)
^{138}Cs	4.3 ± 0.5(-6)	*	9.2 ± 0.3(-5)
^{24}Na	7.9 ± 2.0(-7)	2.6 ± 1.0(-6)	1.2 ± 0.1(-5)
^{41}Ar	<9.1(-7)	<9.2(-5)	<4.0(-6)
^{51}Cr	<9.0(-7)	<2.3(-8)	<2.4(-6)
^{54}Mn	<1.9(-7)	<2.6(-6)	<2.0(-5)
^{56}Mn	<6.9(-7)	<7.6(-6)	<3.4(-6)
^{59}Fe	<6.4(-7)	<1.5(-6)	<5.3(-6)
^{57}Co	<1.2(-8)	<1.2(-7)	<5.5(-7)
^{58}Co	<9.2(-7)	<2.8(-7)	<1.1(-5)
^{60}Co	<2.4(-7)	<1.9(-7)	<2.4(-7)
^{65}Zn	<8.0(-7)	<3.4(-7)	<1.1(-6)
^{91}Sr	<1.0(-7)	<2.0(-7)	<5.8(-7)
^{93}Y	<8.7(-7)	<2.7(-6)	<1.5(-7)
^{95}Zr	<2.1(-7)	<7.6(-7)	<1.6(-7)
^{95}Nb	<1.6(-7)	<1.1(-6)	<6.7(-6)
^{99}Mo	<5.7(-8)	<4.6(-7)	<3.4(-7)

TABLE B.37 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/17-18/77

Nuclide	Steam Generator Blowdown 3A 11/17/77; 13:21 (μCi/ml)	Steam Generator Blowdown 3B 11/17/77; 12:46 (μCi/ml)	Steam Generator Blowdown 3C 11/17/77; 12:46 (μCi/ml)
^{103}Ru	3.6 ± 1.3(-7)	<1.2(-6)	<3.3(-7)
^{106}RuD	7.3 ± 1.5(-6)	<7.2(-7)	1.6 ± 0.1(-4)
^{110m}Ag	<9.5(-7)	<1.6(-6)	<7.4(-6)
^{124}Sb	<7.9(-8)	<8.8(-8)	<9.2(-7)
^{125}Sb	<3.7(-7)	<1.5(-7)	<1.3(-7)
^{129}Te	<9.0(-7)	*	<2.2(-5)
^{129m}Te	<3.3(-8)	<1.3(-6)	<2.3(-6)
^{131m}Te	<9.3(-7)	<1.3(-6)	<2.2(-5)
^{132}Te	<2.0(-7)	<1.5(-6)	<3.1(-6)
^{139}Ba	<4.0(-7)	<1.1(-6)	1.2 ± 0.1(-5)
^{140}Ba	<5.2(-7)	<4.9(-7)	<9.3(-6)
^{140}La	<1.2(-7)	<8.6(-7)	<6.5(-7)
^{141}Ce	<1.5(-8)	<3.3(-7)	<3.1(-7)
^{143}Ce	<1.9(-7)	<9.6(-7)	<4.8(-7)
^{144}Ce	<5.4(-7)	<3.5(-8)	<6.5(-6)
^{152}Eu	<6.0(-7)	<6.1(-7)	<5.2(-7)
^{154}Eu	<3.6(-8)	<2.8(-8)	<2.1(-6)
^{187}W	<3.4(-7)	<4.4(-7)	<3.2(-6)
^{239}Np	<5.4(-7)	<6.1(-7)	<3.3(-7)

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* Radionuclide not detected.

TABLE B.37 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/17-18/77

Nuclide	Main Steam 3A 11/17/77; 16:50 (μCi/ml)	Main Steam 3B 11/17/77; 13:21 (μCi/ml)	Main Steam 3C 11/17/77; 11:42 (μCi/ml)	Unit 3 Main Feed 11/17/77; 16:50 (μCi/ml)	Unit 3 Main Condensate 11/17/77; 17:25 (μCi/ml)
^{82}Br	<4.8(-9)	<4.4(-7)	<4.6(-7)	<4.5(-7)	<3.0(-7)
^{131}I	<3.0(-8)	<3.5(-7)	3.6 ± 1.2(-7)	<3.2(-7)	<4.9(-8)
^{132}I	<1.8(-8)	<2.0(-7)	1.3 ± 0.2(-6)	<3.4(-7)	<3.1(-7)
^{133}I	1.4 ± 0.6(-7)	<8.1(-7)	1.9 ± 0.2(-6)	3.7 ± 1.6(-7)	2.9 ± 0.8(-7)
^{134}I	<2.2(-7)	<1.5(-7)	9.1 ± 2.3(-7)	<8.6(-7)	<2.5(-7)
^{135}I	<1.9(-7)	<6.7(-8)	2.6 ± 0.6(-6)	<4.5(-7)	3.2 ± 2.1(-7)
^{88}Rb	<6.5(-7)	*	<1.1(-6)	<1.1(-6)	*
^{89}Rb	<1.4(-7)	<1.2(-6)	<9.7(-7)	<6.4(-7)	<6.1(-7)
^{134}Cs	<1.1(-7)	<9.6(-8)	<6.5(-8)	<2.8(-7)	<1.6(-7)
^{136}Cs	<2.0(-7)	<6.3(-9)	<2.7(-7)	<6.5(-8)	<4.8(-8)
^{137}Cs	<7.0(-8)	6.6 ± 3.5(-8)	<7.1(-8)	<7.8(-8)	<7.3(-8)
^{138}Cs	<4.0(-8)	4.1 ± 3.2(-7)	<4.3(-7)	<2.7(-7)	<5.7(-7)
^{24}Na	<1.2(-7)	<3.2(-7)	<1.5(-7)	*	<5.5(-8)
^{41}Ar	<1.7(-7)	<2.6(-7)	<7.6(-7)	<1.6(-7)	<9.7(-8)
^{51}Cr	<2.5(-7)	<1.1(-7)	<9.9(-8)	<4.5(-7)	<1.0(-7)
^{54}Mn	<4.4(-8)	<5.5(-7)	<3.0(-7)	<6.4(-7)	<4.7(-8)
^{56}Mn	<7.4(-8)	<1.9(-7)	<2.9(-7)	<8.8(-8)	<1.4(-7)
^{59}Fe	<2.0(-7)	<3.0(-7)	<2.8(-8)	<6.9(-7)	<3.0(-8)
^{57}Co	<2.3(-8)	<5.0(-8)	<1.2(-7)	<1.1(-8)	<5.9(-8)
^{58}Co	<1.4(-7)	<4.0(-7)	6.1 ± 3.5(-8)	3.7 ± 2.7(-8)	<4.3(-8)
^{60}Co	<1.9(-7)	<2.5(-7)	<1.9(-7)	<3.3(-7)	<1.8(-7)
^{65}Zn	<3.2(-9)	<2.2(-7)	<1.5(-8)	<3.4(-7)	<1.5(-7)
^{91}Sr	<4.1(-8)	<1.3(-7)	<1.2(-7)	<2.8(-7)	<5.3(-8)
^{93}Y	<1.4(-7)	<2.3(-7)	<8.5(-8)	<1.4(-7)	<4.8(-9)
^{95}Zr	<8.6(-9)	<1.3(-8)	<1.2(-7)	<7.9(-7)	<6.8(-8)
^{95}Nb	<4.2(-8)	<1.1(-7)	<2.2(-7)	<2.8(-7)	<8.0(-8)
^{99}Mo	<5.3(-8)	<6.4(-7)	<3.0(-8)	<1.6(-8)	<1.4(-7)

TABLE B.37 (cont'd)
RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/17-18/77

Nuclide	Main Steam 3A 11/17/77; 16:50 (μCi/ml)	Main Steam 3B 11/17/77; 13:21 (μCi/ml)	Main Steam 3C 11/17/77; 11:42 (μCi/ml)	Unit 3 Main Feed 11/17/77; 16:50 (μCi/ml)	Unit 3 Main Condensate 11/17/77; 17:25 (μCi/ml)
^{103}Ru	<2.0(-7)	<1.4(-7)	2.2 ± 0.8(-7)	<6.1(-8)	<2.4(-8)
^{106}RuD	<1.5(-8)	<2.1(-7)	<1.5(-7)	<9.2(-8)	<9.1(-8)
^{110m}Ag	<2.1(-7)	<4.0(-7)	<1.1(-9)	<1.7(-7)	<2.2(-7)
^{124}Sb	<6.0(-8)	*	<2.4(-8)	<8.3(-8)	<5.0(-8)
^{125}Sb	<1.0(-7)	<5.0(-7)	<3.4(-8)	<4.0(-7)	<1.6(-8)
^{129}Te	1.1 ± 0.8(-6)	<2.9(-7)	<5.9(-7)	<1.8(-7)	<2.7(-7)
^{129m}Te	3.7 ± 1.5(-6)	<1.6(-7)	<1.7(-7)	<4.7(-7)	<2.8(-7)
^{131m}Te	<9.1(-8)	<7.0(-8)	<6.7(-8)	<1.1(-7)	<2.1(-7)
^{132}Te	<3.4(-8)	<2.0(-7)	<3.4(-8)	<3.9(-8)	<4.1(-8)
^{139}Ba	<8.1(-8)	<6.3(-8)	5.8 ± 2.1(-7)	<3.9(-8)	<2.2(-9)
^{140}Ba	<8.3(-8)	<3.4(-8)	<6.6(-8)	<2.1(-7)	<4.4(-8)
^{140}La	<1.3(-7)	<1.4(-7)	<1.0(-7)	<5.3(-7)	<5.9(-8)
^{141}Ce	<5.2(-8)	<2.7(-7)	<1.0(-7)	<1.2(-7)	<2.2(-8)
^{143}Ce	<4.6(-8)	<5.0(-7)	<1.0(-7)	<3.0(-8)	<1.1(-7)
^{144}Ce	<2.0(-7)	4.3 ± 1.4(-6)	<5.4(-8)	<5.1(-7)	<1.7(-7)
^{152}Eu	<1.5(-8)	<2.0(-7)	<4.0(-8)	<4.3(-7)	<1.2(-7)
^{154}Eu	<3.7(-8)	*	<3.1(-7)	<1.8(-7)	<2.4(-7)
^{187}W	<3.6(-7)	<2.9(-7)	<6.7(-8)	<1.3(-8)	<1.5(-7)
^{239}Np	<8.4(-8)	<6.4(-8)	<2.2(-8)	<1.3(-7)	<6.6(-9)

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* Radionuclide not detected.

TABLE B.37 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/17-18/77

Nuclide	Steam Generator Blowdown 3A 11/18/77; 16:40 (μCi/ml)	Steam Generator Blowdown 3B 11/18/77; 16:40 (μCi/ml)	Steam Generator Blowdown 3C 11/18/77; 17:25 (μCi/ml)	Main Steam 3C Part. 11/18/77; 15:42 to 16:07 (μCi/ml)	Main Steam 3C Cation 11/18/77; 15:42 to 16:07 (μCi/ml)	Main Steam 3C Anion 11/18/77; 15:42 to 16:07 (μCi/ml)
^{82}Br	<2.9(-6)	<5.1(-6)	<5.4(-5)	<6.4(-10)	<1.2(-9)	<2.5(-8)
^{131}I	8.1 ± 0.3(-6)	1.3 ± 0.1(-5)	5.5 ± 0.2(-5)	1.2 ± 0.1(-9)	2.0 ± 0.3(-9)	1.3 ± 0.01(-7)
^{132}I	1.0 ± 0.1(-5)	1.3 ± 0.1(-5)	1.9 ± 0.1(-4)	3.1 ± 0.5(-9)	8.3 ± 1.0(-9)	4.7 ± 0.1(-7)
^{133}I	3.6 ± 0.1(-5)	5.2 ± 0.1(-5)	3.1 ± 0.1(-4)	6.4 ± 0.3(-9)	1.0 ± 0.1(-8)	8.7 ± 0.1(-7)
^{134}I	5.3 ± 0.5(-6)	6.1 ± 0.9(-6)	1.5 ± 0.1(-4)	<2.0(-9)	<4.1(-9)	4.8 ± 1.0(-7)
^{135}I	3.3 ± 0.2(-5)	4.4 ± 0.3(-5)	3.9 ± 0.1(-4)	8.2 ± 1.4(-9)	2.2 ± 0.2(-8)	1.1 ± 0.3(-8)
^{88}Rb	<1.2(-6)	<1.9(-7)	1.3 ± 0.3(-5)	2.9 ± 0.6(-6)	*	*
^{89}Rb	<1.0(-6)	<2.4(-6)	9.5 ± 1.7(-6)	*	*	*
^{134}Cs	7.6 ± 0.8(-7)	1.1 ± 0.1(-6)	4.2 ± 0.3(-6)	2.1 ± 0.2(-9)	1.16 ± 0.06(-8)	<7.3(-10)
^{136}Cs	<4.0(-8)	<7.4(-9)	<5.7(-7)	<2.6(-10)	9.3 ± 1.9(-10)	<2.9(-12)
^{137}Cs	1.2 ± 0.1(-6)	1.7 ± 0.1(-6)	7.1 ± 0.2(-6)	4.1 ± 0.2(-9)	1.83 ± 0.06(-8)	<7.0(-10)
^{138}Cs	4.0 ± 0.5(-6)	4.6 ± 0.8(-6)	8.8 ± 0.3(-5)	<1.1(-6)	1.2 ± 0.2(-7)	
^{24}Na	6.7 ± 1.8(-7)	2.1 ± 0.5(-6)	1.3 ± 0.1(-5)	2.7 ± 0.4(-9)	4.2 ± 0.2(-8)	<2.0(-10)
^{41}Ar	<6.7(-7)	<1.5(-6)	<4.8(-6)	<6.6(-10)	<3.4(-9)	<2.4(-7)
^{51}Cr	<3.1(-7)	<2.9(-7)	<9.6(-7)	<5.4(-12)	<1.7(-10)	<1.1(-9)
^{54}Mn	<2.1(-6)	<2.9(-6)	<2.2(-5)	<5.2(-10)	<2.6(-9)	<5.0(-9)
^{56}Mn	<1.6(-7)	<7.4(-7)	<3.7(-6)	<7.9(-10)	<3.3(-9)	<5.0(-11)
^{59}Fe	<1.0(-6)	<1.7(-6)	<6.7(-6)	<2.0(-10)	<7.9(-11)	<3.4(-9)
^{57}Co	<8.5(-8)	<1.6(-6)	<1.4(-6)	<3.0(-11)	<8.9(-11)	<4.7(-10)
^{58}Co	2.6 ± 0.8(-7)	<8.9(-7)	<1.3(-5)	1.6 ± 0.9(-10)	4.5 ± 1.7(-10)	<6.5(-9)
^{60}Co	<2.1(-7)	<2.4(-7)	<3.0(-7)	<7.0(-10)	5.0 ± 0.4(-9)	1.1(-9)
^{65}Zn	<2.7(-7)	<7.2(-7)	<1.9(-6)	<2.8(-10)	<1.6(-10)	<1.7(-9)
^{91}Sr	<1.3(-7)	<2.6(-7)	1.1 ± 0.3(-5)	<3.8(-10)	2.9 ± 0.8(-9)	<4.8(-9)
^{93}Y	<2.3(-7)	<1.5(-7)	<5.1(-7)	<1.4(-10)	<2.4(-10)	<1.8(-9)
^{95}Zr	<3.0(-7)	<5.2(-7)	3.4 ± 0.8(-6)	<3.0(-10)	<1.5(-10)	<6.1(-10)
^{95}Nb	<3.5(-7)	<3.7(-7)	<6.8(-6)	<4.0(-10)	<6.2(-10)	<3.5(-9)
^{99}Mo	<2.9(-7)	<1.9(-7)	<7.6(-7)	<1.4(-11)	<6.7(-10)	<4.0(-10)

TABLE B.37 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/17-18/77

Nuclide	Steam Generator Blowdown 3A 11/18/77; 16:04 (μCi/ml)	Steam Generator Blowdown 3B 11/18/77; 16:40 Ci/ml)	Steam Generator Blowdown 3C 11/18/77; 17:25 (μCi/ml)	Main Steam 3C Part. 11/18/77; 15:42 to 16:07 (μCi/ml)	Main Steam 3C Cation 11/18/77; 15:42 to 16:07 (μCi/ml)	Main Steam 3C Anion 11/18/77; 15:42 to 16:07 (μCi/ml)
^{103}Ru	<3.2(-7)	<3.9(-9)	<4.0(-7)	<1.3(-10)	<2.2(-10)	1.1 ± 0.4(-9)
^{106}RuD	6.4 ± 1.4(-6)	<1.2(-6)	1.8 ± 0.2(-4)	<2.2(-10)	<2.8(-10)	<3.3(-9)
^{110m}Ag	<9.6(-7)	<1.5(-6)	<8.2(-6)	<1.5(-9)	<7.2(-9)	<3.6(-9)
^{124}Sb	<3.0(-8)	<8.1(-8)	<9.7(-7)	<1.5(-10)	<1.4(-10)	<6.1(-11)
^{125}Sb	<1.5(-7)	<1.1(-6)	<2.8(-6)	<2.2(-10)	<2.7(-10)	<1.9(-9)
^{129}Te	<1.1(-6)	<1.5(-6)	<1.2(-5)	<8.1(-9)	<1.4(-8)	<1.7(-8)
^{129m}Te	<4.6(-6)	<1.2(-6)	<2.8(-7)	<3.8(-10)	<2.6(-10)	<4.1(-10)
^{131m}Te	<1.3(-6)	<1.6(-6)	<2.0(-5)	<4.2(-10)	<1.3(-9)	<1.3(-8)
^{132}Te	<7.4(-8)	<1.3(-6)	3.8 ± 0.8(-6)	<3.9(-11)	<4.4(-11)	<1.6(-10)
^{139}Ba	<4.0(-8)	<5.2(-7)	1.2 ± 0.1(-5)	1.8 ± 0.2(-9)	4.2 ± 0.4(-9)	<2.6(-10)
^{140}Ba	<9.1(-7)	<1.8(-7)	<1.0(-5)	<3.7(-10)	2.5 ± 0.5(-9)	<1.1(-9)
^{140}La	<1.4(-7)	<9.5(-6)	<2.1(-6)	<1.2(-10)	<5.5(-11)	<8.5(-10)
^{141}Ce	<1.7(-7)	<2.5(-7)	<8.0(-7)	<1.3(-10)	<4.0(-11)	<6.0(-11)
^{143}Ce	<4.1(-7)	<1.2(-7)	<1.3(-6)	<7.9(-11)	<1.5(-10)	<1.9(-9)
^{144}Ce	<4.8(-7)	<6.3(-7)	<5.3(-6)	<2.7(-10)	<9.4(-11)	<8.2(-10)
^{152}Eu	<6.5(-7)	<3.2(-7)	<8.1(-7)	<4.0(-11)	<2.4(-10)	<1.4(-9)
^{154}Eu	<6.9(-8)	<5.5(-7)	<1.0(-6)	<1.7(-10)	<2.2(-11)	<1.3(-9)
^{187}W	<3.6(-7)	<7.9(-8)	<2.5(-7)	<2.7(-10)	<3.6(-10)	<8.4(-10)
^{239}Np	<4.7(-8)	<8.5(-7)	<1.3(-6)	<8.7(-12)	<1.8(-10)	1.6 ± 0.8(-9)

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* Radionuclide not detected.

TABLE B.38

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/21/77

Nuclide	Steam Generator Blowdown 3A 11/21/77; 12:10 (μCi/ml)	Steam Generator Blowdown 3C 11/21/77; 15:43 (μCi/ml)	Main Steam 3A Part. 11/21/77; 11:05 to 11:43 (μCi/ml)	Main Steam 3A Cation 11/21/77; 11:05 to 11:43 (μCi/ml)
^{82}Br	<1.0(-6)	<1.5(-6)	<2.9(-10)	<2.3(-10)
^{131}I	3.3 ± 0.2(-6)	6.8 ± 0.1(-5)	<2.1(-10)	<1.8(-10)
^{132}I	3.0 ± 0.2(-6)	*	<7.5(-10)	<7.3(-9)
^{133}I	1.0 ± 0.1(-5)	1.3 ± 0.2(-4)	<6.6(-10)	<1.6(-10)
^{134}I	1.8 ± 0.2(-6)	*	<1.3(-8)	<7.5(-8)
^{135}I	8.8 ± 0.8(-6)	*	<6.1(-11)	<2.8(-9)
^{88}Rb	1.6 ± 0.6(-6)	*	*	*
^{89}Rb	<1.7(-8)	*	*	*
^{134}Cs	3.0 ± 1.0(-7)	6.4 ± 0.3(-6)	6.3 ± 1.8(-10)	2.5 ± 0.5(-9)
^{136}Cs	<1.3(-7)	6.5 ± 0.8(-7)	<2.1(-10)	<3.2(-10)
^{137}Cs	3.7 ± 1.2(-7)	1.13 ± 0.03(-5)	9.9 ± 3.2(-10)	3.6 ± 0.6(-9)
^{138}Cs	2.6 ± 0.3(-6)	*	<3.9(-8)	*
^{24}Na	4.3 ± 1.1(-7)	*	<4.2(-10)	1.3 ± 0.5(-9)
^{41}Ar	<2.5(-7)	*	<1.7(-9)	<7.8(-9)
^{51}Cr	<1.9(-7)	<2.4(-8)	1.1 ± 0.8(-9)	<3.1(-10)
^{54}Mn	<8.5(-7)	<7.6(-8)	6.9 ± 1.9(-10)	5.6 ± 2.1(-10)
^{56}Mn	<8.6(-8)	*	<4.7(-10)	<2.5(-9)
^{59}Fe	<4.4(-7)	<5.4(-8)	<4.8(-12)	<8.8(-10)
^{57}Co	<5.0(-8)	<2.2(-8)	<3.7(-10)	<1.5(-10)
^{58}Co	<3.4(-7)	1.1 ± 0.3(-7)	1.2 ± 0.2(-9)	<6.0(-10)
^{60}Co	<3.2(-7)	4.1 ± 1.5(-7)	6.3 ± 0.9(-9)	<2.0(-9)
^{65}Zn	<5.6(-8)	<2.5(-8)	<6.8(-11)	<7.4(-10)
^{91}Sr	<3.9(-7)	*	<8.9(-11)	<3.3(-10)
^{93}Y	3.9 ± 1.1(-6)	*	<7.6(-10)	<1.0(-9)
^{95}Zr	<1.8(-7)	<8.2(-8)	<1.0(-10)	<2.9(-10)
^{95}Nb	<4.5(-8)	<9.7(-8)	<9.8(-11)	<3.6(-10)
^{99}Mo	<1.3(-7)	<1.1(-7)	<6.2(-11)	<1.8(-10)

TABLE B.38 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/21/77

Nuclide	Steam Generator Blowdown 3A 11/21/77; 12:10 (μCi/ml)	Steam Generator Blowdown 3C 11/21/77; 15:43 (μCi/ml)	Main Steam 3A Part. 11/21/77; 11:05 to 11:43 (μCi/ml)	Main Steam 3A Cation 11/21/77; 11:05 to 11:43 (μCi/ml)
^{103}Ru	<3.1(-7)	<8.5(-8)	<1.6(-10)	<6.4(-10)
^{106}RuD	<4.7(-7)	<6.9(-8)	<1.0(-10)	<2.3(-11)
^{110m}Ag	<3.8(-7)	<2.6(-6)	<7.1(-10)	<3.2(-9)
^{124}Sb	<1.9(-7)	<1.8(-8)	<8.9(-11)	<3.8(-10)
^{125}Sb	<2.3(-7)	<2.1(-7)	<1.2(-10)	<5.5(-10)
^{129}Te	<9.3(-7)	*	<9.1(-9)	<4.2(-8)
^{129m}Te	1.6 ± 1.5(-7)	<2.9(-8)	<2.0(-10)	<2.7(-10)
^{131m}Te	<3.9(-7)	<2.7(-6)	<1.4(-10)	<1.9(-10)
^{132}Te	<2.6(-7)	<1.6(-7)	<1.0(-10)	<1.7(-10)
^{139}Ba	<1.3(-7)	*	<4.7(-11)	2.0 ± 1.1(-9)
^{140}Ba	4.8 ± 2.0(-7)	1.2 ± 0.2(-6)	<2.9(-12)	<3.4(-10)
^{140}La	<1.9(-10)	1.3 ± 0.1(-5)	<1.6(-10)	<7.0(-10)
^{141}Ce	<2.5(-7)	<3.2(-9)	<3.1(-11)	<5.5(-11)
^{143}Ce	<3.2(-8)	<2.1(-6)	<1.0(-10)	<9.7(-12)
^{144}Ce	<2.7(-9)	<6.8(-8)	<3.8(-10)	<1.9(-10)
^{152}Eu	<3.6(-7)	<2.5(-8)	<8.7(-11)	<1.0(-10)
^{154}Eu	<1.7(-7)	<1.7(-9)	<1.0(-10)	<9.2(-10)
^{187}W	<9.1(-8)	<1.1(-5)	<3.3(-10)	<2.9(-10)
^{239}Np	<5.3(-8)	<1.4(-7)	<8.5(-11)	<2.7(-10)

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* Radionuclide not detected.

TABLE B.38 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/21/77

Nuclide	Main Steam 3A Anion 11/21/77; 11:05 to 11:43 (μCi/ml)	Main Steam 3C Cation 11/21/77; 15:20 to 15:50 (μCi/ml)	Main Steam 3C Anion 11/21/77; 15:20 to 15:50 (μCi/ml)
^{82}Br	<1.2(-10)	<3.8(-10)	<9.7(-10)
^{131}I	9.5 ± 0.7(-9)	1.1 ± 0.3(-9)	8.1 ± 0.2(-8)
^{132}I	<5.7(-9)	<2.1(-7)	<1.4(-7)
^{133}I	1.9 ± 0.1(-8)	2.6 ± 0.6(-9)	4.2 ± 0.1(-7)
^{134}I	<3.5(-7)	*	*
^{135}I	2.1 ± 0.3(-8)	<3.3(-9)	4.8 ± 0.5(-7)
^{88}Rb	*	*	*
^{89}Rb	*	*	*
^{134}Cs	<1.1(-9)	6.4 ± 0.6(-9)	1.7 ± 0.6(-9)
^{136}Cs	<5.7(-10)	2.2 ± 0.7(-9)	9.9 ± 3.9(-10)
^{137}Cs	<6.0(-10)	1.7 ± 0.1(-8)	<7.0(-10)
^{138}Cs			
^{24}Na	<1.3(-10)	2.0 ± 0.3(-8)	<8.8(-10)
^{41}Ar	<4.1(-8)	*	*
^{51}Cr	<5.8(-10)	<3.4(-10)	7.1 ± 2.5(-9)
^{54}Mn	<6.7(-10)	1.6 ± 0.5(-9)	<3.6(-9)
^{56}Mn	<2.5(-9)	<8.1(-8)	3.9 ± 1.9(-7)
^{59}Fe	<3.2(-10)	<8.1(-10)	<2.4(-10)
^{57}Co	<5.1(-11)	<5.7(-10)	<3.0(-10)
^{58}Co	<1.4(-9)	1.4 ± 0.4(-9)	<1.1(-9)
^{60}Co	8.1 ± 1.0(-9)	8.1 ± 0.8(-9)	5.9 ± 0.7(-9)
^{65}Zn	<6.3(-10)	<5.1(-10)	<1.8(-10)
^{91}Sr	<1.3(-9)	<7.0(-10)	<1.1(-9)
^{93}Y	<5.8(-10)	<1.5(-9)	<4.5(-10)
^{95}Zr	<1.4(-9)	<8.9(-11)	<8.6(-11)
^{95}Nb	<1.5(-10)	<9.8(-11)	<6.4(-10)
^{99}Mo	<5.9(-10)	<4.2(-10)	<2.8(-10)

TABLE B.38 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/21/77

Nuclide	Main Steam 3A Anion 11/21/77; 11:05 to 11:43 (μCi/ml)	Main Steam 3C Cation 11/21/77; 15:20 to 15:50 (μCi/ml)	Main Steam 3C Anion 11/21/77; 15:20 to 15:50 (μCi/ml)
^{103}Ru	<1.3(-9)	<4.7(-10)	<4.5(-10)
^{106}RuD	<4.6(-10)	<1.1(-9)	<9.8(-10)
^{110m}Ag	<3.2(-10)	<2.1(-9)	<1.0(-9)
^{124}Sb	<6.9(-10)	<6.6(-10)	<6.6(-10)
^{125}Sb	<1.3(-10)	1.8 ± 0.8(-9)	<3.6(-10)
^{129}Te	<3.1(-8)	*	*
^{129m}Te	<4.6(-10)	<6.2(-10)	<5.0(-10)
^{131m}Te	<2.2(-10)	<2.4(-10)	<3.4(-9)
^{132}Te	<1.1(-9)	<8.6(-10)	<1.3(-10)
^{139}Ba	<2.3(-10)	<6.9(-11)	7.1 ± 2.6(-9)
^{140}Ba	<6.8(-10)	<7.9(-10)	<3.1(-10)
^{140}La	<8.7(-11)	<4.7(-10)	<5.6(-10)
^{141}Ce	<7.9(-11)	<4.1(-10)	<7.0(-10)
^{143}Ce	<4.9(-10)	<3.0(-10)	<7.6(-10)
^{144}Ce	<1.5(-10)	<6.3(-10)	<1.4(-9)
^{152}Eu	<6.0(-10)	<1.4(-10)	<1.9(-10)
^{154}Eu	<2.0(-10)	<4.4(-10)	<6.7(-10)
^{187}W	<2.2(-10)	<9.5(-11)	<2.8(-9)
^{239}Np	<2.0(-9)	<3.9(-10)	<1.2(-9)

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* Radionuclide not detected.

TABLE B.39

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #3, 11/22/77

Nuclide	Steam Generator Blowdown 3C 11/22/77; 13:15 (μCi/ml)	Blowdown Flash Tank Unit 3 11/22/77; (μCi/ml)
^{82}Br	<6.2(-5)	<3.4(-6)
^{131}I	6.6 ± 0.2(-5)	2.2 ± 0.1(-5)
^{132}I	2.1 ± 0.1(-4)	6.5 ± 0.3(-5)
^{133}I	3.7 ± 0.1(-4)	1.2 ± 0.1(-4)
^{134}I	1.5 ± 0.1(-4)	<1.4(-4)
^{135}I	4.3 ± 0.1(-4)	1.3 ± 0.1(-4)
^{88}Rb	2.2 ± 0.5(-5)	*
^{89}Rb	1.1 ± 0.3(-5)	*
^{134}Cs	7.8 ± 0.7(-6)	2.4 ± 0.2(-6)
^{136}Cs	<1.4(-6)	<3.4(-7)
^{137}Cs	1.05 ± 0.08(-5)	3.9 ± 0.2(-6)
^{138}Cs	8.9 ± 0.3(-5)	*
^{24}Na	1.5 ± 0.1(-5)	5.2 ± 0.3(-6)
^{41}Ar	<5.2(-6)	<2.5(-5)
^{51}Cr	1.6 ± 0.5(-5)	<9.5(-8)
^{54}Mn	<2.5(-5)	<3.4(-6)
^{56}Mn	<3.4(-6)	<1.6(-7)
^{59}Fe	<5.5(-6)	<9.6(-7)
^{57}Co	<8.3(-7)	<4.2(-8)
^{58}Co	<1.4(-5)	<5.1(-7)
^{60}Co	<2.3(-6)	<3.5(-7)
^{65}Zn	<3.8(-7)	<2.7(-7)
^{91}Sr	<5.0(-7)	2.2 ± 0.8(-6)
^{93}Y	<2.3(-7)	<4.7(-7)
^{95}Zr	<9.4(-7)	<2.7(-7)
^{95}Nb	<7.1(-6)	<6.4(-7)
^{99}Mo	<1.4(-6)	<5.3(-8)
^{103}Ru	<1.8(-6)	<1.9(-7)
^{106}RuD	1.6 ± 0.1(-4)	<4.0(-7)
^{110m}Ag	<8.6(-6)	<2.8(-6)
^{124}Sb	<5.2(-7)	<1.0(-7)
^{125}Sb	<3.6(-7)	<4.2(-7)
^{129}Te	<2.3(-5)	<1.8(-5)
^{129m}Te	<1.1(-6)	<8.7(-8)
^{131m}Te	<1.2(-5)	<1.1(-6)
^{132}Te	<2.5(-6)	<5.9(-7)
^{139}Ba	1.4 ± 0.2(-5)	<5.8(-7)
^{140}Ba	<9.0(-6)	<4.3(-7)
^{140}La	<9.3(-7)	<7.4(-9)
^{141}Ce	<1.9(-7)	<2.2(-7)
^{143}Ce	<2.5(-6)	<5.9(-7)
^{144}Ce	<3.9(-6)	<2.7(-7)
^{152}Eu	<6.4(-7)	<1.1(-7)
^{154}Eu	<8.4(-7)	<1.6(-7)
^{187}W	<1.6(-6)	<2.7(-7)
^{239}Np	<4.1(-7)	<6.5(-8)

* Radionuclide not detected.

TABLE B.40

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR SAMPLES UNIT #3, 11/9/77

	Steam Jet Air Ejector					Main Steam Air Ejectors
Nuclide	Particulate Filter 11/9/77; 16:54 to 17:09 (μCi/cc)	CDI$_2$ 11/9/77; 16:54 to 17:09 (μCi/cc)	IpH 11/9/77; 16:54 to 17:09 (μCi/cc)	AgX 11/9/77; 16:54 to 17:09 (μCi/cc)	Whole Gas 11/9/77; 17:09 (μCi/cc)	Whole Gas 11/9/77; 17:09 (μCi/cc)
^{82}Br	<1.1(-8)	<3.6(-9)	<2.3(-9)	<7.3(-9)	<1.1(-9)	<3.5(-7)
^{131}I	<1.6(-9)	<8.8(-9)	2.9 ± 0.4(-8)	8.4 ± 0.6(-8)	<1.8(-9)	<6.5(-7)
^{132}I	<2.4(-9)	<2.7(-8)	<1.0(-7)	<2.3(-8)	<1.7(-9)	<9.1(-7)
^{133}I	<8.8(-10)	<6.5(-9)	2.9 ± 0.6(-8)	6.6 ± 1.1(-8)	<3.8(-9)	<7.4(-7)
^{134}I	<1.4(-7)	<9.2(-7)	<6.7(-7)	<2.8(-7)	<3.5(-10)	<4.6(-7)
^{135}I	<5.1(-9)	<2.6(-8)	<3.3(-8)	<1.2(-8)	<1.3(-9)	<4.1(-7)
^{88}Rb	*	*	*	*	<9.8(-8)	<2.2(-4)
^{89}Rb	*	*	*	*	9.7 ± 2.3(-8)	<3.1(-5)
^{134}Cs	<5.7(-9)	<5.3(-9)	<7.8(-9)	<7.9(-9)	<1.3(-9)	1.0 ± 0.2(-6)
^{136}Cs	<3.2(-9)	<4.8(-9)	<3.9(-9)	<1.1(-8)	<1.2(-10)	<1.4(-7)
^{137}Cs	<4.6(-9)	<1.1(-8)	<3.2(-9)	<8.3(-9)	<1.1(-9)	2.1 ± 0.2(-6)
^{138}Cs	*	*	*	*	1.1 ± 0.3(-7)	1.0 ± 0.1(-4)
^{24}Na	*	<1.3(-8)	<1.7(-8)	<2.5(-8)	<4.4(-10)	<1.6(-7)
^{41}Ar	<4.7(-8)	<1.1(-8)	<3.8(-8)	<1.7(-7)	<2.6(-9)	<7.1(-7)
^{51}Cr	<6.3(-9)	<5.4(-9)	<3.2(-9)	<9.8(-10)	<3.1(-10)	<3.4(-7)
^{54}Mn	<1.4(-8)	<1.5(-8)	<4.5(-11)	<4.2(-10)	4.2 ± 0.5(-9)	2.8 ± 0.3(-6)
^{56}Mn	<2.1(-9)	<9.5(-9)	<9.9(-9)	<7.1(-8)	<2.0(-9)	<1.1(-6)
^{59}Fe	<5.8(-9)	<1.4(-8)	<5.0(-9)	<6.0(-9)	<1.2(-9)	6.7 ± 2.5(-7)
^{57}Co	<7.1(-9)	<1.4(-9)	<3.3(-9)	<3.6(-9)	<2.8(-10)	<2.2(-7)
^{58}Co	<1.2(-9)	<2.6(-8)	<1.6(-10)	<2.4(-10)	<6.4(-11)	8.6 ± 2.2(-7)
^{60}Co	<2.0(-9)	<2.4(-8)	<2.4(-8)	<3.2(-8)	<8.1(-10)	3.6 ± 0.6(-6)
^{65}Zn	<7.1(-9)	<1.4(-8)	<5.0(-9)	<1.7(-9)	<2.8(-10)	<8.4(-8)
^{91}Sr	<7.7(-9)	<1.2(-9)	<1.1(-8)	<2.3(-8)	<1.4(-9)	<5.3(-7)
^{93}Y	<5.2(-9)	<4.9(-9)	<4.1(-9)	<2.7(-9)	<1.0(-10)	<6.5(-8)
^{95}Zr	<2.6(-10)	<1.9(-9)	<1.2(-8)	<1.9(-8)	<8.5(-10)	8.6 ± 2.3(-7)
^{95}Nb	<1.8(-9)	<6.8(-9)	<4.8(-9)	<6.8(-9)	<6.3(-12)	<3.0(-7)
^{99}Mo	<3.8(-9)	<2.9(-9)	<1.1(-9)	<2.9(-9)	<1.3(-10)	<9.2(-7)

TABLE B.40 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR SAMPLES
UNIT #3, 11/9/77

Nuclide	Particulate Filter 11/9/77; 16:54 to 17:09 (μCi/cc)	CDI$_2$ 11/9/77; 16:54 to 17:09 (μCi/cc)	IpH 11/9/77; 16:54 to 17:09 (μCi/cc)	AgX 11/9/77; 16:54 to 17:09 (μCi/cc)	Whole Gas 11/9/77; 17:09 (μCi/cc)	Main Steam Air Ejectors Whole Gas 11/9/77; 17:09 (μCi/cc)
^{103}Ru	4.9 ± 2.0(-9)	<1.1(-8)	<4.5(-9)	<1.6(-9)	<1.6(-10)	<2.6(-7)
^{106}RuD	<8.0(-10)	<1.4(-9)	<1.3(-8)	<6.8(-9)	<3.0(-10)	<2.4(-7)
^{110m}Ag	<1.9(-9)	<3.8(-9)	<1.8(-8)	5.0 ± 3.4(-9)	<2.0(-10)	<7.9(-7)
^{124}Sb	<2.5(-11)	<2.9(-9)	<4.3(-9)	<1.1(-9)	<1.0(-9)	<5.5(-7)
^{125}Sb	<3.2(-9)	<7.2(-9)	<6.9(-9)	<2.5(-9)	<2.8(-10)	4.9 ± 2.6(-7)
^{129}Te	<4.5(-8)	<1.3(-7)	<2.0(-7)	<5.0(-7)	<2.2(-8)	<9.8(-6)
^{129m}Te	<2.9(-9)	<1.1(-8)	<8.4(-9)	<1.2(-7)	<2.3(-10)	<2.2(-7)
^{131m}Te	<1.0(-8)	<9.6(-9)	<8.1(-9)	<6.1(-9)	<5.0(-10)	<3.4(-8)
^{132}Te	<2.4(-9)	<3.1(-10)	<3.2(-9)	<2.5(-9)	<4.5(-9)	<5.8(-7)
^{139}Ba	5.2 ± 0.9(-8)	<3.2(-9)	<5.0(-9)	<1.6(-11)	1.2 ± 0.1(-8)	4.1 ± 0.8(-6)
^{140}Ba	<5.3(-9)	<1.7(-9)	<6.6(-9)	<5.3(-9)	<7.3(-10)	<1.2(-10)
^{140}La	<2.4(-9)	<5.3(-9)	<3.3(-9)	<6.7(-9)	<5.8(-10)	<5.9(-8)
^{141}Ce	<1.0(-9)	<1.3(-9)	<4.2(-9)	<1.9(-9)	<2.0(-10)	<4.3(-7)
^{143}Ce	<6.4(-9)	<1.0(-8)	<8.8(-9)	<1.2(-8)	<8.0(-11)	<1.4(-7)
^{144}Ce	<1.7(-9)	<2.1(-9)	<4.7(-9)	<1.7(-9)	<7.9(-10)	<5.5(-8)
^{152}Eu	<3.8(-9)	<1.1(-8)	<8.2(-9)	<8.5(-9)	<9.8(-11)	<8.5(-8)
^{154}Eu	<2.4(-9)	<1.9(-8)	<2.0(-10)	<6.0(-9)	<7.5(-10)	<5.0(-8)
^{187}W	<1.9(-9)	<4.9(-9)	<4.5(-9)	<9.2(-10)	<3.3(-10)	<7.0(-8)
^{239}Np	<3.3(-10)	<6.4(-9)	<2.7(-10)	<1.3(-10)	<2.2(-10)	<1.7(-7)

* Radionuclide not detected.

TABLE B.41

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR SAMPLES
UNIT #3, 11/14/77

	Air Ejector Species					
Nuclide	Particulate Filter 11/14/77; (μCi/cc)	CDI$_2$ 11/14/77; (μCi/cc)	IpH 11/14/77; (μCi/cc)	AgX 11/14/77; (μCi/cc)	Charcoal 11/14/77; (μCi/cc)	Whole Gas 11/14/77; 12:02 (μCi/cc)
^{82}Br	<1.3(-10)	<4.5(-12)	<2.4(-11)	<4.6(-10)	<8.7(-11)	<3.2(-7)
^{131}I	<2.5(-11)	2.0 ± 0.6(-10)	3.9 ± 0.6(-10)	3.0 ± 0.2(-9)	5.8 ± 1.1(-9)	<2.9(-6)
^{132}I	<3.9(-11)	<3.5(-10)	<3.5(-10)	2.0 ± 0.6(-9)	<2.1(-10)	<6.0(-7)
^{133}I	<3.8(-10)	<3.4(-10)	5.0 ± 0.7(-11)	3.4 ± 0.3(-9)	<7.4(-10)	<2.0(-5)
^{134}I	<1.7(-9)	<6.7(-9)	<2.4(-9)	<6.7(-9)	<3.8(-9)	<7.2(-7)
^{135}I	<6.0(-11)	<2.0(-10)	<1.1(-10)	2.3 ± 0.8(-9)	<2.5(-10)	<6.4(-7)
^{88}Rb	2.5 ± 0.4(-7)	*	*	*	<4.5(-7)	<6.9(-6)
^{89}Rb	1.0 ± 0.2(-7)	*	*	*	<6.4(-7)	3.3 ± 0.6(-5)
^{134}Cs	1.9 ± 0.1(-8)	<9.9(-9)	<8.1(-11)	<3.7(-10)	<3.5(-10)	<1.4(-6)
^{136}Cs	<1.5(-10)	<1.3(-11)	<1.8(-12)	<1.9(-10)	<4.4(-10)	<1.0(-6)
^{137}Cs	4.8 ± 0.1(-8)	<2.5(-8)	<1.5(-10)	<5.5(-10)	<1.5(-10)	<5.5(-8)
^{138}Cs	1.6 ± 0.1(-7)	<7.8(-8)	<3.3(-8)	<3.2(-8)	<9.0(-8)	5.1 ± 0.8(-5)
^{24}Na	<1.4(-10)	<2.2(-10)	*	<9.6(-11)	<6.4(-12)	<3.9(-7)
^{41}Ar	<3.7(-10)	<8.4(-11)	<9.6(-10)	<9.0(-10)	<4.3(-10)	3.2 ± 0.7(-6)
^{51}Cr	<4.9(-11)	<1.4(-11)	<4.2(-12)	<8.0(-11)	<6.2(-11)	<5.4(-7)
^{54}Mn	<1.8(-10)	<2.4(-10)	<4.6(-11)	<7.2(-11)	<3.9(-10)	8.6 ± 0.8(-6)
^{56}Mn	<1.8(-12)	<2.5(-10)	<1.2(-10)	<3.8(-10)	<7.8(-10)	<2.5(-6)
^{59}Fe	<2.8(-10)	<1.1(-10)	<5.7(-11)	<2.8(-10)	<2.8(-10)	<5.2(-6)
^{57}Co	<2.0(-11)	<8.0(-11)	<9.2(-11)	<5.3(-11)	<4.7(-11)	<1.8(-7)
^{58}Co	<8.2(-11)	<7.9(-11)	<6.4(-11)	<4.1(-10)	<1.5(-10)	<3.7(-7)
^{60}Co	<3.2(-10)	<2.6(-10)	<2.7(-10)	<3.8(-10)	<3.1(-10)	<1.0(-6)
^{65}Zn	<4.5(-10)	<4.6(-11)	<1.5(-10)	<5.4(-10)	<7.0(-10)	<3.7(-7)
^{91}Sr	<1.8(-11)	<9.5(-11)	<1.2(-10)	<1.4(-9)	<6.2(-11)	<9.0(-7)
^{93}Y	<3.9(-11)	<2.2(-10)	<8.5(-11)	<5.8(-10)	<3.1(-10)	<2.2(-6)
^{95}Zr	<7.4(-11)	<3.3(-11)	<6.2(-11)	<2.3(-11)	<9.6(-12)	<1.8(-6)
^{95}Nb	<7.4(-11)	<1.0(-10)	<7.2(-11)	<2.0(-10)	<3.3(-10)	<2.8(-7)
^{99}Mo	<4.4(-10)	<9.3(-11)	<1.6(-12)	<3.9(-11)	<4.6(-10)	<2.0(-6)

TABLE B.41 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR SAMPLES
UNIT #3, 11/14/77

	Air Ejector Species					
Nuclide	Particulate Filter 11/14/77; (µCi/cc)	CDI$_2$ 11/14/77; (µCi/cc)	IpH 11/14/77; (µCi/cc)	AgX 11/14/77; (µCi/cc)	Charcoal 11/14/77; (µCi/cc)	Whole Gas 11/14/77; 12:02 (µCi/cc)
^{103}Ru	<4.9(-10)	<6.2(-11)	<3.2(-11)	<4.8(-10)	<5.6(-11)	<1.2(-7)
^{106}RuD	<8.4(-12)	<4.5(-11)	<1.8(-11)	<2.0(-10)	<1.6(-10)	<1.4(-6)
^{110m}Ag	<9.6(-9)	<5.1(-9)	<1.6(-10)	<3.3(-10)	<4.6(-10)	<1.7(-6)
^{124}Sb	<5.8(-10)	<5.4(-11)	<6.6(-11)	<6.1(-11)	<1.6(-10)	<1.7(-7)
^{125}Sb	<5.6(-11)	<3.9(-11)	<1.2(-10)	<2.5(-10)	<4.4(-11)	<2.2(-7)
^{129}Te	<9.4(-11)	<4.9(-9)	<4.8(-10)	<2.2(-9)	<1.6(-8)	<2.3(-5)
^{129m}Te	<4.7(-11)	<2.6(-10)	<1.4(-10)	<7.9(-9)	<2.3(-10)	<3.8(-7)
^{131m}Te	<3.3(-10)	<2.9(-10)	<9.6(-11)	<2.1(-10)	<8.3(-11)	<1.3(-6)
^{132}Te	<6.0(-10)	<7.5(-11)	<7.6(-11)	<4.8(-10)	<6.0(-10)	<1.4(-6)
^{139}Ba	<7.8(-9)	<1.0(-10)	<2.1(-11)	<1.9(-10)	<7.9(-9)	<1.4(-6)
^{140}Ba	<1.8(-10)	<3.3(-10)	<1.8(-11)	<5.1(-11)	<3.6(-12)	<7.2(-7)
^{140}La	<2.6(-10)	<8.7(-12)	<6.7(-11)	<1.9(-10)	<9.7(-11)	<1.0(-6)
^{141}Ce	<3.9(-11)	<1.7(-11)	<1.6(-11)	<2.0(-10)	<3.0(-10)	<2.6(-6)
^{143}Ce	<3.9(-12)	<1.1(-10)	<4.3(-11)	<3.8(-10)	<3.1(-10)	<5.5(-7)
^{144}Ce	<2.2(-11)	<7.9(-11)	<6.3(-11)	<2.3(-10)	<1.2(-11)	<2.2(-7)
^{152}Eu	<2.7(-11)	<2.0(-11)	<1.2(-11)	<1.2(-10)	<1.0(-10)	<1.0(-6)
^{154}Eu	<6.3(-10)	<6.9(-11)	<8.6(-12)	<6.6(-11)	<1.6(-10)	<6.1(-7)
^{187}W	<1.9(-10)	<5.9(-11)	<3.2(-11)	<7.0(-10)	<2.2(-10)	<1.5(-7)
^{239}Np	<1.3(-10)	<3.5(-11)	<1.9(-11)	<1.2(-10)	<3.4(-10)	<8.6(-8)

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* Radionuclide not detected.

TABLE B.41 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR SAMPLES
UNIT #3, 11/14/77

Nuclide	Main Steam Air Ejectors Whole Gas and Water 11/14/77; 12:04 (μCi/cc)
^{82}Br	<3.0(-7)
^{131}I	<4.0(-7)
^{132}I	2.0 ± 0.7(-6)
^{133}I	<1.6(-5)
^{134}I	<1.9(-6)
^{135}I	<2.9(-7)
^{88}Rb	2.2 ± 0.8(-4)
^{89}Rb	1.2 ± 0.2(-4)
^{134}Cs	<7.3(-7)
^{136}Cs	<7.6(-7)
^{137}Cs	<8.0(-7)
^{138}Cs	1.3 ± 0.2(-4)
^{24}Na	<7.1(-7)
^{41}Ar	<1.5(-6)
^{51}Cr	<6.1(-7)
^{54}Mn	7.6 ± 0.8(-6)
^{56}Mn	<2.4(-6)
^{59}Fe	<1.7(-7)
^{57}Co	<1.4(-7)
^{58}Co	<2.7(-6)
^{60}Co	1.3 ± 0.6(-6)
^{65}Zn	<6.6(-7)
^{91}Sr	<6.2(-7)
^{93}Y	<7.3(-7)
^{95}Zr	<3.4(-7)
^{95}Nb	<7.7(-7)
^{99}Mo	<2.3(-6)

TABLE B.41 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR SAMPLES
UNIT #3, 11/14/77

	Main Steam Air Ejectors
Nuclide	Whole Gas and Water 11/14/77; 12:04 (μCi/cc)
^{103}Ru	<1.1(-7)
^{106}RuD	<1.3(-7)
^{110m}Ag	<1.5(-6)
^{124}Sb	<1.2(-6)
^{125}Sb	<1.0(-7)
^{129}Te	<2.2(-5)
^{129m}Te	<6.8(-7)
^{131m}Te	<1.5(-6)
^{132}Te	<5.6(-6)
^{139}Ba	1.5 ± 0.1(-5)
^{140}Ba	<1.6(-6)
^{140}La	<9.6(-7)
^{141}Ce	<2.4(-7)
^{143}Ce	<3.0(-7)
^{144}Ce	<1.4(-8)
^{152}Eu	<4.3(-7)
^{154}Eu	<3.0(-7)
^{187}W	<2.0(-7)
^{239}Np	<5.3(-7)

TABLE B.42

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/18/78

Nuclide	Steam Generator Blowdown 4A 1/18/78; 11:26 (μCi/ml)	Steam Generator Blowdown 4B 1/18/78 11:23 (μCi/ml)	Steam Generator Blowdown 4C 1/18/78; 11:28 (μCi/ml)	Main Steam 4B 1/18/78; 12:12 (μCi/ml)
^{82}Br	<1.3(-8)	<2.6(-7)	<7.1(-9)	<9.6(-9)
^{131}I	2.7 ± 0.1(-6)	5.4 ± 2.5(-7)	6.9 ± 0.4(-7)	<5.6(-8)
^{132}I	<7.6(-6)	<2.1(-6)	<6.9(-8)	<8.6(-8)
^{133}I	4.2 ± 0.1(-6)	9.2 ± 2.4(-7)	1.1 ± 0.1(-6)	<4.1(-8)
^{134}I	*	<9.4(-6)	*	<1.2(-8)
^{135}I	4.0 ± 0.5(-6)	<3.4(-7)	1.1 ± 0.7(-6)	<5.5(-8)
^{88}Rb	*	*	<1.1(-5)	*
^{89}Rb	*	*	*	*
^{134}Cs	3.3 ± 0.6(-7)	1.0 ± 0.7(-7)	<1.7(-7)	6.3 ± 3.1(-8)
^{136}Cs	<4.1(-8)	<7.6(-7)	8.9 ± 3.1(-8)	<3.6(-8)
^{137}Cs	4.4 ± 0.5(-7)	<1.24(-7)	1.4 ± 0.4(-7)	<5.6(-8)
^{138}Cs	*	*	*	<5.3(-7)
^{24}Na	1.7 ± 0.1(-6)	<6.2(-7)	4.7 ± 0.8(-7)	<2.4(-8)
^{41}Ar	<2.4(-5)	<2.5(-6)	<1.9(-6)	<4.3(-8)
^{51}Cr	<5.2(-8)	<5.1(-7)	<6.9(-9)	<3.9(-8)
^{54}Mn	<1.4(-8)	<2.2(-7)	7.9 ± 1.0(-7)	<5.0(-8)
^{56}Mn	<5.1(-7)	*	<5.3(-7)	<6.6(-9)
^{59}Fe	<9.8(-8)	<2.9(-7)	<6.5(-8)	<1.4(-8)
^{57}Co	<3.8(-9)	<2.9(-7)	<1.8(-8)	<3.0(-8)
^{58}Co	<5.0(-8)	7 ± 5(-8)	1.72 ± 0.09(-6)	6.4 ± 2.5(-8)
^{60}Co	<1.1(-7)	<2.0(-7)	1.6 ± 0.1(-6)	<1.6(-7)
^{65}Zn	<1.2(-7)	<1.1(-7)	<3.0(-8)	<1.1(-8)
^{91}Sr	<3.6(-7)	<1.6(-7)	<1.1(-7)	<1.2(-8)
^{93}Y	<9.0(-8)	<1.6(-7)	<2.4(-7)	<1.0(-7)
^{95}Zr	<3.9(-8)	<2.3(-7)	<9.9(-8)	<2.1(-7)
^{95}Nb	<1.8(-9)	<6.9(-8)	<5.1(-8)	<3.1(-8)
^{99}Mo	<1.0(-9)	<1.1(-7)	<1.4(-8)	<3.1(-8)

TABLE B.42 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/18/78

Nuclide	Steam Generator Blowdown 4A 1/18/78; 11:26 (μCi/ml)	Steam Generator Blowdown 4B 1/18/78; 11:23 (μCi/ml)	Steam Generator Blowdown 4C 1/18/78; 11:28 (μCi/ml)	Main Steam 4B 1/18/78; 12:12 (μCi/ml)
^{103}Ru	<1.7(-8)	<3.0(-7)	<2.3(-8)	<3.8(-8)
^{106}RuD	<2.6(-8)	<1.3(-7)	<7.5(-8)	<5.7(-8)
^{110m}Ag	<4.2(-7)	<9.6(-7)	<1.6(-7)	<6.6(-8)
^{124}Sb	<3.8(-8)	*	<9.5(-9)	<5.4(-8)
^{125}Sb	<7.6(-9)	<2.6(-7)	<2.1(-8)	<1.3(-8)
^{129}Te	*	<2.1(-5)	<8.3(-6)	<4.8(-7)
^{129m}Te	<2.5(-8)	<1.3(-7)	<1.6(-8)	<2.5(-8)
^{131m}Te	<7.5(-8)	<9.2(-7)	<2.9(-9)	<4.8(-8)
^{132}Te	<1.3(-8)	<2.4(-7)	<2.7(-8)	<1.5(-9)
^{139}Ba	<1.2(-7)	<1.7(-7)	<4.0(-8)	<4.8(-9)
^{140}Ba	<1.6(-8)	<4.8(-7)	<1.0(-7)	<1.6(-8)
^{140}La	<1.8(-8)	<1.8(-7)	<3.8(-8)	<7.6(-8)
^{141}Ce	<4.2(-9)	<3.9(-8)	<6.8(-8)	<1.3(-8)
^{143}Ce	<1.8(-7)	<3.5(-7)	<1.5(-7)	<2.0(-8)
^{144}Ce	<4.4(-8)	<6.8(-8)	<3.1(-8)	<1.1(-8)
^{152}Eu	<2.2(-8)	<1.4(-7)	<3.2(-8)	<1.6(-8)
^{154}Eu	<4.0(-8)	*	<5.7(-9)	<5.4(-8)
^{187}W	<3.0(-8)	<3.8(-7)	<1.7(-7)	<3.4(-8)
^{239}Np	<6.7(-8)	<3.1(-7)	<1.3(-8)	<1.2(-9)

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* Radionuclide not detected.

TABLE B.42 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/18/78

Nuclide	Main Steam 4C 1/18/78; 12:06 (μCi/ml)	Unit 4 Blowdown Flash Tank 1/18/78; 13:54 (μCi/ml)	Unit 4 Feedwater 1/18/78; 11:30 (μCi/ml)	Unit 4 Main Condensate 1/18/78; 11:32 (μCi/ml)
^{82}Br	<7.0(-8)	<1.9(-10)	<9.7(-9)	<7.9(-8)
^{131}I	<1.0(-8)	1.8 ± 0.1(-6)	<1.3(-8)	<2.1(-8)
^{132}I	<2.2(-7)	<1.3(-5)	<2.6(-6)	<1.4(-6)
^{133}I	<2.6(-8)	2.8 ± 0.1(-6)	<9.8(-8)	<1.0(-7)
^{134}I	<2.6(-7)	*	*	*
^{135}I	<1.1(-7)	1.0 ± 0.6(-6)	<1.0(-7)	<7.1(-8)
^{88}Rb	*	*	*	*
^{89}Rb	*	*	*	*
^{134}Cs	<5.4(-8)	1.2 ± 0.5(-7)	<5.3(-8)	<7.2(-8)
^{136}Cs	<5.8(-8)	<1.3(-7)	<1.5(-8)	<4.0(-8)
^{137}Cs	<5.7(-8)	4.4 ± 0.5(-7)	<7.0(-8)	1.4 ± 0.3(-7)
^{138}Cs	<6.9(-6)	*	*	*
^{24}Na	<2.6(-8)	1.0 ± 0.2(-6)	<2.2(-8)	<7.4(-8)
^{41}Ar	<9.8(-9)	*	<4.6(-7)	<8.8(-7)
^{51}Cr	<3.5(-8)	<3.9(-8)	<5.9(-9)	<1.1(-8)
^{54}Mn	<5.6(-8)	1.2 ± 0.4(-7)	<4.7(-8)	<6.8(-8)
^{56}Mn	<8.1(-8)	<2.8(-5)	<1.1(-6)	<2.8(-7)
^{59}Fe	<9.8(-8)	<2.9(-8)	<2.2(-9)	<6.8(-8)
^{57}Co	<2.0(-9)	<4.7(-8)	<7.5(-9)	<4.5(-9)
^{58}Co	<3.5(-8)	1.4 ± 0.4(-7)	<4.7(-8)	<2.6(-8)
^{60}Co	<1.5(-7)	<1.6(-7)	<1.6(-7)	<1.4(-7)
^{65}Zn	<3.1(-8)	<8.8(-8)	<1.4(-7)	<9.2(-8)
^{91}Sr	<7.2(-8)	<4.8(-8)	<1.9(-7)	<8.7(-8)
^{93}Y	<2.3(-8)	<6.8(-8)	<4.3(-8)	<1.2(-7)
^{95}Zr	<2.3(-8)	<1.1(-8)	<4.8(-8)	<9.0(-8)
^{95}Nb	<5.0(-8)	<9.1(-8)	<7.8(-8)	<4.5(-8)
^{99}Mo	<2.5(-8)	<6.2(-8)	<2.9(-8)	<2.4(-9)

TABLE B.42 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/18/78

Nuclide	Main Steam 4C 1/18/78; 12:06 (μCi/ml)	Unit 4 Blowdown Flash Tank 1/18/78; 13:54 (μCi/ml)	Unit 4 Feedwater 1/18/78; 11:30 (μCi/ml)	Unit 4 Main Condensate 1/18/78; 11:32 (μCi/ml)
^{103}Ru	<3.4(-9)	<1.1(-7)	<1.6(-8)	<4.1(-8)
^{106}RuD	<1.1(-8)	<2.0(-9)	<5.7(-8)	<6.2(-8)
^{110m}Ag	<1.3(-7)	<2.5(-7)	<7.6(-8)	<7.8(-8)
[illegible]	<3.5(-8)	<2.0(-8)	<5.4(-10)	<1.2(-9)
^{124}Sb	<4.4(-8)	<7.3(-8)	<1.9(-8)	<2.6(-9)
^{125}Sb	<9.2(-7)	*	*	1.8 ± 0.9(-4)
^{129}Te	<4.3(-9)	<7.3(-8)	<5.1(-8)	<2.1(-8)
^{129m}Te	<1.5(-8)	<5.8(-8)	<6.0(-8)	<3.1(-8)
^{131m}Te	<2.9(-8)	<2.5(-8)	<1.4(-8)	<7.4(-8)
^{132}Te	<6.6(-8)	<4.8(-8)	<1.2(-8)	<9.7(-8)
^{139}Ba	<2.8(-8)	<8.0(-9)	1.3 ± 0.5(-7)	<8.9(-9)
^{140}Ba	<6.3(-8)	<6.9(-9)	<2.9(-8)	<3.0(-8)
^{140}La	<1.3(-8)	<1.8(-8)	<2.0(-8)	<1.4(-8)
^{141}Ce	<8.0(-8)	<1.2(-7)	<1.3(-8)	<6.6(-8)
^{143}Ce	<1.2(-8)	<3.7(-8)	2.4 ± 0.9(-7)	<3.3(-8)
^{144}Ce	<6.7(-9)	<3.4(-8)	<2.7(-8)	<2.6(-8)
^{152}Eu	<2.7(-8)	<5.5(-9)	<2.0(-8)	<6.5(-8)
^{154}Eu	<2.8(-8)	<2.2(-8)	<3.6(-8)	<1.3(-8)
^{187}W	<5.6(-8)	2.2 ± 0.7(-8)	<1.3(-8)	<3.5(-9)

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* Radionuclide not measured.

TABLE B.42 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/18/78

Nuclide	Unit 4 Condensate Storage Tank 1/18/78; 12:05 (μCi/ml)	Unit 4 Condensate Recovery Tank 1/18/78; 12:02 (μCi/ml)	Unit 4 Turbine Cooling Water 1/18/78; 11:35 (μCi/ml)	#4 BS Condenser Hotwell Resin Inlet 1/18/78; 12:08 (μCi/ml)	#4 BS Condenser Hotwell Resin Outlet 1/18/78; 12:09 (μCi/ml)
^{82}Br	<4.7(-8)	<1.1(-7)	<4.0(-8)	<3.4(-7)	<4.7(-8)
^{131}I	<4.0(-8)	<3.7(-8)	<3.7(-8)	<6.6(-8)	<1.9(-8)
^{132}I	<2.2(-6)	<3.2(-6)	<3.9(-7)	*	*
^{133}I	<1.9(-8)	<2.5(-8)	<3.7(-8)	<2.6(-7)	<5.7(-7)
^{134}I					
^{135}I	<2.4(-7)	<1.0(-8)	<1.9(-8)	*	*
^{88}Rb	*	*	*	*	*
^{89}Rb	*	*	*	*	*
^{134}Cs	<5.8(-8)	5.4 ± 3.0(-8)	3.1 ± 0.5(-7)	4 ± 2(-8)	1.1 ± 0.5(-7)
^{136}Cs	<6.2(-8)	<4.4(-8)	<2.5(-8)	<4.4(-8)	<8.0(-8)
^{137}Cs	<7.0(-8)	<6.6(-8)	4.7 ± 0.4(-7)	<4.1(-8)	<6.5(-8)
^{138}Cs	*	*	*	*	*
^{24}Na	<1.3(-7)	<1.1(-7)	<4.7(-8)	<4.0(-7)	<1.6(-6)
^{41}Ar	<5.7(-6)	<5.8(-6)	<1.9(-6)	*	*
^{51}Cr	<7.1(-9)	<4.2(-8)	<2.2(-8)	<2.2(-9)	<1.0(-7)
^{54}Mn	<4.6(-8)	<1.2(-7)	<9.1(-8)	<3.7(-8)	4 ± 3(-8)
^{56}Mn	<1.3(-7)	<3.4(-7)	<1.4(-6)	*	*
^{59}Fe	<1.9(-8)	<3.3(-8)	<4.0(-8)	<1.6(-8)	<2.6(-8)
^{57}Co	<3.3(-8)	<1.3(-8	<2.4(-8)	<2.7(-8)	<6.4(-8)
^{58}Co	<6.9(-8)	<1.0(-7)	<5.1(-8)	<5.4(-8)	<9.6(-8)
^{60}Co	<2.3(-7)	<1.6(-7)	<2.7(-7)	<1.6(-7)	<1.3(-7)
^{65}Zn	<5.2(-8)	<7.6(-8)	<9.7(-8)	<8.4(-9)	<1.0(-7)
^{91}Sr	<1.1(-7)	<6.5(-8)	<5.4(-8)	<4.0(-6)	<2.6(-5)
^{93}Y	<1.2(-7)	<6.4(-8)	<4.6(-8)	<9.1(-6)	<3.0(-6)
^{95}Zr	<3.0(-9)	<1.0(-8)	<6.5(-8)	<1.3(-8)	<3.2(-8)
^{95}Nb	<1.3(-8)	<2.8(-8)	<9.6(-9)	<4.3(-8)	<4.0(-8)
^{99}Mo	<5.2(-8)	<1.3(-8)	<2.3(-8)	<1.1(-7)	<2.2(-7)

TABLE B.42 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/18/78

Nuclide	Unit 4 Condensate Storage Tank 1/18/78; 12:05 (μCi/ml)	Unit 4 Condensate Recovery Tank 1/18/78; 12:02 (μCi/ml)	Unit 4 Turbine Cooling Water 1/18/78; 11:35 (μCi/ml)	#4 BS Condenser Hotwell Resin Inlet 1/18/78; 12:08 (μCi/ml)	#4 BS Condenser Hotwell Resin Outlet 1/18/78; 12:09 (μCi/ml)
^{103}Ru	<3.1(-9)	<6.0(-8)	<6.7(-8)	<2.9(-8)	<2.6(-8)
^{106}RuD	<2.6(-8)	<7.0(-8)	3.3 ± 1.4(-7)	<1.6(-8)	<1.3(-8)
^{110m}Ag	<7.8(-8)	<6.8(-8)	<2.6(-7)	<1.2(-7)	<1.3(-7)
^{124}Sb	<2.7(-8)	<2.0(-8)	<8.6(-10)	<2.0(-8)	<5.6(-9)
^{125}Sb	<5.9(-9)	<3.8(-8)	8.6 ± 4.7(-8)	<7.1(-10)	<7.8(-8)
^{129}Te	*	*	*	*	*
^{129m}Te	<1.6(-8)	<8.5(-8)	<3.0(-8)	<1.3(-8)	<6.8(-8)
^{131m}Te	<5.7(-8)	<1.1(-7)	<5.2(-8)	<1.4(-7)	<1.0(-7)
^{132}Te	<5.2(-9)	<4.3(-8)	<4.3(-8)	<1.2(-7)	<1.2(-9)
^{139}Ba	<5.2(-9)	<1.2(-8)	<3.6(-8)	<5.6(-7)	<1.6(-6)
^{140}Ba	<1.6(-8)	<1.1(-7)	<7.9(-8)	<1.9(-8)	<4.6(-9)
^{140}La	<1.8(-8)	<2.6(-8)	<1.7(-8)	<1.3(-7)	<6.0(-8)
^{141}Ce	<8.1(-10)	<2.3(-8)	<3.1(-8)	<1.9(-9)	<1.4(-7)
^{143}Ce	<8.0(-8)	<9.8(-8)	<1.5(-8)	<3.4(-7)	<6.2(-7)
^{144}Ce	<3.7(-9)	<1.6(-8)	<2.1(-8)	<6.1(-8)	<3.3(-8)
^{152}Eu	<5.4(-8)	<1.3(-8)	<2.8(-8)	<1.6(-8)	<7.1(-9)
^{154}Eu	<5.0(-10)	<4.6(-8)	<4.6(-9)	<2.4(-8)	<1.0(-7)
^{187}W	<5.2(-8)	3.7 ± 0.9(-7)	<9.8(-8)	<2.7(-7)	<3.4(-7)
^{239}Np	<7.4(-10)	<2.5(-8)	<1.9(-8)	<1.7(-8)	<1.6(-7)

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* Radionuclide not measured.

TABLE B.43

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/19/78

Nuclide	Steam Generator Blowdown 4A 1/19/78; 12:10 (μCi/ml)	Steam Generator Blowdown 4B 1/19/78; 12:12 (μCi/ml)	Steam Generator Blowdown 4C 1/19/78; 12:15 (μCi/ml)	Main Steam 4A Anion 1/19/78; 11:40 (μCi/ml)	Main Steam 4A Cation 1/19/78; 11:40 (μCi/ml)	Main Steam 4A Anion 1/19/78; 11:40 (μCi/ml)
^{82}Br	<7.8(-7)	<2.3(-7)	<1.5(-7)	<4.4(-9)	<2.3(-10)	<2.5(-10)
^{131}I	3.7 ± 0.1(-6)	6.7 ± 1.6(-7)	7.5 ± 0.6(-7)	4.9 ± 0.1(-8)	<2.0(-10)	4.3 ± 0.1(-8)
^{132}I	3.3 ± 0.2(-6)	<2.2(-7)	4.4 ± 0.9(-7)	4.2 ± 0.2(-8)	*	*
^{133}I	5.6 ± 0.2(-6)	8.1 ± 1.1(-7)	1.00 ± 0.07(-6)	6.8 ± 0.2(-8)	<8.5(-10)	6.5 ± 0.2(-8)
^{134}I	2.3 ± 0.3(-6)	<5.8(-8)	<6.0(-8)	<3.9(-8)	*	*
^{135}I	5.6 ± 0.5(-6)	<2.5(-7)	1.1 ± 0.2(-6)	5.8 ± 0.4(-8)	<6.7(-10)	6.4 ± 1.2(-8)
^{88}Rb	<1.1(-6)	<2.3(-6)	<1.3(-6)	*	*	*
^{89}Rb	4.6 ± 1.8(-6)	<2.8(-6)	<2.3(-6)	*	*	*
^{134}Cs	5.4 ± 1.1(-7)	<3.3(-7)	<1.7(-7)	<2.8(-10)	5.3 ± 0.3(-9)	<4.2(-10)
^{136}Cs	<1.4(-7)	<1.6(-7)	<1.2(-7)	<3.3(-10)	<8.7(-11)	<1.5(-10)
^{137}Cs	7.0 ± 1.3(-7)	2.1 ± 1.0(-7)	1.6 ± 0.5(-7)	4.7 ± 1.9(-10)	1.1 ± 0.1(-7)	3.9 ± 1.4(-10)
^{138}Cs	4.8 ± 0.8(-6)	<5.6(-7)	<9.7(-7)	<4.3(-9)	*	*
^{24}Na	2.6 ± 0.2(-6)	3.9 ± 1.4(-7)	3.4 ± 0.8(-7)	6.6 ± 1.7(-10)	<1.4(-8)	<9.8(-10)
^{41}Ar	<4.1(-7)	<1.9(-7)	<1.2(-7)	<5.8(-9)	*	*
^{51}Cr	<6.5(-9)	<1.3(-7)	5.9 ± 2.5(-7)	<6.7(-10)	<5.7(-11)	<2.1(-10)
^{54}Mn	<3.2(-7)	<7.8(-9)	<9.9(-9)	<2.2(-9)	4.7 ± 1.3(-10)	<2.6(-10)
^{56}Mn	<5.0(-8)	<2.0(-7)	<9.9(-8)	<4.0(-10)	*	*
^{59}Fe	<3.1(-8)	<1.5(-8)	<1.1(-7)	<7.4(-10)	<1.3(-10)	<5.9(-10)
^{57}Co	<1.7(-8)	<1.3(-7)	<6.6(-8)	<1.7(-10)	<1.2(-10)	<5.3(-12)
^{58}Co	<3.3(-7)	<4.3(-7)	<1.7(-8)	1.1 ± 0.4(-9)	<7.1(-10)	<4.2(-10)
^{60}Co	<2.9(-7)	<2.8(-7)	<8.4(-7)	<7.1(-10)	<2.7(-9)	<6.9(-10)
^{65}Zn	<1.4(-7)	<3.2(-7)	<1.7(-7)	<2.2(-10)	<3.2(-10)	<2.5(-10)
^{91}Sr	<1.7(-7)	<8.5(-8)	<5.3(-9)	<1.6(-10)	<3.6(-9)	<2.2(-9)
^{93}Y	<2.3(-7)	<4.0(-8)	<5.6(-8)	<1.4(-10)	<2.1(-9)	<1.0(-9)
^{95}Zr	<1.9(-7)	<1.8(-7)	<1.0(-8)	<4.6(-12)	<6.2(-11)	<3.2(-10)
^{95}Nb	<4.1(-8)	<1.2(-7)	<7.8(-8)	<3.6(-11)	<5.3(-11)	<7.4(-12)
^{99}Mo	<4.4(-9)	<3.1(-7)	<2.3(-8)	<2.1(-10)	<3.2(-10)	<4.2(-10)

TABLE B.43 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/19/78

Nuclide	Steam Generator Blowdown 4A 1/19/78; 12:10 (μCi/ml)	Steam Generator Blowdown 4B 1/19/78; 12:12 (μCi/ml)	Steam Generator Blowdown 4C 1/19/78; 12:15 (μCi/ml)	Main Steam 4A Anion 1/19/78; 11:40 (μCi/ml)	Main Steam 4A Cation 1/19/78; 11:40 (μCi/ml)	Main Steam 4A Anion 1/19/78; 11:40 (μCi/ml)
^{103}Ru	<1.7(-8)	<8.6(-8)	<1.3(-7)	<3.6(-10)	<9.4(-11)	<8.3(-11)
^{106}RuD	1.7 ± 0.5(-6)	<7.0(-8)	<7.3(-8)	<7.3(-11)	<6.8(-11)	<3.3(-11)
^{110m}Ag	<6.1(-7)	<3.2(-7)	<1.8(-7)	<1.4(-9)	<3.9(-9)	<5.3(-10)
^{124}Sb	<5.7(-8)	<1.7(-8)	<9.3(-8)	<7.1(-11)	<1.4(-10)	<1.4(-10)
^{125}Sb	<5.2(-8)	<1.5(-7)	<1.7(-8)	<4.3(-10)	<5.2(-11)	<6.3(-11)
^{129}Te	<5.7(-7)	<1.5(-8)	<1.4(-7)	<1.9(-9)	*	*
^{129m}Te	<1.1(-7)	<1.8(-8)	<6.5(-8)	<1.5(-10)	<1.6(-10)	<5.6(-11)
^{131m}Te	<3.3(-7)	<1.2(-7)	<6.3(-8)	<1.1(-9)	<3.9(-10)	<8.8(-10)
^{132}Te	<5.1(-8)	<1.2(-7)	<5.1(-8)	<3.1(-10)	<2.3(-10)	<4.7(-11)
^{139}Ba	<1.1(-7)	<1.2(-7)	<1.1(-7)	<2.0(-10)	<2.6(-10)	<2.7(-10)
^{140}Ba	<4.7(-9)	<5.4(-8)	<1.3(-8)	<4.3(-10)	<4.7(-10)	7.2 ± 2.9(-10)
^{140}La	<1.0(-7)	9.1 ± 6.6(-8)	<5.9(-9)	<1.8(-10)	<2.7(-10)	<2.1(-10)
^{141}Ce	<1.5(-7)	<1.3(-7)	<2.1(-8)	<1.1(-10)	<4.1(-10)	<8.9(-11)
^{143}Ce	<1.4(-7)	<5.1(-8)	<1.2(-7)	<3.4(-10)	<4.8(-10)	<2.9(-10)
^{144}Ce	<1.3(-7)	<3.9(-8)	<1.3(-7)	<3.7(-11)	<8.3(-11)	<2.0(-11)
^{152}Eu	<8.8(-8)	<3.4(-8)	<1.4(-7)	<1.4(-9)	<1.6(-11)	<1.5(-10)
^{154}Eu	<6.6(-9)	<7.5(-8)	<1.4(-8)	<1.2(-10)	<1.6(-10)	<1.7(-10)
^{187}W	<1.5(-7)	<1.0(-7)	<1.3(-9)	<2.6(-10)	<8.8(-11)	3.0 ± 0.7(-9)
^{239}Np	<3.0(-8)	<2.7(-7)	2.3 ± 0.8(-7)	<1.6(-10)	<1.9(-10)	<7.0(-11)

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* Radionuclide not detected.

TABLE B.43 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/19/78

Nuclide	Main Steam 4A Cation 1/19/78; 11:40 (μCi/ml)	Unit 4 Condensate Storage Tank 1/19/78; 15:30 (μCi/ml)	Unit 4 Condensate Recovery Tank 1/19/78; 15:25 (μCi/ml)	Unit 4 Main Feedwater 1/19/78; 12:15 (μCi/ml)	Unit 4 Main Condensate 1/19/78; 12:20 (μCi/ml)
^{82}Br	<6.1(-10)	<1.2(-7)	<1.1(-7)	<4.9(-8)	<1.4(-7)
^{131}I	<1.1(-10)	<2.7(-8)	<4.5(-8)	<2.3(-8)	<5.4(-8)
^{132}I	*	*	*	<1.7(-7)	<9.3(-8)
^{133}I	<5.5(-10)	<2.2(-7)	<1.9(-7)	<5.6(-8)	<4.6(-8)
^{134}I	*	*	*	<3.1(-7)	<2.9(-7)
^{135}I	<3.0(-9)	<8.4(-5)	*	<1.4(-8)	<1.0(-7)
^{88}Rb	*	*	*	<2.5(-5)	<4.2(-6)
^{89}Rb	*	*	*	*	<2.7(-6)
^{134}Cs	5.4 ± 0.4(-8)	<4.6(-8)	4 ± 3(-8)	<6.9(-8)	<1.7(-7)
^{136}Cs	<1.6(-10)	<4.8(-9)	<1.5(-8)	<2.1(-9)	<9.1(-7)
^{137}Cs	1.1 ± 0.1(-7)	<5.4(-8)	<7.2(-8)	4.1 ± 3.4(-8)	<1.6(-7)
^{138}Cs	*	*	*	<8.1(-7)	<1.6(-6)
^{24}Na	<1.9(-8)	<7.0(-7)	<1.3(-8)	<6.3(-8)	<8.5(-8)
^{41}Ar	*	*	*	<3.4(-8)	<5.6(-7)
^{51}Cr	<5.7(-11)	<2.9(-8)	<6.8(-8)	4.8 ± 1.3(-7)	<4.4(-8)
^{54}Mn	<8.4(-10)	<2.5(-8)	<3.8(-8)	<5.7(-8)	<3.3(-7)
^{56}Mn	*	*	*	<1.9(-8)	<5.1(-8)
^{59}Fe	<1.0(-10)	<9.6(-8)	<3.6(-8)	<1.1(-7)	<5.5(-8)
^{57}Co	<6.6(-11)	<8.4(-8)	<1.4(-8)	<1.0(-8)	<1.8(-7)
^{58}Co	<1.5(-10)	<8.7(-8)	<8.8(-9)	<2.6(-8)	<2.1(-7)
^{60}Co	<2.6(-9)	<1.2(-7)	<1.5(-7)	<1.4(-7)	<2.4(-7)
^{65}Zn	<1.7(-10)	<1.0(-7)	<2.0(-8)	<9.3(-8)	<2.3(-7)
^{91}Sr	<1.2(-9)	<3.5(-6)	<1.8(-6)	<2.7(-9)	<2.9(-8)
^{93}Y	<4.3(-9)	<3.6(-6)	<4.4(-6)	<7.4(-8)	<4.8(-8)
^{95}Zr	<6.2(-11)	9.0 ± 2.7(-8)	<2.6(-9)	<1.6(-8)	<1.0(-7)
^{95}Nb	<1.7(-10)	8.1 ± 2.1(-8)	<7.2(-9)	<2.1(-8)	<1.3(-7)
^{99}Mo	<1.9(-10)	<1.9(-9)	<1.5(-8)	<7.2(-8)	<9.5(-8)

TABLE B.43 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/19/78

Nuclide	Main Steam 4A Cation 1/19/78; 11:40 (µCi/ml)	Unit 4 Condensate Storage Tank 1/19/78; 15:30 (µCi/ml)	Unit 4 Condensate Recovery Tank 1/19/78; 15:25 (µCi/ml)	Unit 4 Main Feedwater 1/19/78; 12:15 (µCi/ml)	Unit 4 Main Condensate 1/19/78; 12:20 (µCi/ml)
^{103}Ru	2.6 ± 1.0(-10)	<1.0(-8)	<2.1(-9)	<6.6(-8)	<1.1(-7)
^{106}RuD	2.4 ± 0.9(-9)	<2.0(-8)	<4.2(-8)	<7.7(-8)	<1.6(-7)
^{110m}Ag	<4.8(-9)	<9.3(-8)	<1.1(-7)	<8.5(-8)	<3.4(-7)
^{124}Sb	<4.4(-12)	<4.0(-8)	<3.0(-9)	<6.7(-8)	<1.0(-8)
^{125}Sb	<6.2(-11)	<7.0(-8)	<2.7(-8)	<6.9(-8)	<1.1(-7)
^{129}Te	*	*	*	<1.3(-7)	<3.8(-7)
^{129m}Te	<1.1(-10)	<8.0(-7)	<6.1(-8)	<1.4(-8)	<1.3(-7)
^{131m}Te	<8.2(-10)	<4.5(-8)	<1.2(-7)	<5.5(-9)	<4.9(-8)
^{132}Te	<4.0(-10)	<1.7(-8)	<2.6(-8)	<2.4(-8)	<9.7(-8)
^{139}Ba	<9.4(-10)	<2.0(-6)	<2.9(-7)	<3.6(-9)	<9.2(-8)
^{140}Ba	<1.7(-10)	<7.3(-8)	<7.0(-8)	<3.3(-8)	<1.1(-7)
^{140}La	<3.3(-10)	<9.0(-8)	<1.2(-9)	<3.7(-8)	<1.3(-7)
^{141}Ce	<1.8(-10)	<6.7(-8)	<1.1(-8)	<8.9(-8)	<1.0(-7)
^{143}Ce	<4.2(-10)	<1.4(-8)	<3.2(-7)	<7.8(-8)	<6.1(-8)
^{144}Ce	<7.8(-11)	<3.5(-8)	<3.8(-8)	<4.9(-9)	<1.3(-9)
^{152}Eu	<8.0(-11)	<2.8(-8)	<4.0(-9)	<6.3(-8)	<1.4(-7)
^{154}Eu	<2.2(-10)	<2.4(-8)	<2.4(-8)	<3.7(-8)	<7.3(-10)
^{187}W	<3.5(-12)	<2.4(-7)	<6.1(-7)	<3.4(-8)	<6.8(-8)
^{239}Np	<5.2(-11)	<4.0(-8)	<7.3(-8)	<1.5(-8)	<1.1(-7)

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*Radionuclide not detected.

TABLE B.43 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/19/78

Nuclide	Flash Tank Outlet #4 1/19/78; 14:06 (μCi/ml)	4 BS Hotwell Resin Inlet 1/19/78; 12:25 (μCi/ml)	4 BS Hotwell Resin Outlet 1/19/78; 12:23 (μCi/ml)	Blowdown Flash Tank Gas 1/19/78; 14:50 (μCi/ml)	Unit 4 Air Ejector Whole Gas 1/19/78; 15:00 (μCi/cc)
^{82}Br	<4.6(-8)	<4.7(-8)	<1.0(-7)	<2.1(-7)	<1.0(-8)
^{131}I	2.3 ± 0.1(-6)	5.2 ± 2.0(-8)	<7.9(-8)	<4.9(-8)	3.6 ± 1.6(-8)
^{132}I	*	*	*	*	*
^{133}I	3.3 ± 0.2(-6)	<1.3(-7)	<1.3(-7)	<3.0(-7)	<1.6(-7)
^{134}I	*	*	*	*	*
^{135}I	<2.1(-6)	*	<5.9(-5)	<3.5(-6)	<8.8(-6)
^{88}Rb	*	*	*	*	*
^{89}Rb	*	*	*	*	*
^{134}Cs	2.6 ± 0.3(-7)	<6.2(-8)	4 ± 3(-8)	5.7 ± 4.2(-8)	4.8 ± 4.1(-8)
^{136}Cs	<2.2(-9)	<3.8(-8)	<3.1(-8)	<1.7(-8)	<3.1(-8)
^{137}Cs	4.8 ± 0.4(-7)	<5.3(-8)	<4.8(-8)	<8.6(-8)	<1.1(-7)
^{138}Cs	*	*	*	*	*
^{24}Na	1.8 ± 0.3(-6)	<5.9(-7)	<4.5(-7)	<5.0(-7)	<1.6(-6)
^{41}Ar	*	*	*	*	*
^{51}Cr	<5.0(-8)	3.9 ± 1.3(-7)	3.9 ± 1.4(-7)	<5.7(-8)	<1.0(-8)
^{54}Mn	7 ± 2(-8)	<1(-7)	4 ± 2(-8)	<1.5(-8)	<5.4(-8)
^{56}Mn	*	*	*	*	*
^{59}Fe	<4.4(-7)	<9.8(-9)	<7.0(-8)	<3.5(-8)	<6.8(-8)
^{57}Co	<3.7(-9)	<9.5(-8)	<7.1(-9)	<4.8(-8)	<6.4(-8)
^{58}Co	6 ± 4(-8)	<4.9(-8)	<6.4(-8)	5.1 ± 3.2(-8)	4.8 ± 3.2(-8)
^{60}Co	<1.3(-7)	<1.2(-7)	<1.2(-7)	<3.3(-7)	<1.4(-7)
^{65}Zn	<7.1(-8)	<9.1(-8)	<1.0(-7)	<4.3(-8)	<1.4(-7)
^{91}Sr	<2.1(-6)	<1.3(-9)	<7.1(-6)	<2.5(-6)	<4.3(-6)
^{93}Y	<1.4(-7)	<1.8(-6)	<4.5(-6)	<2.0(-6)	<9.6(-7)
^{95}Zr	<5.7(-8)	<1.3(-8)	<1.1(-7)	<8.9(-8)	<5.0(-8)
^{95}Nb	<6.5(-10)	5.5 ± 1.8(-8)	<9.3(-8)	<7.3(-8)	1.2 ± 0.3(-7)
^{99}Mo	<2.8(-8)	<1.5(-8)	<4.6(-8)	<3.6(-7)	<2.5(-7)

TABLE B.43 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/19/78

Nuclide	Flash Tank Outlet #4 1/19/78; 14:06 (μCi/ml)	4 BS Hotwell Resin Inlet 1/19/78; 12:25 (μCi/ml)	4 BS Hotwell Resin Outlet 1/19/78; 12:23 (μCi/ml)	Blowdown Flash Tank Gas 1/19/78; 14:50 (μCi/ml)	Unit 4 Air Ejector Whole Gas 1/19/78; 15:00 (μCi/cc)
^{103}Ru	<5.9(-9)	<2.8(-8)	<1.9(-8)	<1.8(-8)	<6.0(-8)
^{106}RuD	<6.4(-8)	<2.6(-8)	<7.7(-8)	<8.7(-9)	<1.3(-8)
^{110m}Ag	<2.7(-7)	<6.7(-8)	<9.9(-8)	<2.0(-7)	<6.0(-9)
^{124}Sb	<3.6(-8)	<4.2(-8)	<1.7(-8)	<1.3(-8)	<5.8(-8)
^{125}Sb	<2.1(-8)	<1.7(-8)	<2.3(-8)	<6.0(-8)	<4.0(-8)
^{129}Te	*	*	*	*	*
^{129m}Te	<8.7(-8)	<3.4(-8)	1.4 ± 0.5(-6)	<6.2(-8)	<3.2(-9)
^{131m}Te	<3.7(-8)	<1.1(-7)	<3.5(-8)	<8.1(-8)	<1.8(-7)
^{132}Te	<2.6(-8)	<1.4(-7)	<7.6(-9)	<1.8(-8)	<3.6(-8)
^{139}Ba	<3.7(-7)	<2.6(-7)	<1.1(-6)	<1.3(-7)	<1.2(-7)
^{140}Ba	<2.3(-9)	<5.8(-9)	<1.3(-8)	<6.5(-9)	<1.9(-8)
^{140}La	<7.6(-8)	<1.3(-8)	<7.5(-9)	<1.1(-7)	<2.5(-9)
^{141}Ce	<1.2(-8)	<1.7(-8)	<1.1(-8)	<1.4(-7)	<1.8(-8)
^{143}Ce	<1.5(-7)	<6.3(-7)	<2.7(-7)	<3.4(-7)	<4.9(-7)
^{144}Ce	<6.6(-8)	<1.0(-8)	<4.4(-8)	<3.4(-8)	<8.3(-9)
^{152}Eu	<2.6(-8)	<6.7(-9)	<3.4(-9)	<1.2(-8)	<2.8(-8)
^{154}Eu	<1.4(-8)	<2.0(-8)	<3.4(-8)	<3.2(-8)	<2.0(-8)
^{187}W	<3.2(-8)	<4.0(-7)	<1.5(-7)	<2.4(-7)	<3.9(-7)
^{239}Np	<5.7(-8)	<2.5(-9)	<2.4(-7)	<3.2(-9)	<5.7(-8)

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* Radionuclide not detected.

TABLE B.44

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/20/78

Nuclide	Steam Generator Blowdown 4A 1/20/78; 10:00 (μCi/ml)	Steam Generator Blowdown 4B 1/20/78; 10:00 (μCi/ml)	Steam Generator Blowdown 4C 1/20/78; 10:02 (μCi/ml)	Main Steam 4A 1/20/78; 10:07 (μCi/ml)	Main Steam 4B 1/20/78; 10:05 (μCi/ml)	Main Steam 4C 1/20/78; 10:00 (μCi/ml)
^{82}Br	*	<5.9(-8)	<7.0(-8)	<3.8(-8)	<2.2(-7)	<1.7(-8)
^{131}I	3.9 ± 0.1(-6)	7.7 ± 0.6(-7)	7.7 ± 0.6(-7)	1.0 ± 0.3(-7)	<5.8(-8)	<6.5(-9)
^{132}I	3.8 ± 0.3(-6)	<2.1(-7)	<1.6(-7)	<1.1(-9)	<4.0(-7)	<5.0(-7)
^{133}I	6.1 ± 0.2(-6)	8.6 ± 0.7(-7)	<8.4(-7)	<1.3(-7)	<1.1(-7)	<8.2(-8)
^{134}I	2.4 ± 0.8(-6)	<1.9(-6)	<7.6(-6)	<2.4(-6)	<4.9(-6)	*
^{135}I	4.9 ± 0.6(-6)	<3.3(-7)	<2.4(-7)	<3.3(-8)	<2.2(-8)	<9.1(-8)
^{88}Rb	*	*	*	*	*	*
^{89}Rb	*	*	*	*	*	*
^{134}Cs	1.1 ± 0.8(-6)	1.5 ± 0.6(-7)	1.2 ± 0.5(-7)	<1.2(-7)	<1.1(-7)	<5.5(-8)
^{136}Cs	<1.6(-7)	<2.4(-8)	<1.3(-7)	<1.1(-7)	<2.1(-8)	<9.3(-9)
^{137}Cs	8.7 ± 0.8(-7)	1.9 ± 0.5(-7)	1.7 ± 0.5(-7)	<8.8(-8)	<1.7(-7)	<5.2(-8)
^{138}Cs	<1.1(-5)	<2.8(-6)	*	<7.6(-6)	<2.4(-6)	*
^{24}Na	3.1 ± 0.2(-6)	<4.2(-7)	<3.6(-7)	<1.9(-8)	<5.6(-8)	<2.4(-9)
^{41}Ar	*	<1.0(-7)	<5.8(-7)	<1.2(-7)	<4.5(-7)	<1.8(-5)
^{51}Cr	<1.4(-7)	<8.5(-8)	<4.8(-9)	<1.1(-7)	<2.2(-8)	<1.3(-8)
^{54}Mn	*	<9.4(-8)	8.4 ± 4.1(-8)	1.1 ± 0.4(-7)	<3.6(-8)	<1.3(-8)
^{56}Mn	<3.5(-7)	<8.2(-9)	<4.3(-8)	<2.1(-7)	<5.6(-8)	<1.3(-6)
^{59}Fe	<1.4(-7)	<1.5(-7)	<5.0(-8)	<1.7(-7)	<3.8(-8)	<1.2(-8)
^{57}Co	<2.4(-8)	<9.2(-8)	<5.1(-8)	<1.9(-8)	<1.3(-7)	<1.3(-8)
^{58}Co	<1.4(-7)	<5.5(-8)	<5.2(-8)	<6.7(-8)	<1.3(-7)	<6.8(-8)
^{60}Co	<1.8(-7)	<1.0(-6)	<7.5(-7)	<2.2(-7)	<1.9(-7)	<1.2(-7)
^{65}Zn	<1.1(-7)	<4.7(-8)	<1.3(-7)	<7.4(-8)	<1.3(-7)	<1.3(-7)
^{91}Sr	<1.1(-7)	<7.2(-8)	<2.5(-8)	<1.6(-7)	<4.2(-8)	<1.1(-7)
^{93}Y	<1.1(-8)	<1.9(-7)	<4.7(-8)	<1.8(-8)	<1.5(-10)	<8.2(-8)
^{95}Zr	<1.7(-7)	<1.6(-7)	<8.4(-8)	<5.1(-8)	<1.1(-8)	<3.2(-8)
^{95}Nb	<2.0(-7)	<1.4(-7)	<3.3(-8)	<6.4(-9)	<3.9(-8)	<2.3(-8)
^{99}Mo	*	<4.0(-8)	<8.4(-8)	<1.5(-8)	<3.5(-8)	<2.8(-8)

TABLE B.44 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/20/78

Nuclide	Steam Generator Blowdown 4A 1/20/78; 10:00 (μCi/ml)	Steam Generator Blowdown 4B 1/20/78; 10:00 (μCi/ml)	Steam Generator Blowdown 4C 1/20/78; 10:02 (μCi/ml)	Main Steam 4A 1/20/78; 10:07 (μCi/ml)	Main Steam 4B 1/20/78; 10:05 (μCi/ml)	Main Steam 4C 1/20/78; 10:00 (μCi/ml)
^{103}Ru	<1.5(-7)	<6.5(-8)	<5.3(-8)	<1.4(-8)	<5.5(-10)	<1.7(-8)
^{106}RuD	*	<1.4(-8)	<9.8(-8)	<4.3(-8)	<2.1(-8)	<2.2(-8)
^{110m}Ag	*	<1.9(-7)	<2.2(-7)	<1.4(-7)	<2.9(-7)	<1.6(-7)
^{124}Sb	<6.6(-8)	<9.9(-9)	<5.4(-9)	<2.3(-8)	<1.3(-8)	<4.3(-9)
^{125}Sb	<1.7(-7)	<1.2(-10)	<4.4(-9)	<7.6(-8)	<4.2(-8)	<1.5(-8)
^{129}Te	<9.4(-7)	<5.5(-7)	<2.8(-6)	<1.0(-6)	<4.5(-7)	*
^{129m}Te	<5.4(-8)	<5.1(-8)	<2.6(-6)	<7.1(-8)	<2.4(-6)	<6.9(-9)
^{131m}Te	*	<4.1(-8)	<3.9(-8)	<5.4(-9)	<1.2(-7)	<1.3(-8)
^{132}Te	<4.9(-8)	<7.2(-9)	<1.0(-8)	<3.5(-8)	<3.1(-8)	<6.7(-8)
^{139}Ba	<9.8(-8)	<2.4(-8)	<1.2(-7)	<9.6(-8)	<7.7(-8)	<3.0(-8)
^{140}Ba	<1.6(-7)	<3.3(-10)	<9.2(-8)	<1.6(-8)	<6.4(-8)	<2.5(-8)
^{140}La	<2.9(-8)	<2.7(-8)	<1.5(-8)	<6.1(-9)	<1.5(-7)	<5.0(-8)
^{141}Ce	<1.2(-7)	<9.2(-9)	<1.5(-8)	<3.1(-8)	<1.0(-7)	<5.0(-8)
^{143}Ce	<1.6(-7)	<1.2(-8)	<2.6(-8)	<1.1(-7)	<2.4(-8)	<1.6(-7)
^{144}Ce	<1.2(-7)	<3.2(-8)	<4.5(-8)	<9.5(-8)	<1.6(-7)	<7.3(-8)
^{152}Eu	<5.1(-8)	<6.5(-8)	<3.3(-8)	<1.1(-7)	<8.6(-8)	<1.9(-8)
^{154}Eu	<2.8(-7)	<1.5(-8)	<1.8(-8)	<3.5(-8)	<2.0(-9)	<5.0(-9)
^{187}W	*	<3.0(-8)	<1.1(-7)	<4.3(-8)	<1.6(-8)	<1.0(-7)
^{239}Np	<1.7(-8)	<5.8(-8)	<2.0(-7)	<1.3(-8)	<1.1(-7)	<1.4(-8)

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* Radionuclide not detected.

TABLE B.44 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/20/78

Nuclide	Unit #4 Blowdown Flash Tank 1/20/78; 11:50 (μCi/ml)	Unit #4 Main Feed 1/20/78; 10:06 (μCi/ml)	Unit #4 Main Condensate Anion 1/20/78; 09:30 (μCi/ml)	Unit #4 Main Condensate Anion 1/20/78; 09:30 (μCi/ml)	Unit #4 Main Condensate Cation 1/20/78; 09:30 (μCi/ml)	Unit #4 Main Condensate Cation 1/20/78; 09:30 (μCi/ml)
^{82}Br	<3.4(-9)	<7.1(-8)	<2.6(-10)	<3.0(-11)	<1.1(-10)	<1.1(-11)
^{131}I	2.3 ± 0.1(-6)	1.9 ± 0.3(-7)	2.2 ± 0.2(-9)	2.6 ± 0.2(-9)	<2.2(-10)	<1.3(-10)
^{132}I	3.2 ± 0.4(-6)	*	<1.8(-9)	<7.7(-9)	<6.8(-8)	<5.4(-8)
^{133}I	6.0 ± 0.2(-6)	<5.1(-8)	3.2 ± 0.3(-9)	3.3 ± 0.3(-9)	<5.6(-11)	<2.5(-10)
^{134}I	<2.2(-6)	*	*	*	*	*
^{135}I	4.8 ± 0.6(-6)	<4.8(-7)	<1.4(-9)	<3.8(-10)	<2.4(-9)	<7.0(-10)
^{88}Rb	*	*	*	*	*	*
^{89}Rb	*	*	*	*	*	*
^{134}Cs	3.1 ± 0.8(-7)	4 ± 2(-8)	<5.2(-10)	<6.6(-10)	4.3 ± 1.6(-10)	9.1 ± 1.5(-10)
^{136}Cs	<8.6(-8)	<3.1(-8)	<2.0(-10)	<1.6(-10)	<2.3(-11)	<2.6(-11)
^{137}Cs	5.1 ± 0.7(-7)	<4.6(-8)	<1.0(-9)	<8.1(-10)	7.8 ± 1.5(-10)	1.8 ± 0.2(-9)
^{138}Cs	<3.2(-7)	*	*	*	*	*
^{24}Na	<9.2(-7)	<1.4(-8)	<1.8(-10)	<1.2(-10)	<1.8(-9)	<7.5(-10)
^{41}Ar	<1.5(-6)	*	<4.7(-10)	<8.0(-9)	*	*
^{51}Cr	<2.0(-7)	<4.9(-9)	<7.9(-11)	<7.2(-11)	<3.6(-10)	<3.1(-10)
^{54}Mn	1.6 ± 0.5(-7)	<4.2(-8)	<4.7(-10)	<5.5(-10)	<6.3(-10)	<5.0(-10)
^{56}Mn	<2.2(-7)	*	<5.4(-9)	<1.2(-9)	<4.0(-8)	<3.7(-8)
^{59}Fe	<3.1(-8)	<5.5(-8)	<3.7(-10)	<2.7(-12)	<6.7(-12)	<3.0(-10)
^{57}Co	<2.5(-8)	<4.2(-10)	<1.1(-11)	<8.2(-12)	<6.4(-12)	<1.3(-10)
^{58}Co	<2.1(-7)	<1.1(-7)	<4.3(-11)	<1.5(-10)	<7.0(-10)	<6.7(-10)
^{60}Co	<5.2(-7)	<1.2(-7)	<1.8(-9)	<2.2(-9)	1.3 ± 0.8(-10)	1.1 ± 0.5(-10)
^{65}Zn	<1.7(-7)	<6.2(-8)	<2.1(-10)	<8.3(-11)	<7.6(-12)	<5.9(-10)
^{91}Sr	<2.4(-7)	<6.2(-7)	<5.7(-10)	<2.7(-10)	<7.7(-10)	<2.5(-10)
^{93}Y	<4.2(-8)	<3.7(-7)	<7.0(-11)	<4.6(-10)	<2.9(-11)	<1.3(-9)
^{95}Zr	<2.2(-9)	<2.0(-8)	<1.4(-10)	<1.9(-10)	<1.6(-10)	<1.7(-11)
^{95}Nb	<1.6(-8)	<1.7(-8)	<3.0(-10)	<3.9(-11)	<1.8(-10)	<2.6(-10)
^{99}Mo	<5.0(-9)	<4.8(-8)	<2.9(-10)	<7.0(-11)	<1.5(-10)	<1.5(-12)

TABLE B.44 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/20/78

Nuclide	Unit #4 Blowdown Flash Tank 1/20/78; 11:50 (μCi/ml)	Unit #4 Main Feed 1/20/78; 10:06 (μCi/ml)	Unit #4 Main Condensate Anion 1/20/78; 09:30 (μCi/ml)	Unit #4 Main Condensate Anion 1/20/78; 09:30 (μCi/ml)	Unit #4 Main Condensate Cation 1/20/78; 09:30 (μCi/ml)	Unit #4 Main Condensate Cation 1/20/78; 09:30 (μCi/ml)
^{103}Ru	<6.7(-8)	<7.9(-9)	<1.3(-11)	2.0 ± 0.7(-10)	<2.8(-10)	<8.7(-11)
^{106}RuD	<1.3(-7)	<6.4(-8)	<2.8(-12)	<4.4(-11)	<3.3(-10)	<1.4(-10)
^{110m}Ag	<3.8(-7)	<8.0(-8)	<7.3(-10)	<3.1(-10)	<9.7(-10)	<1.0(-9)
^{124}Sb	<2.4(-8)	<8.9(-9)	<6.0(-11)	<3.7(-11)	<1.0(-10)	<2.7(-10)
^{125}Sb	<2.0(-8)	<9.6(-9)	<8.7(-11)	<1.6(-11)	<1.3(-10)	<1.2(-10)
^{129}Te	<2.4(-6)	*	<8.3(-8)	*	*	*
^{129m}Te	<8.0(-8)	<1.2(-8)	<8.7(-11)	<2.5(-10)	<5.4(-11)	<2.9(-11)
^{131m}Te	<2.3(-8)	<1.6(-8)	<2.9(-12)	<2.8(-10)	<4.0(-10)	<2.9(-10)
^{132}Te	<8.8(-9)	<1.3(-9)	<7.5(-11)	<7.0(-11)	<9.4(-11)	<5.4(-11)
^{139}Ba	<1.9(-7)	<8.3(-8)	<3.0(-10)	<2.4(-10)	<1.6(-10)	<2.3(-10)
^{140}Ba	<3.9(-8)	<4.0(-8)	<3.0(-10)	6.6 ± 2.6(-10)	<5.3(-11)	<2.4(-10)
^{140}La	<1.5(-8)	<5.6(-8)	<8.1(-11)	<8.2(-11)	<3.1(-10)	<1.9(-11)
^{141}Ce	<5.6(-8)	<2.6(-9)	<9.6(-11)	<1.1(-10)	<1.5(-10)	<1.2(-10)
^{143}Ce	<1.3(-7)	<1.4(-7)	<4.5(-10)	<1.4(-10)	<2.5(-10)	<1.7(-10)
^{144}Ce	6.7 ± 2.1(-7)	<5.9(-9)	<7.6(-12)	<1.2(-10)	<5.7(-11)	<4.7(-11)
^{152}Eu	<4.7(-9)	<8.0(-9)	<4.6(-11)	1.2 ± 0.7(-10)	<4.8(-12)	<3.7(-10)
^{154}Eu	<3.5(-8)	<1.1(-8)	<4.2(-10)	<4.1(-11)	<3.6(-11)	<7.7(-13)
^{187}W	<5.5(-8)	<1.5(-8)	<4.1(-10)	<2.8(-10)	<6.1(-11)	<1.6(-11)
^{239}Np	<6.4(-8)	<7.7(-8)	<1.1(-10)	<4.6(-11)	<4.7(-11)	<2.0(-10)

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* Radionuclide not detected.

TABLE B.45

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/22/78

Nuclide	Steam Generator Blowdown 4A 1/22/78; 11:00 (μCi/ml)	Steam Generator Blowdown 4B 1/22/78; 11:00 (μCi/ml)	Steam Generator Blowdown 4C 1/22/78; 11:00 (μCi/ml)	Main Steam 4A Anion 1/22/78; 10:46 to 14:40 (μCi/ml)	Main Steam 4A Cation 1/22/78; 10:46 to 14:40 (μCi/ml)	Steam Generator Blowdown 4A 1/22/78; 14:45 (μCi/ml)
^{82}Br	<1.9(-6)	<1.2(-7)	<1.7(-7)	<8.2(-9)	<7.6(-11)	*
^{131}I	8.4 ± 0.2(-6)	2.0 ± 0.1(-6)	2.2 ± 0.1(-6)	1.2 ± 0.1(-7)	<7.3(-10)	9.0 ± 0.2(-6)
^{132}I	7.8 ± 0.3(-6)	7.2 ± 1.3(-7)	7.0 ± 2.3(-7)	1.1 ± 0.1(-7)	<4.0(-9)	<4.4(-5)
^{133}I	1.3 ± 0.1(-5)	2.6 ± 0.1(-6)	2.7 ± 0.2(-6)	1.8 ± 0.1(-7)	<1.6(-9)	1.5 ± 0.1(-5)
^{134}I	4.8 ± 0.6(-6)	<3.1(-7)	<4.1(-7)	<3.3(-7)	<5.7(-7)	*
^{135}I	1.3 ± 0.1(-5)	1.8 ± 0.2(-6)	2.0 ± 0.3(-6)	1.5 ± 0.1(-7)	<3.4(-9)	1.3 ± 0.1(-5)
^{88}Rb	<4.1(-6)	*	*	*	*	*
^{89}Rb	<3.4(-6)	*	*	*	*	*
^{134}Cs	1.0 ± 0.1(-6)	1.7 ± 0.5(-7)	3.5 ± 0.7(-7)	8.0(-10)	1.7 0.1(-8)	1.2 ± 0.1(-6)
^{136}Cs	<3.4(-7)	<7.6(-8)	<3.8(-8)	<4.1(-10)	9.6 ± 2.1(-10)	<1.2(-7)
^{137}Cs	2.0 ± 0.1(-6)	3.3 ± 0.5(-7)	6.4 ± 0.9(-7)	<8.0(-10)	3.3 ± 0.1(-8)	2.3 ± 0.1(-6)
^{138}Cs	1.0 ± 0.1(-5)	<1.2(-5)	<6.3(-5)	*	*	*
^{24}Na	5.7 ± 0.3(-6)	1.1 ± 0.1(-9)	9.6 ± 1.4(-7)	<4.6(-10)	5.3 ± 0.2(-8)	6.5 ± 0.5(-6)
^{41}Ar	5.6 ± 1.1(-7)	<1.3(-7)	<7.7(-7)	<3.4(-8)	<6.1(-8)	*
^{51}Cr	<8.5(-8)	<7.2(-8)	<3.0(-8)	<5.3(-11)	<5.6(-10)	<3.6(-8)
^{54}Mn	<8.6(-7)	<1.8(-7)	<2.5(-7)	<4.9(-9)	<6.1(-10)	*
^{56}Mn	<1.5(-8)	<1.0(-7)	<4.3(-7)	<9.2(-10)	<1.3(-8)	<1.4(-5)
^{59}Fe	<4.7(-8)	<7.5(-8)	<1.7(-7)	<7.7(-10)	<6.0(-10)	<1.4(-7)
^{57}Co	3.2 ± 0.7(-7)	<1.1(-8)	<5.0(-8)	<1.0(-9)	<1.2(-9)	<3.9(-8)
^{58}Co	<3.9(-7)	<8.3(-8)	<2.2(-7)	1.25 ± 0.73(-9)	<1.2(-10)	<7.4(-8)
^{60}Co	2.0 ± 1.0(-7)	<1.6(-7)	<1.8(-7)	<1.8(-9)	<2.2(-9)	<1.9(-7)
^{65}Zn	<1.9(-7)	<2.6(-8)	<1.9(-7)	<1.9(-10)	2.1 ± 0.5(-9)	<1.2(-7)
^{91}Sr	<6.8(-8)	<1.6(-7)	<3.1(-8)	<4.5(-10)	<2.2(-9)	<1.1(-7)
^{93}Y	<2.6(-8)	<2.8(-8)	<7.2(-8)	<2.3(-9)	<1.7(-10)	<5.0(-7)
^{95}Zr	<2.6(-8)	<1.8(-9)	<9.4(-8)	<6.1(-10)	<4.6(-10)	<1.1(-8)
^{95}Nb	<9.7(-8)	<6.4(-10)	<1.0(-7)	<7.2(-10)	<1.3(-9)	<1.1(-8)
^{99}Mo	<2.5(-8)	<3.5(-8)	<1.0(-7)	<1.1(-10)	<2.0(-10)	<9.5(-8)

TABLE B.45 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/22/78

Nuclide	Steam Generator Blowdown 4A 1/22/78; 11:00 (μCi/ml)	Steam Generator Blowdown 4B 1/22/78; 11:00 (μCi/ml)	Steam Generator Blowdown 4C 1/22/78; 11:00 (μCi/ml)	Main Steam 4A Anion 1/22/78; 10:46 to 14:40 (μCi/ml)	Main Steam 4A Cation 1/22/78; 10:46 to 14:40 (μCi/ml)	Steam Generator Blowdown 4A 1/22/78; 14:45 (μCi/ml)
^{103}Ru	<3.1(-7)	<2.2(-8)	<6.5(-8)	<8.8(-10)	<2.6(-10)	<7.5(-8)
^{106}RuD	2.4 ± 0.5(-6)	<7.8(-8)	<5.5(-8)	<6.7(-10)	<4.2(-10)	*
^{110m}Ag	<1.5(-6)	<2.4(-7)	<4.5(-7)	<1.8(-9)	<1.6(-8)	<7.1(-7)
^{124}Sb	<1.4(-7)	<3.0(-8)	<3.0(-8)	<4.6(-10)	<7.9(-10)	<7.2(-8)
^{125}Sb	<3.2(-8)	<5.7(-8)	<2.0(-8)	<6.2(-10)	<4.2(-11)	<1.4(-7)
^{129}Te	<1.6(-6)	<9.1(-7)	<2.2(-7)	<1.1(-7)	<1.5(-8)	*
^{129m}Te	<1.7(-7)	<2.3(-8)	<1.6(-7)	<2.2(-10)	<2.1(-10)	<8.7(-9)
^{131m}Te	<5.2(-7)	<4.9(-8)	<4.0(-8)	<3.3(-9)	<4.1(-10)	*
^{132}Te	<5.4(-8)	<7.3(-8)	<2.2(-7)	<5.4(-11)	<4.9(-10)	<1.5(-8)
^{139}Ba	<1.4(-8)	<3.3(-9)	<2.1(-7)	<1.7(-9)	<1.6(-9)	<1.3(-7)
^{140}Ba	<3.1(-7)	<5.0(-8)	<1.2(-8)	<2.5(-10)	2.2 ± 1.0(-9)	<6.2(-8)
^{140}La	<1.8(-8)	<5.7(-8)	<8.1(-8)	<2.7(-10)	<4.2(-10)	1.3 ± 0.4(-7)
^{141}Ce	<3.5(-8)	<6.2(-8)	<6.3(-9)	<1.2(-10)	<1.9(-11)	<9.3(-9)
^{143}Ce	<2.0(-7)	<1.1(-7)	<2.2(-7)	<1.4(-9)	<2.0(-9)	*
^{144}Ce	<3.9(-8)	<7.0(-8)	<6.7(-8)	<7.7(-10)	<7.6(-10)	<6.5(-8)
^{152}Eu	<1.5(-7)	<1.2(-9)	<1.4(-8)	<1.1(-10)	<5.9(-10)	<1.2(-7)
^{154}Eu	<5.7(-8)	<4.9(-8)	<9.4(-9)	<3.6(-11)	<5.2(-10)	<4.2(-8)
^{187}W	<1.8(-7)	<1.1(-7)	<2.1(-7)	<5.6(-10)	<2.1(-10)	<8.8(-8)
^{239}Np	<9.3(-8)	<4.3(-8)	<6.3(-8)	<2.0(-10)	<5.7(-10)	<2.2(-8)

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* Radionuclide not detected.

TABLE B.45 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/22/78

Nuclide	Unit 4 Blowdown Flash Tank 1/22/78; 11:10 (μCi/ml)	Unit 4 Main Feed Anion 1/22/78; 10:46 (μCi/ml)	Unit 4 Main Feed Cation 1/22/78; 10:46 (μCi/ml)	Unit 4 Main Condensate Anion 1/22/78; 10:46 (μCi/ml)	Unit 4 Main Condensate Cation 1/22/78; 10:46 (μCi/ml)
^{82}Br	<8.7(-7)	2.7 ± 1.0(-10)	<5.6(-10)	<2.6(-10)	<7.4(-10)
^{131}I	5.0 ± 0.1(-6)	1.3 ± 0.1(-8)	<6.5(-12)	5.7 ± 0.2(-9)	<1.9(-10)
^{132}I	3.6 ± 0.2(-6)	<1.4(-8)	<2.1(-7)	<4.5(-9)	*
^{133}I	7.8 ± 0.1(-6)	1.8 ± 0.1(-8)	<6.0(-10)	8.6 ± 0.3(-9)	<1.1(-9)
^{134}I	3.4 ± 0.5(-6)	*	*	<1.6(-7)	*
^{135}I	6.4 ± 0.5(-)	1.4 ± 0.1(-8)	2.2 ± 0.7(-8)	6.3 ± 1.1(-9)	<3.1(-9)
^{88}Rb	<5.2(-6)	*	*	*	*
^{89}Rb	<4.9(-5)	*	*	*	*
^{134}Cs	6.4 ± 0.6(-7)	5.1 ± 0.1(-11)	2.0 ± 0.4(-9)	<6.4(-10)	1.1 ± 0.5(-9)
^{136}Cs	<2.1(-7)	<3.3(-11)	<6.8(-10)	<4.1(-11)	<2.0(-10)
^{137}Cs	1.3 ± 0.1(-6)	2.7 ± 1.2(-10)	3.7 ± 0.7(-9)	2.4 ± 1.1(-10)	1.6 ± 0.4(-9)
^{138}Cs	4.1 ± 1.1(-6)	*	*	*	*
^{24}Na	3.4 ± 0.2(-6)	<2.3(-10)	4.9 ± 0.8(-9)	<1.2(-10)	2.4 ± 0.6(-9)
^{41}Ar	<3.0(-7)	<2.6(-8)	*	<4.3(-10)	*
^{51}Cr	<4.3(-8)	<5.5(-10)	<2.7(-11)	<2.8(-11)	<3.1(-10)
^{54}Mn	<4.4(-7)	<5.7(-10)	<3.2(-10)	<4.3(-10)	<9.6(-10)
^{56}Mn	<4.7(-8)	<2.8(-9)	<6.7(-8)	<5.5(-10)	<8.7(-7)
^{59}Fe	<2.2(-8)	<1.2(-10)	<1.4(-9)	<1.2(-10)	<2.1(-10)
^{57}Co	<1.6(-7)	<7.6(-11)	<2.9(-10)	<7.1(-11)	<5.2(-10)
^{58}Co	<1.9(-7)	<2.7(-10)	<8.4(-10)	<4.2(-10)	8.4 ± 3.3(-10)
^{60}Co	1.9 ± 0.7(-7)	<5.0(-10)	<9.0(-10)	<5.4(-10)	<1.2(-9)
^{65}Zn	<1.9(-7)	<2.1(-10)	<8.7(-10)	<1.6(-10)	<6.1(-10)
^{91}Sr	<3.8(-8)	<1.2(-10)	<3.6(-9)	1.9 ± 0.5(-9)	<6.5(-10)
^{93}Y	<2.9(-8)	<2.4(-10)	<2.2(-9)	<8.4(-11)	<2.6(-9)
^{95}Zr	<5.5(-8)	<1.4(-10)	<5.2(-10)	<1.2(-10)	<7.1(-10)
^{95}Nb	<6.7(-9)	<1.2(-10)	7.2 ± 2.0(-10)	<2.1(-11)	<7.9(-10)
^{99}Mo	<5.3(-8)	<7.8(-11)	<5.0(-10)	<3.0(-10)	<1.2(-10)

TABLE B.45 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/22/78

Nuclide	Unit 4 Blowdown Flash Tank 1/22/78; 11:10 (μCi/ml)	Unit 4 Main Feed Anion 1/22/78; 10:46 (μCi/ml)	Unit 4 Main Feed Cation 1/22/78; 10:46 (μCi/ml)	Unit 4 Main Condensate Anion 1/22/78; 10:46 (μCi/ml)	Unit 4 Main Condensate Cation 1/22/78; 10:46 (μCi/ml)
^{103}Ru	<1.2(-7)	<3.5(-10)	<5.5(-10)	<1.6(-10)	<5.3(-10)
^{106}RuD	1.3 ± 0.3(-6)	<9.5(-11)	<5.8(-10)	<6.7(-11)	<2.0(-10)
^{110m}Ag	<2.9(-7)	<6.7(-10)	<2.1(-9)	<4.7(-10)	<1.9(-9)
^{124}Sb	<5.9(-8)	<1.0(-10)	<5.3(-10)	<5.4(-11)	<4.3(-11)
^{125}Sb	<1.3(-8)	<1.1(-10)	<5.6(-10)	4.3 ± 1.7(-10)	<1.2(-10)
^{129}Te	<5.9(-7)	<1.4(-7)	*	<6.8(-8)	*
^{129m}Te	<1.3(-8)	<3.0(-10)	<8.3(-10)	<2.1(-10)	<1.1(-10)
^{131m}Te	<2.4(-7)	<2.9(-11)	<6.5(-10)	<3.8(-10)	<1.1(-10)
^{132}Te	<3.2(-8)	<1.6(-10)	<1.8(-10)	1.8 ± 0.5(-10)	<2.9(-10)
^{139}Ba	<4.2(-8)	<5.6(-10)	<1.9(-9)	<3.9(-10)	<2.0(-9)
^{140}Ba	<4.5(-8)	<7.8(-11)	<2.0(-10)	<1.3(-10)	<1.5(-10)
^{140}La	<4.1(-8)	<4.0(-10)	<1.2(-9)	<1.1(-10)	<6.6(-10)
^{141}Ce	<1.6(-8)	<3.2(-10)	<1.8(-10)	<3.3(-11)	<1.4(-10)
^{143}Ce	<1.3(-8)	<3.3(-10)	<8.1(-11)	7.4 ± 2.3(-10)	<6.9(-10)
^{144}Ce	<1.2(-7)	<2.2(-10)	<7.1(-10)	<2.1(-11)	<1.2(-10)
^{152}Eu	<1.1(-9)	<1.6(-10)	<4.6(-10)	<4.6(-10)	<9.5(-11)
^{154}Eu	<1.7(-7)	<1.3(-10)	<2.2(-10)	<3.8(-10)	<3.7(-10)
^{187}W	<6.1(-8)	<5.3(-10)	<4.1(-10)	<1.4(-10)	<1.4(-9)
^{239}Np	<1.4(-7)	<1.2(-11)	<1.8(-10)	<3.4(-10)	<3.5(-11)

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* Radionuclide not detected.

TABLE B.46

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/23/78

Nuclide	Steam Generator Blowdown 4A 1/23/78; 09:50 (μCi/ml)	Steam Generator Blowdown 4B 1/23/78; 09:55 (μCi/ml)	Steam Generator Blowdown 4C 1/23/78; 09:55 (μCi/ml)	Main Steam 4A Anion 1/23/78; 09:32 to 12:52 (μCi/ml)	Main Steam 4A Cation 1/23/78; 09:32 to 12:52 (μCi/ml)
^{82}Br	<2.6(-6)	<2.4(-7)	<1.4(-7)	<1.9(-8)	<5.6(-10)
^{131}I	1.2 ± 0.1(-5)	2.1 ± 0.1(-6)	2.4 ± 0.1(-6)	1.6 ± 0.1(-7)	<2.8(-10)
^{132}I	1.1 ± 0.1(-5)	8.1 ± 1.4(-7)	6.5 ± 1.7(-7)	1.3 ± 0.1(-7)	<1.5(-8)
^{133}I	1.8 ± 0.1(-5)	2.9 ± 0.1(-6)	3.3 ± 0.1(-6)	2.6 ± 0.1(-7)	6.6 ± 2.4(-10)
^{134}I	7.8 ± 1.2(-6)	9.0 ± 3.4(-7)	<3.7(-7)	6.0 ± 0.7(-8)	*
^{135}I	1.6 ± 0.1(-5)	1.9 ± 0.2(-6)	2.5 ± 0.3(-6)	1.9 ± 0.1(-7)	<2.5(-9)
^{88}Rb	<2.7(-5)	<3.1(-5)	*	<9.0(-7)	*
^{89}Rb	<1.5(-4)	<2.1(-5)	*	<2.0(-6)	*
^{134}Cs	1.4 ± 0.2(-6)	1.7 ± 0.5(-7)	2.6 ± 0.6(-7)	1.1 ± 0.4(-9)	2.5 ± 0.1(-8)
^{136}Cs	<5.3(-8)	<1.2(-7)	<7.6(-8)	<1.5(-9)	1.2 ± 0.2(-9)
^{137}Cs	3.1 ± 0.2(-6)	5.9 ± 0.6(-7)	6.5 ± 0.8(-7)	7.6 ± 2.9(-10)	5.3 ± 0.2(-8)
^{138}Cs	6.8 ± 2.5(-6)	<4.8(-7)	<5.6(-6)	<8.0(-8)	*
^{24}Na	7.9 ± 0.5(-6)	1.1 ± 0.1(-6)	1.3 ± 0.2(-6)	5.4 ± 2.1(-10)	1.27 ± 0.06(-7)
^{41}Ar	<9.7(-7)	<1.7(-7)	<1.3(-7)	<1.1(-8)	<6.7(-8)
^{51}Cr	<1.5(-7)	<1.2(-7)	<2.5(-8)	<9.0(-10)	<6.7(-11)
^{54}Mn	<7.5(-7)	<5.3(-8)	<2.6(-7)	<7.6(-9)	<6.4(-10)
^{56}Mn	<4.1(-7)	<2.3(-7)	<1.6(-7)	<8.9(-10)	<1.1(-8)
^{59}Fe	<9.1(-8)	<5.9(-8)	<9.0(-8)	<2.2(-9)	<2.1(-10)
^{57}Co	<1.4(-7)	<8.5(-9)	<5.3(-8)	4.7 ± 1.5(-10)	<2.4(-10)
^{58}Co	<5.9(-7)	<8.0(-8)	<1.1(-7)	<4.0(-9)	<5.4(-10)
^{60}Co	<1.8(-7)	<1.7(-7)	<2.0(-7)	<6.8(-10)	6.0 ± 3.9(-10)
^{65}Zn	<5.5(-7)	<8.6(-8)	<5.9(-8)	<3.4(-10)	<2.0(-10)
^{91}Sr	<5.2(-8)	<5.1(-8)	<8.0(-8)	<7.0(-10)	<5.1(-10)
^{93}Y	<7.1(-7)	<9.1(-8)	<1.5(-7)	<9.8(-10)	<3.1(-10)
^{95}Zr	<7.9(-8)	<4.2(-8)	<2.0(-8)	<1.2(-10)	<6.9(-11)
^{95}Nb	<1.7(-7)	<1.2(-7)	<3.9(-8)	<3.3(-10)	<1.4(-10)
^{99}Mo	<1.8(-8)	<3.1(-8)	5.1 ± 2.7(-8)	<7.1(-10)	<1.5(-10)

TABLE B.46 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/23/78

Nuclide	Steam Generator Blowdown 4A 1/23/78; 09:50 (μCi/ml)	Steam Generator Blowdown 4B 1/23/78; 09:55 (μCi/ml)	Steam Generator Blowdown 4C 1/23/78; 09:55 (μCi/ml)	Main Steam 4A Anion 1/23/78; 09:32 to 12:52 (μCi/ml)	Main Steam 4A Cation 1/23/78; 09:32 to 12:52 (μCi/ml)
^{103}Ru	<1.6(-7)	<1.4(-7)	<3.2(-8)	<1.6(-9)	<1.2(-10)
^{106}RuD	3.3 ± 1.0(-6)	<1.4(-7)	<1.3(-7)	<1.3(-9)	<3.5(-10)
^{110m}Ag	<2.0(-6)	<2.7(-7)	<3.3(-7)	<1.3(-9)	<1.2(-8)
^{124}Sb	<5.8(-9)	<2.1(-8)	<3.8(-8)	<1.0(-10)	<4.1(-10)
^{125}Sb	<1.4(-7)	2.2 ± 0.8(-7)	<4.6(-8)	<2.2(-10)	<1.6(-11)
^{129}Te	<1.6(-6)	<7.4(-7)	<6.5(-7)	<1.5(-8)	*
^{129m}Te	<5.8(-8)	<3.3(-8)	<5.3(-8)	<1.2(-9)	<1.4(-10)
^{131m}Te	<6.8(-7)	<1.2(-7)	<7.9(-8)	<2.5(-9)	<5.8(-10)
^{132}Te	<2.4(-7)	<8.2(-8)	<8.0(-8)	<1.2(-10)	<4.8(-10)
^{139}Ba	<1.1(-7)	<5.5(-8)	<1.8(-9)	<6.4(-11)	<6.1(-10)
^{140}Ba	1.0 ± 0.4(-6)	<3.4(-8)	1.9 ± 1.0(-7)	<9.1(-10)	2.4 ± 0.7(-9)
^{140}La	<2.2(-7)	<5.7(-8)	<7.6(-8)	<1.3(-10)	6.7 ± 1.9(-10)
^{141}Ce	<1.5(-7)	<2.1(-8)	<2.0(-8)	<2.6(-10)	<1.2(-10)
^{143}Ce	<2.4(-7)	<1.7(-7)	<6.7(-8)	<3.7(-10)	<5.0(-10)
^{144}Ce	<3.1(-8)	<4.9(-9)	<1.2(-8)	<1.3(-10)	<2.6(-10)
^{152}Eu	<5.2(-7)	<1.4(-8)	<1.3(-7)	<3.2(-10)	<3.0(-10)
^{154}Eu	<3.6(-7)	<6.1(-8)	<9.3(-8)	<4.0(-10)	<8.1(-10)
^{187}W	<2.3(-7)	<3.4(-8)	<6.8(-8)	<1.1(-9)	<1.2(-9)
^{239}Np	<9.4(-8)	<9.9(-8)	<2.6(-8)	<6.3(-10)	<4.0(-10)

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* Radionuclide not detected.

TABLE B.46 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/23/78

Nuclide	Unit 4 Blowdown Flash Tank 1/23/78; 09:55 (μCi/ml)	Unit 4 Main Feed Anion 1/23/78; 09:32 to 12:52 (μCi/ml)	Unit 4 Main Feed Cation 1/23/78; 09:32 to 12:52 (μCi/ml)	Unit 4 Main Condensate Anion 1/23/78; 09:32 to 12:52 (μCi/ml)	Unit 4 Main Condensate Cation 1/23/78; 09:32 to 12:52 (μCi/ml)
^{82}Br	<1.2(-7)	<1.7(-9)	<2.7(-10)	<5.4(-10)	<6.1(-11)
^{131}I	7.2 ± 0.3(-6)	2.9 ± 0.1(-8)	<5.3(-11)	6.9 ± 0.2(-9)	<3.1(-11)
^{132}I	5.0 ± 0.7(-6)	2.7 ± 0.4(-8)	<1.2(-8)	3.8 ± 0.9(-9)	<2.2(-8)
^{133}I	1.0 ± 0.1(-5)	4.5 ± 0.1(-8)	<4.4(-10)	9.9 ± 0.5(-9)	<7.7(-10)
^{134}I	<4.4(-6)	<1.9(-7)	*	<5.3(-10)	*
^{135}I	8.8 ± 1.1(-6)	4.4 ± 0.3(-8)	<1.9(-9)	1.1 ± 0.1(-8)	<1.1(-9)
^{88}Rb	*	*	*	*	*
^{89}Rb	*	*	*	*	*
^{134}Cs	1.5 ± 0.2(-6)	3.0 ± 1.6(-10)	3.8 ± 0.3(-9)	<2.4(-10)	7.2 ± 1.6(-10)
^{136}Cs	<2.4(-7)	<1.0(-10)	<2.2(-10)	<1.6(-10)	<2.1(-10)
^{137}Cs	1.8 ± 0.2(-6)	<3.0(-10)	7.8 ± 0.3(-9)	5.0 ± 1.8(-10)	1.4 ± 0.2(-9)
^{138}Cs	<1.5(-5)	*	*	<6.8(-8)	*
^{24}Na	4.2 ± 0.4(-6)	<1.1(-9)	1.7 ± 0.1(-8)	5.1 ± 1.6(-10)	3.0 ± 0.5(-9)
^{41}Ar	<4.0(-7)	<1.1(-8)	<5.7(-7)	<4.2(-9)	<2.7(-8)
^{51}Cr	<2.4(-7)	<3.0(-10)	<1.2(-10)	<3.5(-10)	<3.3(-11)
^{54}Mn	<6.1(-7)	<1.4(-9)	2.8 ± 1.5(-10)	7.8 ± 2.4(-10)	3.1 ± 1.4(-10)
^{56}Mn	<9.2(-8)	<1.8(-9)	<3.5(-8)	<3.2(-10)	<3.2(-8)
^{59}Fe	<1.8(-9)	<9.5(-11)	<7.9(-11)	<2.3(-10)	<1.7(-10)
^{57}Co	<1.3(-7)	<3.7(-10)	<1.7(-10)	<1.5(-10)	<1.6(-11)
^{58}Co	<2.8(-7)	<3.0(-10)	<2.0(-10)	<1.8(-10)	<2.6(-10)
^{60}Co	<3.1(-7)	<1.1(-9)	<4.8(-10)	<6.7(-10)	4.3 ± 3.1(-10)
^{65}Zn	<1.6(-7)	<3.8(-11)	<7.4(-11)	<2.6(-10)	<3.0(-10)
^{91}Sr	<2.9(-7)	<1.7(-10)	<6.0(-10)	<1.4(-10)	<2.0(-10)
^{93}Y	<9.8(-8)	<8.3(-11)	<9.2(-10)	<4.0(-10)	<7.5(-10)
^{95}Zr	<3.3(-7)	<4.2(-10)	<2.7(-10)	<2.4(-10)	<1.1(-10)
^{95}Nb	<7.7(-8)	<1.6(-10)	<1.7(-10)	<1.7(-11)	<9.8(-11)
^{99}Mo	<2.1(-7)	<3.3(-10)	<7.8(-12)	<3.2(-10)	<1.8(-11)

TABLE B.46 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/23/78

Nuclide	Unit 4 Blowdown Flash Tank 1/23/78; 09:55 (μCi/ml)	Unit 4 Main Feed Anion 1/23/78; 09:32 to 12:52 (μCi/ml)	Unit 4 Main Feed Cation 1/23/78; 09:32 to 12:52 (μCi/ml)	Unit 4 Main Condensate Anion 1/23/78; 09:32 to 12:52 (μCi/ml)	Unit 4 Main Condensate Cation 1/23/78; 09:32 to 12:52 (μCi/ml)
^{103}Ru	<2.5(-7)	<1.4(-10)	1.9 ± 0.8(-10)	<6.1(-10)	<1.8(-10)
^{106}RuD	<1.6(-8)	<4.4(-10)	<3.9(-10)	<1.8(-10)	<4.6(-10)
^{110m}Ag	<1.4(-6)	<6.8(-10)	<2.4(-9)	2.0 ± 0.9(-10)	<9.9(-10)
^{124}Sb	<4.0(-9)	<5.5(-11)	<4.6(-11)	<1.6(-10)	<2.2(-11)
^{125}Sb	<7.9(-9)	<1.4(-10)	<2.4(-11)	<2.6(-10)	<2.4(-10)
^{129}Te	<2.4(-6)	<9.3(-8)	*	<1.2(-8)	*
^{129m}Te	<8.7(-8)	<2.3(-10)	<2.7(-11)	<6.6(-11)	<6.8(-11)
^{131m}Te	<4.7(-7)	<7.1(-10)	<6.5(-10)	<4.6(-11)	<3.8(-10)
^{132}Te	3.1 ± 0.6(-7)	<3.4(-10)	<1.2(-10)	<3.1(-10)	<2.0(-10)
^{139}Ba	<8.8(-8)	<3.5(-10)	<3.2(-12)	<2.2(-10)	<1.5(-10)
^{140}Ba	<8.4(-8)	<3.1(-11)	7.0 ± 2.9(-10)	<1.3(-10)	<1.6(-10)
^{140}La	<2.4(-7)	<1.9(-10)	<2.8(-10)	<7.8(-11)	<9.3(-11)
^{141}Ce	<1.9(-8)	<3.4(-10)	<7.6(-11)	<1.3(-10)	<8.5(-11)
^{143}Ce	<6.1(-7)	<2.5(-10)	<4.7(-10)	<7.4(-10)	<1.3(-10)
^{144}Ce	<3.2(-7)	<4.1(-10)	<1.3(-10)	<1.2(-11)	<8.8(-13)
^{152}Eu	<5.5(-7)	<1.1(-10)	<3.3(-10)	<3.1(-11)	<1.1(-10)
^{154}Eu	<3.2(-7)	<6.3(-11)	<2.4(-11)	<2.8(-10)	<4.0(-11)
^{187}W	<1.5(-7)	<1.3(-10)	<7.7(-10)	<8.4(-10)	<2.1(-10)
^{239}Np	2.3 ± 0.4(-6)	<8.4(-11)	<5.4(-10)	<6.5(-11)	<4.3(-11)

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* Radionuclide not detected.

TABLE B.47

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/24/78

Nuclide	Steam Generator Blowdown 4A 1/24/78; 09:55 (μCi/ml)	Steam Generator Blowdown 4B 1/24/78; 09:58 (μCi/ml)	Steam Generator Blowdown 4C 1/24/78; 10:05 (μCi/ml)	Main Steam 4A Anion 1/24/78; 09:25 (μCi/ml)	Main Steam 4A Cation 1/24/78; 09:25 (μCi/ml)	Main Steam 4B 1/24/78; 09:50 (μCi/ml)
^{82}Br	<3.5(-6)	<2.3(-7)	<4.5(-7)	<5.6(-9)	<1.3(-10)	<3.3(-9)
^{131}I	1.3 ± 0.1(-5)	2.7 ± 0.2(-6)	2.9 ± 0.1(-6)	1.8 ± 0.1(-7)	<5.9(-10)	<3.7(-8)
^{132}I	1.2 ± 0.1(-5)	7.6 ± 1.1(-7)	1.1 ± 0.2(-6)	1.4 ± 0.1(-7)	<6.0(-8)	<3.6(-7)
^{133}I	2.1 ± 0.1(-5)	3.4 ± 0.1(-6)	3.6 ± 0.2(-6)	2.8 ± 0.1(-7)	<1.5(-10)	<1.2(-8)
^{134}I	6.5 ± 1.0(-6)	8.8 ± 2.0(-7)	<3.9(-7)	<8.4(-7)	*	<1.4(-5)
^{135}I	2.1 ± 0.1(-5)	2.3 ± 0.3(-6)	2.8 ± 0.5(-6)	2.4 ± 0.1(-7)	<9.9(-11)	<1.3(-7)
^{88}Rb	1.1 ± 0.6(-5)	<1.6(-6)	<2.2(-5)	*	*	*
^{89}Rb	1.5 ± 1.0(-5)	<5.3(-7)	<5.0(-6)	*	*	*
^{134}Cs	1.6 ± 0.2(-6)	3.3 ± 0.9(-7)	4.1 ± 0.9(-7)	<9.4(-10)	2.57 ± 0.05(-8)	<1.3(-7)
^{136}Cs	<1.9(-7)	<1.6(-7)	<2.7(-7)	<2.3(-11)	1.8 ± 0.3(-9)	<4.0(-8)
^{137}Cs	3.5 ± 0.2(-6)	6.2 ± 1.1(-7)	5.0 ± 1.2(-7)	6.9 ± 2.1(-10)	5.2 ± 0.1(-8)	<7.5(-8)
^{138}Cs	9.8 ± 1.6(-6)	8.8 ± 3.1(-7)	<9.8(-7)	*	*	*
^{24}Na	9.0 ± 0.5(-6)	1.0 ± 0.2(-6)	1.4 ± 0.2(-6)	<1.9(-9)	1.4 ± 0.1(-7)	<7.8(-11)
^{41}Ar	<1.4(-6)	<2.3(-7)	<1.2(-7)	<9.5(-8)	<2.5(-7)	<2.2(-7)
^{51}Cr	<3.1(-7)	<1.7(-7)	<1.0(-7)	<1.1(-9)	<1.3(-10)	<7.4(-8)
^{54}Mn	<1.1(-6)	<2.3(-7)	<5.0(-8)	<4.5(-9)	<7.2(-11)	7.8 ± 3.8(-8)
^{56}Mn	<2.1(-7)	<5.4(-8)	<5.0(-7)	<3.1(-9)	<1.1(-7)	<5.1(-7)
^{59}Fe	<2.9(-7)	<4.3(-7)	<3.1(-7)	<1.8(-9)	<1.7(-10)	<2.8(-8)
^{57}Co	<1.2(-7)	<1.0(-8)	<1.6(-7)	<6.6(-9)	<1.5(-10)	<2.3(-8)
^{58}Co	<9.3(-7)	<2.2(-7)	<3.0(-8)	<4.0(-10)	<5.0(-10)	<8.0(-8)
^{60}Co	<2.7(-7)	<1.7(-7)	<2.0(-7)	<7.0(-10)	<7.2(-9)	<2.8(-8)
^{65}Zn	<2.7(-7)	<2.3(-8)	<2.7(-7)	<7.4(-10)	<2.8(-10)	<3.2(-8)
^{91}Sr	<3.4(-7)	<3.8(-8)	<1.5(-7)	<1.6(-9)	<2.6(-9)	<8.0(-9)
^{93}Y	<2.6(-7)	<1.1(-8)	<3.9(-7)	<3.3(-10)	<1.1(-9)	1.6 ± 0.5(-6)
^{95}Zr	<1.5(-7)	<5.9(-8)	<5.5(-8)	<8.5(-10)	<3.4(-10)	<9.4(-8)
^{95}Nb	<1.4(-7)	<3.6(-8)	<1.9(-7)	<3.5(-10)	<5.0(-10)	<1.0(-7)
^{99}Mo	<6.0(-7)	<4.3(-8)	<7.0(-8)	<2.0(-10)	<6.3(-11)	<7.4(-9)

TABLE B.47 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/24/78

Nuclide	Steam Generator Blowdown 4A 1/24/78; 09:55 (μCi/ml)	Steam Generator Blowdown 4B 1/24/78; 09:58 (μCi/ml)	Steam Generator Blowdown 4C 1/24/78; 10:05 (μCi/ml)	Main Steam 4A Anion 1/24/78; 09:25 (μCi/ml)	Main Steam 4A Cation 1/24/78; 09:25 (μCi/ml)	Main Steam 4B 1/24/78; 09:50 (μCi/ml)
^{103}Ru	<3.2(-7)	<3.2(-8)	<3.4(-8)	<3.8(-10)	<8.2(-11)	<4.0(-8)
^{106}RuD	6.2 ± 1.6(-6)	<7.4(-8)	<5.5(-8)	<1.2(-9)	<6.7(-10)	<1.0(-8)
^{110m}Ag	<2.4(-6)	<3.8(-7)	<5.3(-7)	<1.2(-9)	<3.9(-9)	<8.7(-8)
^{124}Sb	<8.8(-8)	<5.2(-9)	<2.2(-8)	<2.1(-10)	<3.5(-11)	<4.6(-8)
^{125}Sb	<6.2(-9)	<8.7(-8)	<2.8(-7)	<2.2(-10)	<8.0(-10)	<1.3(-7)
^{129}Te	<1.4(-6)	<3.9(-7)	<2.4(-8)	<1.3(-7)	*	<5.5(-7)
^{129m}Te	<4.5(-8)	<3.3(-8)	<8.7(-8)	<1.4(-9)	1.1 ± 0.4(-8)	<1.8(-8)
^{131m}Te	<8.3(-7)	<6.1(-8)	<5.9(-9)	<2.3(-9)	<1.7(-10)	<3.6(-8)
^{132}Te	2.7 ± 1.0(-7)	<1.6(-8)	<1.7(-7)	<1.1(-10)	<1.6(-10)	<7.1(-8)
^{139}Ba	<1.3(-8)	<6.5(-8)	<3.4(-7)	<2.6(-10)	<8.5(-10)	<5.7(-8)
^{140}Ba	<1.2(-7)	<6.6(-8)	<1.8(-8)	<4.0(-11)	2.4 ± 0.6(-9)	<5.7(-9)
^{140}La	<2.5(-7)	<2.3(-8)	<3.0(-8)	<5.8(-10)	<4.9(-10)	<9.2(-8)
^{141}Ce	<3.9(-7)	<5.1(-8)	<1.8(-7)	<2.8(-11)	<1.9(-10)	<6.9(-8)
^{143}Ce	<2.6(-7)	<1.6(-7)	<3.4(-7)	<6.7(-10)	<9.6(-11)	<3.9(-8)
^{144}Ce	<3.4(-7)	<3.1(-8)	<1.9(-7)	<1.3(-10)	<1.8(-10)	<1.2(-7)
^{152}Eu	<1.7(-7)	<1.1(-8)	<2.6(-7)	6.7 ± 3.4(-10)	<4.2(-11)	<1.3(-7)
^{154}Eu	<4.1(-7)	<1.2(-7)	<2.0(-7)	<7.6(-10)	<3.4(-10)	<1.1(-7)
^{187}W	<2.8(-7)	<6.9(-8)	<1.5(-7)	<1.2(-9)	<1.6(-10)	<1.2(-7)
^{239}Np	<3.8(-8)	<3.2(-8)	<3.4(-7)	<1.9(-11)	<2.0(-10)	<9.6(-9)

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* Radionuclide not detected.

TABLE B.47 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/24/78

Nuclide	Main Steam 4C 1/24/78; 09:43 (μCi/ml)	Unit 4 Blowdown Flash Tank 1/24/78; 10:36 (μCi/ml)	Unit 4 Main Feedwater Anion 1/24/78; 09:25 (μCi/ml)	Unit 4 Main Feedwater Cation 1/24/78; 09:25 (μCi/ml)	Unit 4 Main Condensate Anion 1/24/78; 09:25 (μCi/ml)	Unit 4 Main Condensate Cation 1/24/78; 09:25 (μCi/ml)
^{82}Br	<3.1(-8)	<1.4(-6)	<1.6(-10)	<7.8(-10)	<7.8(-11)	<9.4(-11)
^{131}I	<1.0(-8)	8.6 ± 0.3(-6)	1.7 ± 0.1(-8)	<2.0(-10)	6.5 ± 0.3(-9)	1.9 ± 1.1(-10)
^{132}I	<3.6(-7)	5.2 ± 0.3(-6)	<2.3(-8)	<7.3(-8)	<1.9(-8)	<2.6(-8)
^{133}I	<6.7(-8)	1.2 ± 0.1(-5)	2.4 ± 0.1(-8)	<2.1(-10)	1.0 ± 0.1(-8)	<9.6(-10)
^{134}I	<5.6(-6)	2.3 ± 0.4(-6)	*	*	*	*
^{135}I	<7.3(-8)	1.0 ± 0.1(-5)	2.8 ± 0.4(-8)	<2.3(-9)	1.0 ± 0.2(-8)	<2.2(-9)
^{88}Rb	*	<1.4(-5)	*	*	*	*
^{89}Rb	*	<4.0(-6)	*	*	*	*
^{134}Cs	<1.2(-7)	1.2 ± 0.1(-6)	<6.1(-10)	2.4 ± 0.4(-9)	<3.1(-10)	1.6 ± 0.3(-9)
^{136}Cs	<6.9(-9)	<1.1(-7)	<6.3(-11)	<9.8(-12)	<8.1(-11)	<2.0(-11)
^{137}Cs	8.8 ± 4.7(-8)	2.2 ± 0.1(-6)	<4.3(-10)	6.0 ± 0.4(-9)	<3.8(-10)	2.2 ± 0.3(-9)
^{138}Cs	*	4.2 ± 1.1(-6)	*	*	*	*
^{24}Na	<1.1(-7)	5.2 ± 0.4(-6)	<1.3(-9)	1.2 ± 0.1(-8)	<5.4(-10)	4.0 ± 0.8(-9)
^{41}Ar	<2.1(-7)	<4.9(-7)	<2.8(-8)	<1.5(-8)	<5.1(-8)	<1.2(-6)
^{51}Cr	<2.3(-8)	<1.4(-7)	<5.5(-11)	<3.9(-10)	<1.4(-10)	<7.8(-11)
^{54}Mn	<8.5(-8)	<5.5(-7)	<1.1(-9)	<8.5(-10)	3.6 ± 1.5(-10)	<6.8(-10)
^{56}Mn	<9.5(-8)	<1.5(-7)	<6.3(-9)	<5.2(-8)	<7.4(-9)	<4.4(-8)
^{59}Fe	<7.0(-8)	<1.3(-7)	<8.5(-11)	<2.8(-10)	<8.3(-10)	<3.8(-10)
^{57}Co	<3.0(-8)	<6.8(-8)	<1.9(-10)	<3.3(-12)	<3.8(-11)	<1.5(-10)
^{58}Co	<7.3(-8)	<2.5(-7)	<6.8(-10)	<3.0(-10)	<3.8(-10)	<2.6(-10)
^{60}Co	<1.6(-7)	<1.8(-7)	<1.3(-9)	6.2 ± 5.0(-10)	<9.6(-10)	<1.1(-9)
^{65}Zn	<9.9(-8)	<3.4(-8)	<2.7(-10)	<7.9(-10)	<2.6(-10)	<1.7(-10)
^{91}Sr	<2.8(-8)	<2.6(-8)	<1.6(-9)	<1.2(-10)	<1.2(-10)	<8.0(-10)
^{93}Y	<5.9(-8)	<9.4(-9)	<1.4(-9)	<8.6(-10)	<2.8(-10)	<1.9(-9)
^{95}Zr	<3.1(-9)	<4.3(-8)	<2.5(-10)	<1.5(-10)	<2.0(-10)	<1.5(-10)
^{95}Nb	<4.0(-8)	<1.3(-7)	<5.4(-10)	<3.9(-10)	<2.1(-10)	<2.0(-10)
^{99}Mo	<3.5(-8)	<9.7(-8)	<2.7(-10)	<2.6(-10)	1.8 ± 0.7(-10)	<2.7(-10)

TABLE B.47 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/24/78

Nuclide	Main Steam 4C 1/24/78; 09:43 (μCi/ml)	Unit 4 Blowdown Flash Tank 1/24/78; 10:36 (μCi/ml)	Unit 4 Main Feedwater Anion 1/24/78; 09:25 (μCi/ml)	Unit 4 Main Feedwater Cation 1/24/78; 09:25 (μCi/ml)	Unit 4 Main Condensate Anion 1/24/78; 09:25 (μCi/ml)	Unit 4 Main Condensate Cation 1/24/78; 09:25 (μCi/ml)
^{103}Ru	<1.6(-8)	<1.4(-7)	<6.6(-10)	<3.1(-10)	<4.8(-10)	<5.2(-11)
^{106}RuD	<3.1(-8)	<2.3(-7)	3.2 ± 1.4(-9)	<2.2(-10)	<1.5(-10)	<1.3(-10)
^{110m}Ag	<1.5(-7)	<1.2(-6)	<1.0(-9)	<8.2(-10)	<7.5(-10)	<1.4(-9)
^{124}Sb	<5.9(-8)	<1.4(-7)	<5.5(-11)	<6.5(-11)	<1.6(-10)	<3.7(-10)
^{125}Sb	<1.1(-7)	<1.5(-8)	<2.1(-10)	<4.4(-10)	<1.3(-10)	<1.4(-10)
^{129}Te	<2.6(-6)	<5.9(-7)	*	*	<2.1(-7)	*
^{129m}Te	<7.0(-8)	<1.6(-8)	<8.6(-10)	<1.2(-10)	<4.6(-10)	<2.0(-10)
^{131m}Te	<1.3(-7)	<5.1(-7)	<1.5(-10)	<4.9(-10)	<1.0(-10)	<2.5(-10)
^{132}Te	<9.2(-8)	<1.5(-7)	<1.5(-10)	<4.2(-10)	<2.2(-10)	<2.0(-10)
^{139}Ba	<1.3(-8)	<1.6(-7)	<9.5(-10)	<2.7(-10)	<4.7(-10)	<1.1(-9)
^{140}Ba	<4.2(-8)	<1.3(-7)	<1.4(-10)	<5.7(-10)	<1.2(-10)	<1.1(-10)
^{140}La	<3.1(-10)	<1.1(-7)	<2.0(-10)	<2.7(-11)	<3.7(-10)	<1.8(-10)
^{141}Ce	<1.9(-8)	<1.2(-7)	<4.0(-11)	<2.3(-10)	<3.6(-10)	<6.0(-11)
^{143}Ce	<1.1(-7)	<2.0(-7)	<1.2(-10)	<8.1(-11)	<1.1(-10)	<7.6(-10)
^{144}Ce	<1.1(-8)	<1.7(-7)	<1.2(-10)	<1.9(-10)	<4.2(-11)	<2.4(-11)
^{152}Eu	<2.8(-8)	<6.8(-8)	<5.3(-10)	<6.7(-11)	<2.7(-10)	<1.9(-10)
^{154}Eu	<5.3(-8)	<1.9(-8)	<2.5(-10)	<3.3(-10)	<1.3(-10)	<1.4(-10)
^{187}W	<4.9(-8)	<1.2(-7)	<1.9(-10)	<7.6(-10)	<4.9(-10)	<7.2(-11)
^{239}Np	<7.8(-8)	<1.6(-7)	<5.7(-11)	<1.4(-10)	<1.0(-10)	<2.9(-11)

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* Radionuclide not detected.

TABLE B.47 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/24/78

Nuclide	Main Steam 4A 1/24/78; 09:55 (μCi/ml)	Unit 4 Feedwater 1/24/78; 10:10 (μCi/ml)	Unit 4 Condensate 1/24/78; 10:10 (μCi/ml)	Steam Generator Blowdown 4A 1/24/78; 12:20 (μCi/ml)
^{82}Br	*	<8.8(-8)	<5.2(-8)	*
^{131}I	2.1 ± 0.4(-7)	1.3 ± 0.4(-7)	<4.7(-8)	1.3 ± 0.1(-5)
^{132}I	3.9 ± 1.2(-7)	<1.2(-7)	<7.1(-7)	1.0 ± 0.1(-5)
^{133}I	3.5 ± 0.5(-7)	<5.4(-8)	<4.0(-8)	2.1 ± 0.1(-5)
^{134}I	2.6 ± 1.2(-6)	<6.1(-7)	<6.2(-6)	6.8 ± 1.0(-6)
^{135}I	<7.3(-8)	<2.3(-7)	*	1.7 ± 0.1(-5)
^{88}Rb	*	*	*	<1.3(-4)
^{89}Rb	*	*	*	*
^{134}Cs	7.5 ± 4.0(-8)	1.5 ± 0.8(-7)	<8.6(-8)	2.2 ± 0.1(-6)
^{136}Cs	<2.8(-9)	<1.2(-7)	<9.1(-8)	*
^{137}Cs	1.1 ± 0.4(-7)	<1.2(-7)	<8.1(-8)	3.5 ± 0.2(-6)
^{138}Cs	<1.2(-5)	<1.4(-5)	*	9.0 ± 2.8(-6)
^{24}Na	<2.1(-7)	<2.6(-7)	<3.9(-8)	9.0 ± 0.4(-6)
^{41}Ar	<1.3(-7)	<1.4(-7)	7.3 ± 2.3(-7)	*
^{51}Cr	3.5 ± 4.7(-7)	<1.8(-8)	*	<2.4(-8)
^{54}Mn	<1.1(-7)	<4.6(-8)	<1.9(-8)	<2.3(-7)
^{56}Mn	<4.6(-7)	<5.6(-7)	<4.4(-7)	<6.4(-7)
^{59}Fe	<6.9(-9)	<4.6(-8)	*	<2.9(-7)
^{57}Co	<1.5(-8)	<2.0(-7)	<3.8(-8)	<1.6(-7)
^{58}Co	<7.0(-8)	<4.6(-8)	<1.1(-7)	<7.4(-7)
^{60}Co	<2.0(-7)	<1.8(-7)	<1.5(-7)	<2.2(-7)
^{65}Zn	<4.2(-8)	*	*	<3.0(-9)
^{91}Sr	<1.6(-8)	<1.4(-7)	<1.8(-8)	<1.9(-7)
^{93}Y	<1.4(-7)	<1.0(-7)	<1.3(-7)	<1.8(-7)
^{95}Zr	<1.8(-8)	<1.8(-7)	<9.8(-8)	<1.3(-7)
^{95}Nb	<1.1(-7)	<1.9(-7)	<8.3(-9)	<2.7(-7)
^{99}Mo	<1.2(-7)	*	*	<1.8(-7)

TABLE B.47 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/24/78

Nuclide	Main Steam 4A 1/24/78; 09:55 (μCi/ml)	Unit 4 Feedwater 1/24/78; 10:10 (μCi/ml)	Unit 4 Condensate 1/24/78; 10:10 (μCi/ml)	Steam Generator Blowdown 4A 1/24/78; 12:20 (μCi/ml)
^{103}Ru	*	<1.5(-7)	<2.0(-8)	<6.4(-8)
^{106}RuD	<1.0(-7)	<3.5(-8)	<5.0(-8)	1.7 ± 0.6(-6)
^{110m}Ag	*	*	*	*
^{124}Sb	<1.4(-7)	<2.0(-7)	<9.2(-8)	<1.6(-7)
^{125}Sb	*	3.4 ± 1.0(-7)	<7.8(-8)	<3.0(-7)
^{129}Te	<1.0(-6)	<5.1(-7)	<6.1(-7)	*
^{129m}Te	<1.0(-7)	<7.4(-8)	<8.1(-8)	<2.0(-7)
^{131m}Te	<1.3(-7)	<2.6(-7)	<9.8(-8)	*
^{132}Te	<9.5(-9)	<8.4(-9)	*	*
^{139}Ba	<6.8(-8)	<2.1(-7)	<1.4(-7)	<1.2(-7)
^{140}Ba	<8.8(-8)	<5.9(-8)	<3.4(-8)	<1.6(-7)
^{140}La	<1.4(-7)	<1.4(-7)	<1.0(-7)	<3.0(-8)
^{141}Ce	<1.1(-7)	<9.8(-8)	<1.1(-8)	*
^{143}Ce	*	*	*	<3.3(-8)
^{144}Ce	<1.0(-7)	<1.0(-7)	<1.4(-7)	<1.1(-7)
^{152}Eu	<1.0(-7)	<6.9(-8)	<8.4(-8)	*
^{154}Eu	<1.0(-7)	<1.4(-8)	<7.6(-9)	<1.8(-8)
^{187}W	<4.6(-9)	<7.8(-8)	<9.8(-8)	<2.6(-7)
^{239}Np	<8.2(-9)	<4.0(-8)	*	<1.8(-7)

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* Radionuclide not detected.

TABLE B.48

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/26/78

Nuclide	Steam Generator Blowdown 4A 1/26/78; 09:00 (μCi/ml)	Steam Generator Blowdown 4B 1/26/78; 09:13 (μCi/ml)	Steam Generator Blowdown 4C 1/26/78; 09:10 (μCi/ml)	Main Steam 4A 1/26/78; 09:00 (μCi/ml)	Main Steam 4B 1/26/78; 09:13 (μCi/ml)
^{82}Br	<1.7(-5)	<1.8(-6)	<2.7(-6)	<2.6(-7)	<8.8(-8)
^{131}I	7.4 ± 0.1(-4)	2.4 ± 0.1(-4)	2.7 ± 0.1(-4)	1.1 ± 0.1(-5)	7.1 ± 0.5(-7)
^{132}I	5.4 ± 0.2(-5)	4.4 ± 0.5(-6)	6.5 ± 0.6(-6)	7.0 ± 1.4(-7)	<1.2(-7)
^{133}I	4.0 ± 0.1(-4)	1.2 ± 0.1(-4)	1.4 ± 0.1(-4)	5.7 ± 0.2(-6)	3.5 ± 0.5(-7)
^{134}I	2.3 ± 0.2(-5)	<1.2(-6)	<4.3(-6)	<4.9(-7)	<4.9(-7)
^{135}I	9.8 ± 0.3(-5)	1.8 ± 0.1(-5)	2.3 ± 0.2(-5)	1.2 ± 0.2(-6)	<8.9(-8)
^{88}Rb	<3.5(-5)	<2.2(-5)	<5.3(-5)	<1.8(-5)	*
^{89}Rb	<2.2(-5)	<7.1(-6)	<8.0(-5)	*	*
^{134}Cs	2.5 ± 0.1(-5)	6.9 ± 0.7(-6)	8.6 ± 0.5(-6)	3.4 ± 1.0(-7)	<1.1(-7)
^{136}Cs	1.3 ± 0.1(-5)	3.5 ± 0.2(-6)	4.6 ± 0.3(-6)	2.2 ± 0.5(-7)	<3.5(-8)
^{137}Cs	3.8 ± 0.1(-5)	1.2 ± 0.1(-5)	1.2 ± 0.1(-5)	4.6 ± 0.9(-7)	5.8 ± 4.5(-8)
^{138}Cs	5.6 ± 0.4(-5)	1.9 ± 1.1(-6)	<6.3(-6)	<2.5(-6)	<1.3(-6)
^{24}Na	2.0 ± 0.1(-5)	3.9 ± 0.4(-6)	3.3 ± 0.5(-6)	3.4 ± 0.9(-7)	<3.9(-9)
^{41}Ar	<6.3(-6)	<2.1(-6)	<2.2(-6)	<5.9(-7)	<5.3(-8)
^{51}Cr	<1.4(-6)	<1.5(-7)	<1.8(-6)	<1.3(-7)	<1.3(-7)
^{54}Mn	<5.2(-6)	<1.1(-6)	<2.0(-6)	2.6 ± 0.8(-7)	<9.0(-8)
^{56}Mn	<1.0(-6)	<7.7(-8)	<2.9(-7)	<3.2(-7)	<1.7(-7)
^{59}Fe	<1.9(-6)	<6.9(-8)	<4.2(-7)	<1.6(-7)	<1.2(-7)
^{57}Co	<8.8(-7)	<4.4(-7)	<4.3(-8)	<1.3(-7)	<9.0(-8)
^{58}Co	<2.2(-6)	<6.9(-7)	5.4 ± 1.8(-7)	<1.8(-6)	<1.0(-7)
^{60}Co	6.0 ± 2.4(-7)	2.6 ± 1.5(-7)	<3.1(-7)	6.9 ± 1.4(-7)	5.4 ± 1.2(-7)
^{65}Zn	<8.1(-8)	<1.4(-7)	<1.6(-7)	<5.5(-8)	<1.5(-7)
^{91}Sr	<1.7(-6)	<3.7(-7)	<2.0(-7)	<3.5(-8)	<1.4(-7)
^{93}Y	<1.4(-6)	7.6 ± 2.4(-6)	<2.0(-6)	<2.4(-7)	<1.8(-7)
^{95}Zr	<5.3(-7)	<1.2(-7)	<4.0(-7)	<1.1(-7)	<3.6(-8)
^{95}Nb	<2.4(-6)	<6.0(-7)	<7.1(-7)	<2.8(-8)	<1.2(-7)
^{99}Mo	<2.4(-7)	<1.8(-7)	<2.7(-7)	<5.2(-8)	<1.6(-8)

TABLE B.48 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/26/78

Nuclide	Steam Generator Blowdown 4A 1/26/78; 09:00 (μCi/ml)	Steam Generator Blowdown 4B 1/26/78; 09:13 (μCi/ml)	Steam Generator Blowdown 4C 1/26/78; 09:10 (μCi/ml)	Main Steam 4A 1/26/78; 09:00 (μCi/ml)	Main Steam 4B 1/26/78; 09:13 (μCi/ml)
^{103}Ru	<4.5(-7)	<1.0(-6)	<1.3(-6)	<1.7(-8)	<4.0(-8)
^{106}RuD	<1.5(-6)	<9.0(-7)	<4.0(-7)	<9.2(-8)	<3.3(-9)
^{110m}Ag	<1.4(-5)	<4.1(-6)	<5.4(-6)	<3.8(-7)	<1.3(-7)
^{124}Sb	<3.0(-7)	<6.6(-8)	<5.3(-7)	<5.0(-8)	<7.9(-8)
^{125}Sb	<1.3(-7)	<5.9(-8)	<1.2(-6)	<3.0(-7)	<6.3(-9)
^{129}Te	<9.0(-6)	<2.5(-7)	<2.6(-7)	<3.3(-7)	<2.8(-7)
^{129m}Te	<8.3(-7)	<1.9(-7)	<6.9(-8)	<8.6(-8)	<4.7(-8)
^{131m}Te	<4.0(-6)	<7.4(-7)	<1.8(-6)	<2.8(-7)	<4.3(-8)
^{132}Te	<5.9(-7)	<2.5(-7)	<8.0(-7)	<1.1(-7)	<1.7(-8)
^{139}Ba	<2.1(-7)	<7.9(-8)	<1.1(-7)	<8.8(-8)	<1.8(-8)
^{140}Ba	<2.8(-6)	<6.0(-7)	<1.9(-7)	<6.4(-8)	<9.2(-8)
^{140}La	<8.0(-7)	<5.4(-8)	<2.5(-8)	<1.6(-8)	<1.3(-8)
^{141}Ce	<8.9(-7)	<4.6(-7)	<4.4(-7)	<9.4(-9)	<2.0(-8)
^{143}Ce	<2.9(-7)	<4.9(-8)	<8.4(-7)	<8.3(-8)	<1.6(-7)
^{144}Ce	<4.5(-7)	<2.6(-7)	<1.1(-6)	<9.0(-8)	<9.4(-10)
^{152}Eu	<2.9(-7)	<5.6(-7)	<2.9(-6)	<8.1(-8)	<5.7(-8)
^{154}Eu	2.0 ± 0.6(-6)	<3.4(-7)	<1.0(-7)	<1.2(-7)	<3.3(-8)
^{187}W	<1.4(-7)	<3.1(-7)	<4.3(-7)	<1.3(-7)	<6.3(-8)
^{239}Np	<8.8(-7)	<3.3(-7)	<3.0(-7)	<6.3(-8)	<4.6(-8)

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* Radionuclide not detected.

TABLE B.48 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/26/78

Nuclide	Main Steam 4C 1/26/78; 09:10 (μCi/ml)	Unit 4 Blowdown Flash Tank 1/26/78; 09:25 (μCi/ml)	Unit 4 Main Feed Water 1/26/78; 09:05 (μCi/ml)	Unit 4 Main Condensate 1/26/78; 09:15 (μCi/ml)
^{82}Br	<2.2(-8)	<6.9(-6)	<4.9(-8)	<2.1(-8)
^{131}I	5.6 ± 0.5(-7)	5.0 ± 0.1(-4)	9.0 ± 0.3(-6)	6.5 ± 0.5(-7)
^{132}I	<1.4(-7)	2.3 ± 0.1(-5)	<2.3(-6)	<1.9(-7)
^{133}I	2.3 ± 0.5(-7)	2.6 ± 0.1(-4)	4.5 ± 0.3(-6)	3.0 ± 0.4(-7)
^{134}I	<2.3(-6)	1.1 ± 0.2(-5)	*	<2.8(-6)
^{135}I	<5.0(-8)	5.1 ± 0.3(-5)	2.4 ± 0.6(-6)	2.0 ± 1.8(-7)
^{88}Rb	*	<1.7(-4)	*	*
^{89}Rb	*	<6.1(-4)	*	*
^{134}Cs	<1.2(-7)	1.7 ± 0.1(-5)	<1.6(-7)	6.8 ± 4.8(-8)
^{136}Cs	<2.7(-8)	9.2 ± 0.6(-6)	2.7 ± 0.7(-7)	<4.4(-8)
^{137}Cs	9.6 ± 5.3(-8)	2.5 ± 0.1(-5)	5.5 ± 1.1(-7)	<9.2(-8)
^{138}Cs	<3.6(-5)	1.7 ± 0.5(-5)	*	*
^{24}Na	<7.3(-8)	1.15 ± 0.08(-5)	<3.3(-7)	<3.3(-9)
^{41}Ar	<2.0(-8)	<5.4(-6)	<1.5(-7)	<1.1(-6)
^{51}Cr	<1.2(-7)	<2.2(-6)	<2.3(-7)	<3.7(-8)
^{54}Mn	<1.7(-8)	<2.8(-6)	<2.3(-7)	<9.6(-8)
^{56}Mn	<6.1(-8)	<2.9(-7)	<1.0(-6)	<2.8(-7)
^{59}Fe	<7.4(-8)	<9.3(-7)	<9.3(-8)	<6.9(-8)
^{57}Co	<2.3(-8)	<5.6(-7)	<1.1(-7)	<5.6(-8)
^{58}Co	<1.0(-7)	2.0 ± 0.3(-6)	<2.5(-7)	<6.6(-8)
^{60}Co	4.9 ± 1.3(-7)	<4.3(-7)	<2.3(-7)	<1.7(-7)
^{65}Zn	<1.5(-7)	<4.3(-7)	<2.2(-7)	<1.3(-7)
^{91}Sr	<4.7(-8)	<8.7(-7)	<3.7(-7)	<4.6(-8)
^{93}Y	<8.7(-8)	<2.1(-6)	<1.3(-7)	<2.5(-7)
^{95}Zr	<6.6(-8)	<3.5(-7)	<8.3(-8)	1.2 ± 0.4(-7)
^{95}Nb	<6.6(-8)	<1.5(-6)	<1.7(-8)	<1.7(-9)
^{99}Mo	5.0 ± 2.1(-8)	<9.0(-7)	<7.8(-8)	<4.8(-8)

TABLE B.48 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/26/78

Nuclide	Main Steam 4C 1/26/78; 09:10 (μCi/ml)	Unit 4 Blowdown Flash Tank 1/26/78; 09:25 (μCi/ml)	Unit 4 Main Feed Water 1/26/78; 09:05 (μCi/ml)	Unit 4 Main Condensate 1/26/78; 09:15 (μCi/ml)
^{103}Ru	<3.7(-8)	<3.0(-7)	<9.6(-8)	<5.2(-8)
^{106}RuD	<1.0(-7)	<1.5(-6)	<8.5(-9)	<5.9(-9)
^{110m}Ag	<1.4(-7)	<1.2(-5)	<4.5(-7)	<2.4(-7)
^{124}Sb	<3.0(-9)	<3.7(-7)	<2.0(-7)	<4.0(-8)
^{125}Sb	<2.2(-8)	<2.8(-7)	<6.4(-8)	<4.1(-8)
^{129}Te	<2.0(-7)	<2.1(-6)	<2.3(-5)	<1.2(-6)
^{129m}Te	5.0 ± 1.4(-6)	<2.0(-7)	<1.4(-7)	<6.0(-8)
^{131m}Te	<2.4(-8)	<3.2(-6)	<1.1(-7)	<1.6(-8)
^{132}Te	<8.5(-8)	<4.5(-7)	<3.3(-8)	<1.0(-7)
^{139}Ba	<1.2(-8)	<2.3(-6)	<2.0(-7)	<1.7(-7)
^{140}Ba	<2.6(-8)	<2.2(-6)	<3.5(-8)	<3.7(-8)
^{140}La	<1.4(-8)	<6.5(-7)	<7.0(-10)	5.7 ± 2.4(-8)
^{141}Ce	<3.2(-8)	<2.0(-10)	<1.8(-7)	<7.0(-8)
^{143}Ce	<2.4(-8)	<1.9(-6)	<3.2(-7)	<2.1(-7)
^{144}Ce	<3.0(-8)	<1.7(-7)	<1.3(-8)	<1.7(-8)
^{152}Eu	<1.3(-8)	<3.3(-6)	<1.1(-7)	<6.7(-8)
^{154}Eu	<1.8(-8)	<3.4(-7)	<1.4(-10)	<5.4(-8)
^{187}W	<1.6(-7)	<8.3(-7)	<1.2(-7)	<5.6(-8)
^{239}Np	<2.1(-8)	<5.0(-8)	<4.8(-8)	<3.3(-8)

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* Radionuclide not detected.

TABLE B.48 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/26/78

Nuclide	Steam Generator Blowdown 4A 1/26/78; 12:48 (μCi/ml)	Steam Generator Blowdown 4B 1/26/78; 12:45 (μCi/ml)	Steam Generator Blowdown 4C 1/26/78; 12:45 (μCi/ml)	Main Steam 4A 1/26/78; 12:48 (μCi/ml)	Main Steam 4B 1/26/78; 12:40 (μCi/ml)
^{82}Br	<1.7(-5)	<1.7(-6)	<1.3(-6)	<3.3(-7)	<1.3(-7)
^{131}I	5.7 ± 0.1(-4)	2.0 ± 0.1(-4)	2.0 ± 0.1(-4)	9.2 ± 0.3(-6)	6.6 ± 0.5(-7)
^{132}I	4.9 ± 0.1(-5)	3.8 ± 0.6(-6)	4.5 ± 0.4(-6)	8.0 ± 1.6(-7)	<6.7(-9)
^{133}I	3.0 ± 0.1(-4)	9.1 ± 0.2(-5)	9.6 ± 0.2(-5)	4.6 ± 0.2(-6)	<3.6(-7)
^{134}I	2.5 ± 0.1(-5)	<1.4(-6)	4.0 ± 1.1(-6)	<1.9(-6)	<2.6(-6)
^{135}I	9.2 ± 0.2(-5)	1.5 ± 0.1(-5)	1.6 ± 0.1(-5)	1.6 ± 0.3(-6)	<2.3(-7)
^{88}Rb	<1.0(-5)	<1.4(-6)	<2.8(-5)	*	*
^{89}Rb	<4.8(-6)	<2.0(-5)	*	*	*
^{134}Cs	1.9 ± 0.1(-5)	6.4 ± 0.3(-6)	6.6 ± 0.3(-6)	4.0 ± 0.8(-7)	6.7 ± 4.2(-8)
^{136}Cs	9.0 ± 0.5(-6)	3.1 ± 0.3(-6)	3.2 ± 0.2(-6)	2.0 ± 0.5(-7)	<2.4(-7)
^{137}Cs	3.0 ± 0.1(-5)	9.6 ± 0.3(-6)	9.6 ± 0.3(-6)	5.1 ± 0.8(-7)	5.0 ± 4.1(-8)
^{138}Cs	4.2 ± 0.2(-5)	<2.9(-6)	<1.1(-5)	<1.1(-6)	*
^{24}Na	2.1 ± 0.1(-5)	3.7 ± 0.3(-6)	3.8 ± 0.3(-6)	2.7 ± 0.9(-7)	<5.7(-8)
^{41}Ar	<5.1(-6)	<1.9(-6)	<2.4(-6)	<1.5(-7)	<1.2(-6)
^{51}Cr	<1.3(-6)	<2.8(-7)	<8.0(-8)	<3.0(-7)	<1.2(-8)
^{54}Mn	<5.0(-6)	<8.0(-7)	<1.1(-6)	<2.8(-7)	7.6 ± 4.2(-8)
^{56}Mn	<7.1(-8)	<2.9(-7)	<7.4(-8)	<2.4(-7)	<1.1(-7)
^{59}Fe	<1.9(-6)	<4.8(-7)	<4.7(-7)	<1.8(-7)	<1.1(-7)
^{57}Co	<8.4(-8)	<5.0(-7)	<1.2(-7)	<7.6(-8)	<1.7(-8)
^{58}Co	<3.0(-6)	<4.6(-7)	<4.6(-7)	<1.0(-7)	<1.0(-7)
^{60}Co	3.3 ± 1.9(-7)	4.6 ± 2.3(-7)	1.7 ± 0.1(-6)	7.9 ± 1.3(-7)	8.0 ± 1.3(-7)
^{65}Zn	<4.0(-7)	<3.9(-7)	<4.0(-7)	<1.8(-8)	<1.5(-7)
^{91}Sr	<7.5(-7)	<8.0(-8)	<1.4(-7)	<1.5(-7)	<9.8(-8)
^{93}Y	9.0 ± 4.2(-6)	5.8 ± 2.0(-6)	<4.4(-8)	<9.8(-8)	<9.5(-9)
^{95}Zr	<3.0(-7)	<6.4(-8)	<1.9(-7)	<9.5(-8)	<5.8(-8)
^{95}Nb	<8.1(-7)	<3.7(-7)	<6.7(-7)	<8.9(-8)	<1.0(-7)
^{99}Mo	<4.5(-7)	<2.7(-7)	<4.0(-9)	<1.2(-8)	<7.1(-8)

TABLE B.48 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/26/78

Nuclide	Steam Generator Blowdown 4A 1/26/78; 12:48 (μCi/ml)	Steam Generator Blowdown 4B 1/26/78; 12:45 (μCi/ml)	Steam Generator Blowdown 4C 1/26/78; 12:45 (μCi/ml)	Main Steam 4A 1/26/78; 12:48 (μCi/ml)	Main Steam 4B 1/26/78; 12:40 (μCi/ml)
^{103}Ru	<4.2(-7)	<2.9(-7)	<2.9(-7)	<5.7(-9)	<4.9(-8)
^{106}RuD	1.5 ± 0.2(-5)	<4.9(-7)	<6.7(-7)	<2.4(-8)	<8.2(-9)
^{110m}Ag	<1.3(-5)	<3.3(-6)	<3.5(-6)	<3.4(-7)	<9.6(-8)
^{124}Sb	<2.6(-7)	<1.9(-8)	<5.1(-9)	<3.7(-8)	<1.7(-8)
^{125}Sb	<7.5(-7)	<5.1(-7)	<1.0(-7)	<1.5(-8)	<9.8(-8)
^{129}Te	<8.1(-6)	<2.1(-6)	<4.5(-6)	<5.5(-7)	<2.0(-6)
^{129m}Te	<1.3(-6)	<5.5(-7)	<2.8(-9)	<4.9(-8)	<3.6(-8)
^{131m}Te	<3.4(-6)	<8.5(-7)	<7.9(-7)	<2.1(-8)	<2.6(-7)
^{132}Te	<3.9(-7)	<2.3(-7)	<3.2(-8)	<1.8(-8)	<2.1(-9)
^{139}Ba	<6.0(-7)	<2.6(-8)	<6.8(-8)	4.3 ± 1.8(-7)	<3.0(-8)
^{140}Ba	<1.9(-6)	<6.6(-7)	<5.7(-7)	<7.1(-8)	<6.7(-8)
^{140}La	<2.4(-7)	<2.0(-7)	<3.7(-8)	<3.4(-8)	<6.1(-8)
^{141}Ce	<1.6(-6)	<3.1(-7)	<2.4(-7)	<7.9(-8)	<6.6(-8)
^{143}Ce	<4.6(-7)	<6.6(-7)	<4.0(-7)	<2.6(-7)	<1.6(-7)
^{144}Ce	<1.3(-6)	<2.2(-7)	<1.1(-7)	<5.1(-8)	<5.1(-8)
^{152}Eu	<1.5(-6)	<2.9(-7)	<1.2(-6)	<6.5(-8)	<3.0(-8)
^{154}Eu	<4.8(-7)	<2.5(-7)	<8.3(-8)	<1.4(-7)	<3.2(-8)
^{187}W	<1.1(-7)	<3.2(-7)	<9.3(-9)	<1.6(-7)	<4.7(-8)
^{239}Np	<3.3(-7)	<5.8(-7)	<2.4(-7)	<1.1(-7)	<3.8(-8)

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* Radionuclide not detected.

TABLE B.48 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/26/78

Nuclide	Main Steam 4C 1/26/78; 12:40 (μCi/ml)	Unit 4 Blowdown Flash Tank 1/26/78; 12:45 (μCi/ml)	Unit 4 Feed Water 1/26/78; 12:42 (μCi/ml)	Unit 4 Main Condensate 1/26/78; 12:42 (μCi/ml)
^{82}Br	<1.4(-7)	1.6 ± 0.2(-6)	<5.5(-8)	<5.8(-8)
^{131}I	3.7 ± 0.6(-7)	4.2 ± 0.1(-4)	1.4 ± 0.1(-6)	4.6 ± 0.3(-7)
^{132}I	<3.0(-7)	2.1 ± 0.1(-5)	<3.2(-8)	<3.4(-7)
^{133}I	3.1 ± 0.6(-7)	2.06 ± 0.04(-4)	8.2 ± 0.7(-7)	1.7 ± 0.3(-7)
^{134}I	<5.9(-6)	<7.7(-6)	<2.1(-5)	<4.4(-6)
^{135}I	<8.5(-8)	4.9 ± 0.2(-5)	<1.5(-7)	<8.4(-8)
^{88}Rb	*	*	*	*
^{89}Rb	*	*	*	*
^{134}Cs	8.0 ± 4.4(-8)	1.3 ± 0.1(-5)	9.2 ± 5.2(-8)	5.7 ± 2.9(-8)
^{136}Cs	<5.8(-8)	6.3 ± 0.3(-6)	<1.1(-7)	<1.0(-7)
^{137}Cs	<1.8(-7)	2.1 ± 0.1(-5)	<1.0(-7)	4.7 ± 4.3(-8)
^{138}Cs	*	<4.1(-5)	*	*
^{24}Na		1.07 ± 0.09(-5)	<1.4(-7)	<2.1(-8)
^{41}Ar	<1.9(-6)	<4.6(-6)	<1.7(-6)	<1.5(-6)
^{51}Cr	<6.1(-8)	<1.2(-6)	<3.6(-8	<2.1(-8)
^{54}Mn	<1.1(-7)	<2.4(-6)	<1.7(-8)	<6.7(-8)
^{56}Mn	<4.7(-7)	<8.7(-7)	<6.9(-8)	<2.2(-7)
^{59}Fe	<7.6(-8)	<1.1(-6)	<3.4(-8)	<4.3(-8)
^{57}Co	<6.5(-8)	<3.9(-7)	<1.8(-7)	<1.0(-8)
^{58}Co	<8.0(-8)	<4(-7)	<1.7(-7)	<1.0(-7)
^{60}Co	5.9 ± 1.1(-7)	6.5 ± 1.7(-7)	<2.1(-7)	7.9 ± 1.1(-7)
^{65}Zn	<1.2(-7)	<3.8(-7)	<1.5(-7)	<1.3(-8)
^{91}Sr	<1.3(-7)	<2.7(-7)	<1.9(-7)	<1.3(-7)
^{93}Y	<3.3(-8)	<1.7(-6)	<1.2(-7)	<3.2(-8)
^{95}Zr	<1.1(-9)	<3.2(-7)	<4.4(-8)	<1.2(-7)
^{95}Nb	<6.5(-8)	<1.1(-6)	<3.4(-8)	<5.0(-8)
^{99}Mo	<1.6(-7)	<2.3(-7)	<9.4(-8)	<4.8(-8)

TABLE B.48 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 1/26/78

Nuclide	Main Steam 4C 1/26/78; 12:40 (μCi/ml)	Unit 4 Blowdown Flash Tank 1/26/78; 12:45 (μCi/ml)	Unit 4 Feed Water 1/26/78; 12:42 (μCi/ml)	Unit 4 Main Condensate 1/26/78; 12:42 (μCi/ml)
^{103}Ru	<8.1(-9)	<1.2(-7)	<6.1(-9)	<2.0(-8)
^{106}RuD	<4.9(-8)	<1.0(-6)	<1.5(-8)	<1.1(-7)
^{110m}Ag	<5.4(-8)	<7.6(-6)	<1.9(-7)	3.7 ± 2.0(-8)
^{124}Sb	<1.3(-7)	<1.8(-7)	<8.1(-8)	<1.1(-8)
^{125}Sb	<5.2(-9)	<2.4(-7)	<1.2(-7)	<7.7(-8)
^{129}Te	<1.1(-6)	<2.0(-6)	<3.2(-7)	<8.4(-6)
^{129m}Te	<7.2(-9)	<7.7(-7)	<5.0(-9)	<5.4(-8)
^{131m}Te	<9.9(-9)	<1.5(-6)	4.1 ± 1.6(-7)	<1.2(-7)
^{132}Te	<2.7(-8)	<2.2(-7)	<1.5(-7)	<3.1(-8)
^{139}Ba	<1.3(-7)	<1.0(-7)	<2.2(-7)	<1.5(-8)
^{140}Ba	<9.4(-8)	<7.5(-7)	<6.4(-9)	<1.0(-8)
^{140}La	<1.4(-7)	<1.2(-7)	<1.5(-7)	<2.2(-8)
^{141}Ce	<3.8(-8)	<6.1(-7)	<2.0(-8)	<1.2(-7)
^{143}Ce	<1.2(-7)	<2.7(-7)	<2.1(-7)	<7.9(-8)
^{144}Ce	<4.0(-8)	<7.6(-7)	<1.1(-7)	<6.5(-8)
^{152}Eu	5.1 ± 2.3(-8)	<2.0(-6)	<2.0(-8)	<6.7(-8)
^{154}Eu	<5.3(-8)	<4.3(-7)	<1.2(-7)	<4.0(-8)
^{187}W	<3.3(-8)	<1.1(-7)	<2.0(-7)	<8.3(-10)
^{239}Np	<8.6(-9)	<1.6(-8)	<6.8(-8)	<1.1(-7)

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* Radionuclide not detected.

TABLE B.49

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 2/3/78

Nuclide	Steam Generator Blowdown 4A 2/3/78; 09:09 (μCi/ml)	Steam Generator Blowdown 4B 2/3/78; 09:10 (μCi/ml)	Steam Generator Blowdown 4C 2/3/78; 09:12 (μCi/ml)	Main Steam 4A 2/3/78; 10:15 (μCi/ml)	Main Steam 4B 2/3/78; 10:17 (μCi/ml)
^{82}Br	<3.2(-6)	<9.5(-7)	<7.1(-7)	<4.1(-7)	*
^{131}I	6.9 ± 0.2(-5)	1.9 ± 0.3(-5)	2.4 ± 0.1(-5)	1.4 ± 0.1(-6)	2.0 ± 0.8(-7)
^{132}I	6.3 ± 0.2(-5)	4.4 ± 0.3(-6)	7.4 ± 1.2(-6)	1.1 ± 0.2(-6)	*
^{133}I	1.3 ± 0.01(-4)	3.3 ± 0.3(-5)	3.3 ± 0.1(-5)	2.1 ± 0.1(-6)	<2.1(-7)
^{134}I	3.7 ± 0.2(-5)	2.0 ± 0.4(-6)	4.0 ± 1.0(-6)	<3.6(-6)	*
^{135}I	1.1 ± 0.03(-4)	1.5 ± 0.1(-5)	1.9 ± 0.1(-5)	1.9 ± 0.3(-6)	<2.5(-7)
^{88}Rb	<3.5(-6)	<3.1(-6)	*	*	*
^{89}Rb	<1.6(-6)	<6.0(-6)	<7.6(-5)	*	*
^{134}Cs	8.6 ± 0.5(-6)	2.0 ± 0.1(-6)	2.5 ± 0.3(-6)	1.1 ± 0.5(-7)	<2.1(-7)
^{136}Cs	<1.2(-7)	<1.6(-7)	<3.3(-7)	<1.1(-7)	<4.4(-8)
^{137}Cs	1.7 ± 0.1(-5)	4.0 ± 0.2(-6)	4.2 ± 0.4(-6)	3.7 ± 0.7(-7)	<2.8(-7)
^{138}Cs	5.8 ± 0.4(-5)	3.8 ± 0.8(-6)	<1.1(-5)	<3.3(-5)	<2.3(-5)
^{24}Na	3.3 ± 0.1(-5)	6.2 ± 0.3(-6)	6.8 ± 0.7(-6)	4.2 ± 1.0(-7)	<2.7(-7)
^{41}Ar	*	*	*	*	<3.1(-8)
^{51}Cr	<6.1(-8)	<4.1(-8)	<6.8(-7)	<3.0(-8)	<3.8(-8)
^{54}Mn	<5.3(-7)	<8.7(-8)	<3.1(-7)	7.6 ± 3.9(-8)	<1.3(-7)
^{56}Mn	*	<6.0(-7)	<1.2(-7)	<8.0(-8)	<6.3(-8)
^{59}Fe	<6.0(-7)	<2.3(-9)	<4.5(-7)	<1.3(-7)	<1.8(-8)
^{57}Co	<2.5(-7)	<3.7(-8)	<8.6(-7)	1.8 ± 0.6(-7)	<4.7(-8)
^{58}Co	<7.8(-7)	3.1 ± 0.8(-7)	<3.0(-7)	<1.1(-7)	<1.9(-7)
^{60}Co	<7.0(-8)	<2.3(-7)	<3.6(-7)	<1.8(-8)	<3.1(-7)
^{65}Zn	<6.3(-7)	<4.9(-8)	<3.6(-7)	<6.7(-8)	<3.2(-8)
^{91}Sr	<1.3(-5)	<1.1(-5)	<4.6(-5)	<3.5(-5)	<8.6(-8)
^{93}Y	<4.9(-5)	<1.2(-4)	<4.9(-5)	<6.9(-5)	<9.7(-8)
^{95}Zr	<1.2(-7)	3.1 ± 1.1(-7)	<4.6(-7)	<1.3(-8)	<1.0(-7)
^{95}Nb	<5.3(-7)	<1.0(-7)	<5.8(-7)	<2.8(-7)	<2.2(-7)
^{99}Mo	<3.1(-7)	<7.7(-8)	*	<2.1(-7)	<1.8(-8)

TABLE B.49 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 2/3/78

Nuclide	Steam Generator Blowdown 4A 2/3/78; 09:09 (μCi/ml)	Steam Generator Blowdown 4B 2/3/78; 09:10 (μCi/ml)	Steam Generator Blowdown 4C 2/3/78; 09:12 (μCi/ml)	Main Steam 4A 2/3/78; 10:15 (μCi/ml)	Main Steam 4B 2/3/78; 10:17 (μCi/ml)
^{103}Ru	<1.0(-7)	<2.1(-7)	<4.9(-8)	<3.0(-7)	<1.6(-8)
^{106}RuD	2.5 ± 0.4(-5)	<1.7(-7)	<1.4(-7)	<1.8(-7)	<1.7(-8)
^{110m}Ag	*	*	*	3.2 ± 4.8(-8)	*
^{124}Sb	<3.3(-7)	<3.8(-8)	<1.5(-7)	<2.4(-8)	<2.6(-8)
^{125}Sb	<4.9(-7)	<4.6(-7)	<2.1(-7)	<9.0(-9)	<1.2(-9)
^{129}Te	*	<1.1(-6)	<3.0(-6)	<2.8(-7)	<2.0(-6)
^{129m}Te	<4.4(-8)	<2.0(-7)	<2.6(-8)	<2.1(-7)	*
^{131m}Te	<5.0(-7)	<4.5(-7)	<3.7(-8)	<5.2(-7)	*
^{132}Te	<3.2(-7)	<4.0(-7)	<1.4(-7)	<2.4(-7)	<3.0(-8)
^{139}Ba	<1.5(-6)	<9.2(-8)	<2.4(-7)	4.0 ± 1.6(-7)	<2.9(-8)
^{140}Ba	1.8 ± 0.7(-6)	6.6 ± 2.5(-7)	<9.4(-8)	<2.8(-8)	<2.3(-7)
^{140}La	1.8 ± 0.9(-6)	<1.1(-7)	<9.1(-8)	<7.3(-8)	*
^{141}Ce	<3.8(-7)	<1.6(-7)	<8.5(-8)	<3.4(-7)	<2.7(-7)
^{143}Ce	<1.3(-7)	<7.4(-8)	<2.4(-7)	<2.6(-7)	*
^{144}Ce	<6.6(-8)	<1.0(-7)	3.7 ± 1.1(-6)	9.0 ± 3.8(-7)	<4.0(-7)
^{152}Eu	<6.3(-7)	<5.3(-8)	<4.3(-7)	<4.4(-8)	<2.2(-7)
^{154}Eu	<3.2(-7)	<4.7(-8)	<1.3(-8)	<7.0(-8)	<2.9(-8)
^{187}W	<1.1(-8)	<5.7(-80	<1.6(-7)	<3.4(-6)	<2.2(-7)
^{239}Np	<6.4(-7)	<6.7(-8)	<2.9(-7)	<6.6(-8)	<4.3(-7)

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* Radionuclide not detected.

TABLE B.49 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 2/3/78

Nuclide	Main Steam 4C 2/3/78; 10:19 (μCi/ml)	Unit 4 Feedwater 2/3/78; 09:05 (μCi/ml)	Unit 4 Condensate 2/3/78; 09:07 (μCi/ml)	Unit 4 Blowdown Flash Tank 2/3/78; 09:25 (μCi/ml)
^{82}Br	<1.6(-7)	<1.5(-8)	<1.3(-7)	<1.6(-6)
^{131}I	<1.6(-7)	1.8 ± 0.6(-7)	<1.6(-7)	5.0 ± 0.2(-5)
^{132}I	<6.9(-7)	<2.1(-7)	<8.9(-8)	2.6 ± 0.2(-5)
^{133}I	<5.7(-8)	2.6 ± 0.8(-7)	<9.5(-8)	8.1 ± 0.7(-5)
^{134}I	<7.4(-6)	<2.0(-7)	<3.1(-6)	2.0 ± 0.3(-5)
^{135}I	<3.5(-9)	4.7 ± 1.5(-7)	<6.8(-8)	6.5 ± 1.0(-7)
^{88}Rb	*	<4.7(-5)	*	*
^{89}Rb	*	*	*	*
^{134}Cs	<1.6(-7)	<1.1(-7)	<1.4(-7)	6.0 ± 0.3(-6)
^{136}Cs	<2.9(-8)	<1.1(-7)	<2.4(-7)	5.1 ± 1.3(-7)
^{137}Cs	6.8 ± 5.0(-8)	<8.2(-8)	<7.8(-7)	1.1 ± 0.1(-5)
^{138}Cs	<2.6(-5)	<1.2(-6)	<4.9(-6)	<6.3(-6)
^{24}Na	<1.1(-7)	<3.2(-8)	<9.7(-8)	2.1 ± 0.1(-5)
^{41}Ar	<3.2(-8)	<1.2(-7)	<7.3(-7)	*
^{51}Cr	<7.3(-8)	<1.1(-8)	<4.6(-7)	<5.5(-7)
^{54}Mn	<3.2(-8)	<8.0(-8)	<6.7(-8)	2.4 ± 0.8(-7)
^{56}Mn	<8.0(-8)	<2.4(-7)	<3.7(-8)	<9.5(-9)
^{59}Fe	<3.2(-8)	*	<2.1(-7)	<2.0(-8)
^{57}Co	<3.5(-8)	*	<4.3(-7)	<1.1(-7)
^{58}Co	<8.3(-8)	<6.8(-8)	<1.8(-7)	4.0 ± 0.3(-6)
^{60}Co	<2.1(-7)	<2.0(-5)	<2.9(-7)	<3.0(-7)
^{65}Zn	<5.6(-8)	<5.4(-8)	*	*
^{91}Sr	<2.0(-7)	<2.3(-7)	*	<6.2(-5)
^{93}Y	1.2 ± 0.4(-6)	<9.3(-8)	*	1.7 ± 0.5(-3)
^{95}Zr	<9.7(-9)	<2.2(-7)	<1.8(-7)	<4.3(-8)
^{95}Nb	<3.0(-8)	<1.1(-7)	<5.2(-8)	<2.7(-7)
^{99}Mo	<1.9(-7)	<1.2(-8)	<6.5(-7)	<2.5(-7)

TABLE B.49 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 2/3/78

Nuclide	Main Steam 4C 2/3/78; 10:19 (µCi/ml)	Unit 4 Feedwater 2/3/78; 09:05 (µCi/ml)	Unit 4 Condensate 2/3/78; 09:07 (µCi/ml)	Unit 4 Blowdown Flash Tank 2/3/78; 09:25 (µCi/ml)
^{103}Ru	<9.0(-8)	*	<6.7(-8)	<1.9(-7)
^{106}RuD	<1.1(-8)	<2.4(-8)	<3.9(-8)	<6.2(-7)
^{110m}Ag	*	<2.7(-8)	<1.2(-7)	*
^{124}Sb	<3.6(-8)	<3.4(-8)	<3.6(-8)	<3.0(-7)
^{125}Sb	<2.1(-8)	<1.4(-7)	<2.6(-8)	<9.0(-8)
^{129}Te	<1.2(-6)	<2.8(-7)	<1.4(-6)	<3.1(-6)
^{129m}Te	*	<1.1(-8)	<5.0(-7)	<1.9(-7)
^{131m}Te	<1.2(-8)	<2.4(-7)	<9.7(-8)	<1.7(-6)
^{132}Te	<3.3(-7)	<6.6(-8)	*	<1.5(-7)
^{139}Ba	<9.0(-8)	<5.4(-8)	<4.8(-8)	<3.4(-9)
^{140}Ba	<2.0(-8)	*	<4.5(-8)	*
^{140}La	<8.2(-8)	<4.9(-8)	<4.0(-8)	<3.6(-8)
^{141}Ce	<1.2(-7)	<2.2(-9)	<9.6(-8)	<1.8(-7)
^{143}Ce	*	*	<1.6(-7)	*
^{144}Ce	<3.6(-8)	<5.0(-8)	<1.9(-8)	<1.4(-7)
^{152}Eu	<4.3(-9)	<2.2(-8)	<1.2(-7)	2.4 ± 1.0(-7)
^{154}Eu	*	<1.2(-7)	<4.6(-7)	<4.8(-7)
^{187}W	*	*	<1.2(-7)	<1.7(-6)
^{239}Np	<8.6(-8)	<1.2(-8)	*	<2.4(-7)

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* Radionuclide not detected.

TABLE B.50

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 2/7-9/78

Nuclide	Steam Generator Blowdown 4A 2/7/78; 14:43 (μCi/ml)	Main Steam 4A 2/7/78; 14:40 (μCi/ml)	Steam Generator Blowdown 4A 2/8/78; 09:34 (μCi/ml)	Main Steam 4A 2/8/78; 09:35 (μCi/ml)	Steam Generator Blowdown 4A 2/9/78; 10:40 (μCi/ml)	Main Steam 4A 2/9/78; 10:41 (μCi/ml)
^{82}Br	1.4 ± 0.4(-6)	<1.1(-6)	<2.3(-5)	<6.9(-7)	<2.0(-5)	<9.9(-7)
^{131}I	7.6 ± 0.1(-5)	1.9 ± 0.2(-6)	7.8 ± 0.3(-5)	2.1 ± 0.3(-6)	8.8 ± 0.1(-5)	1.8 ± 0.3(-6)
^{132}I	6.0 ± 0.2(-5)	9.7 ± 1.9(-7)	7.9 ± 0.2(-5)	2.1 ± 0.4(-6)	7.0 ± 0.2(-5)	1.9 ± 0.5(-6)
^{133}I	1.2 ± 0.1(-4)	2.8 ± 0.3(-6)	1.3 ± 0.1(-4)	2.2 ± 0.3(-6)	1.49 ± 0.03(-4)	3.1 ± 0.4(-6)
^{134}I	3.6 ± 0.2(-5)	<5.7(-7)	4.6 ± 0.4(-5)	3.6 ± 0.9(-6)	4.2 ± 0.3(-5)	2.3 ± 0.8(-6)
^{135}I	1.0 ± 0.03(-4)	1.8 ± 0.4(-6)	1.2 ± 0.1(-4)	<3.9(-9)	1.26 ± 0.04(-4)	3.0 ± 0.9(-6)
^{88}Rb	2.8 ± 0.4(-5)	7.7 ± 4.2(-6)	1.3 ± 0.2(-4)	<4.4(-6)	<1.8(-5)	<2.7(-5)
^{89}Rb	<3.6(-6)	<1.2(-6)	<1.7(-5)	<4.1(-6)	<2.8(-5)	<7.3(-6)
^{134}Cs	9.9 ± 0.1(-6)	2.0 ± 0.2(-7)	1.1 ± 0.1(-5)	3.3 ± 1.6(-7)	1.0 ± 0.1(-5)	<6.3(-7)
^{136}Cs	4.1 ± 0.5(-7)	<1.6(-8)	<1.1(-6)	<4.8(-7)	<1.5(-6)	<1.0(-6)
^{137}Cs	1.9 ± 0.1(-5)	3.6 ± 0.3(-7)	1.6 ± 0.1(-5)	8.1 ± 2.5(-7)	2.0 ± 0.1(-5)	6.5 ± 2.0(-7)
^{138}Cs	4.9 ± 0.2(-5)	3.4 ± 0.6(-6)	8.0 ± 0.5(-5)	2.1 ± 0.9(-6)	7.7 ± 0.4(-5)	7.6 ± 2.1(-6)
^{24}Na	4.3 ± 0.1(-5)	1.0 ± 0.2(-7)	4.7 ± 0.3(-5)	<2.1(-6)	4.5 ± 0.3(-5)	<1.9(-6)
^{41}Ar	*	<1.9(-8)	<3.7(-6)	<1.1(-6)	<3.4(-6)	<5.3(-7)
^{51}Cr	1.1 ± 0.3(-5)	<1.1(-8)	<4.6(-7)	<4.6(-7)	7.3 ± 1.2(-6)	<2.9(-7)
^{54}Mn	1.3 ± 0.3(-7)	7.5 ± 1.3(-7)	<7.9(-6)	<6.1(-7)	<6.5(-6)	<3.5(-7)
^{56}Mn	<2.1(-7)	<5.0(-8)	<4.5(-6)	<3.7(-7)	<1.9(-6)	1.6 ± 1.0(-6)
^{59}Fe	<4.7(-8)	<2.6(-7)	<3.8(-6)	<9.6(-8)	<2.7(-6)	<1.5(-7)
^{57}Co	<5.4(-8)	*	<6.8(-7)	<5.2(-7)	<5.2(-8)	<7.9(-8)
^{58}Co	2.1 ± 0.5(-7)	<3.2(-7)	<4.5(-6)	3.8 ± 1.9(-7)	<3.6(-6)	<7.8(-7)
^{60}Co	<6.8(-5)	<1.2(-7)	<1.7(-6)	<5.9(-7)	<6.5(-7)	<6.3(-8)
^{65}Zn	<1.8(-6)	<1.6(-7)	<1.7(-6)	<8.2(-7)	<1.5(-7)	<3.5(-7)
^{91}Sr	<2.5(-6)	<7.4(-7)	<3.4(-7)	<2.1(-7)	<1.2(-6)	<3.7(-7)
^{93}Y	<1.1(-6)	<8.8(-8)	<3.0(-6)	<1.2(-7)	<5.8(-7)	<1.3(-8)
^{95}Zr	<8.5(-7)	<3.4(-8)	<3.3(-6)	<1.6(-7)	<1.1(-6)	6.6 ± 2.4(-7)
^{95}Nb	<7.0(-7)	3.3 ± 1.2(-8)	<8.6(-7)	<5.3(-7)	<3.7(-7)	<5.2(-7)
^{99}Mo	<1.4(-6)	9.8 ± 3.4(-8)	<2.1(-6)	<2.1(-7)	<1.4(-6)	<4.6(-8)

TABLE B.50 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN SECONDARY WATERS
UNIT #4, 2/7-9/78

Nuclide	Steam Generator Blowdown 4A 2/7/78; 14:43 (µCi/ml)	Main Steam 4A 2/7/78; 14:40 (µCi/ml)	Steam Generator Blowdown 4A 2/8/78; 09:34 (µCi/ml)	Main Steam 4A 2/8/78; 09:35 (µCi/ml)	Steam Generator Blowdown 4A 2/9/78; 10:40 (µCi/ml)	Main Steam 4A 2/9/78; 10:41 (µCi/ml)
^{103}Ru	<8.3(-8)	<2.9(-7)	<1.9(-7)	<2.0(-7)	<4.1(-7)	<6.1(-7)
^{106}RuD	<8.6(-6)	<3.6(-8)	4.9 ± 0.7(-6)	<7.6(-7)	1.9 ± 0.4(-5)	<2.4(-7)
^{110m}Ag	*	*	<1.2(-5)	<8.0(-7)	<9.6(-6)	<7.1(-7)
^{124}Sb	<7.6(-7)	5.4 ± 1.6(-8)	<4.1(-7)	<2.8(-7)	<1.2(-7)	<6.6(-8)
^{125}Sb	<8.2(-7)	<2.4(-7)	<9.8(-7)	<3.0(-7)	<1.4(-6)	1.1 ± 0.4(-6)
^{129}Te	*	*	<1.4(-5)	<2.3(-7)	<8.2(-6)	<2.6(-7)
^{129m}Te	<8.5(-7)	<2.7(-8)	<1.2(-7)	<1.9(-7)	<2.5(-7)	<2.5(-7)
^{131m}Te	<5.8(-7)	<6.0(-7)	<1.0(-5)	<5.9(-7)	<3.2(-6)	<3.2(-7)
^{132}Te	<2.8(-7)	<2.8(-8)	<6.0(-7)	<7.1(-7)	<5.3(-7)	<4.6(-8)
^{139}Ba	9.1 ± 8.0(-7)	<5.0(-9)	<2.7(-6)	<5.7(-8)	3.1 ± 1.1(-6)	<9.2(-8)
^{140}Ba	<2.8(-7)	<4.1(-8)	<1.5(-6)	<2.7(-7)	<2.1(-6)	<9.6(-8)
^{140}La	4.7 ± 0.5(-6)	<2.5(-7)	<5.0(-7)	<1.2(-7)	<1.3(-8)	<2.2(-7)
^{141}Ce	<1.9(-7)	<1.6(-7)	<7.1(-7)	<2.1(-7)	<8.8(-8)	<9.4(-7)
^{143}Ce	<1.1(-7)	<2.0(-7)	<3.9(-6)	<1.4(-7)	<1.6(-6)	<3.5(-7)
^{144}Ce	<1.4(-8)	<1.7(-8)	<2.3(-6)	<1.4(-7)	<1.2(-6)	<3.0(-7)
^{152}Eu	<8.3(-8)	<2.3(-8)	<2.4(-6)	<6.7(-7)	<4.3(-7)	<8.7(-8)
^{154}Eu	<8.3(-8)	<6.5(-8)	<2.2(-6)	<1.3(-7)	<1.4(-6)	<7.6(-7)
^{187}W	<1.8(-5)	<3.5(-7)	<3.8(-7)	<3.4(-7)	<6.3(-7)	<6.1(-7)
^{239}Np	<4.2(-7)	<5.6(-7)	<6.4(-7)	<5.5(-7)	<1.3(-6)	<1.1(-6)

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* Radionuclide not detected.

TABLE B.51

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR SAMPLES
UNIT #4, 1/18/78

	Main Steam Air Ejector		Air Ejectors
Nuclide	AgX 1/18/78; 11:14 to 11:53 (μCi/cc)	Whole Gas 1/18/78; 12:05 to 12:10 (μCi/cc)	Gas and Water 1/18/78; 12:05 (μCi/cc)
^{82}Br	<1.9(-10)	<1.9(-7)	<7.0(-8)
^{131}I	1.3 ± 0.2(-9)	<3.8(-7)	<1.1(-7)
^{132}I	*	<1.7(-7)	<1.4(-6)
^{133}I	1.2 ± 0.3(-9)	<4.8(-8)	<4.7(-9)
^{134}I	*	<3.9(-7)	<7.4(-5)
^{135}I	<5.4(-9)	<1.4(-7)	<1.5(-7)
^{88}Rb	*	<4.6(-5)	*
^{89}Rb	*	<4.8(-5)	*
^{134}Cs	9.3 ± 5.4(-10)	1.4 ± 0.6(-7)	1.8 ± 0.9(-7)
^{136}Cs	<5.5(-11)	<1.4(-7)	<5.2(-8)
^{137}Cs	7.6 ± 2.2(-10)	<1.4(-7)	3.3 ± 0.7(-7)
^{138}Cs	*	9.9 ± 2.5(-6)	*
^{24}Na	<3.3(-10)	<1.2(-7)	<6.0(-8)
^{41}Ar	*	<7.4(-7)	<3.2(-6)
^{51}Cr	<1.2(-11)	<7.3(-8)	<6.2(-8)
^{54}Mn	<2.6(-10)	1.1 ± 0.1(-6)	5.2 ± 0.6(-7)
^{56}Mn	<1.3(-7)	<5.9(-8)	<5.4(-7)
^{59}Fe	<2.2(-10)	<5.2(-8)	<1.2(-7)
^{57}Co	<8.8(-11)	<3.4(-8)	<1.1(-7)
^{58}Co	<3.6(-10)	<1.7(-7)	1.1 ± 0.5(-7)
^{60}Co	<9.0(-10)	<2.0(-7)	6.4 ± 1.2(-7)
^{65}Zn	<3.8(-10)	<4.0(-7)	<5.6(-7)
^{91}Sr	<2.6(-9)	<1.6(-8)	<1.2(-7)
^{93}Y	7.4 ± 6.1(-9)	<8.8(-8)	<3.1(-8)
^{95}Zr	<2.3(-10)	<8.5(-8)	<2.9(-7)
^{95}Nb	2.0 ± 1.2(-10)	<9.8(-8)	<8.9(-8)
^{99}Mo	<1.0(-10)	<5.3(-8)	<6.0(-8)

TABLE B.51 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR SAMPLES UNIT #4, 1/18/78

	Main Steam Air Ejector		Air Ejectors
Nuclide	AgX 1/18/78; 11:14 to 11:53 (µCi/cc)	Whole Gas 1/18/78; 12:05 to 12:10 (µCi/cc)	Gas and Water 1/18/78; 12:05 (µCi/cc)
^{103}Ru	<9.9(-11)	<5.1(-8)	<2.3(-8)
^{106}RuD	<3.3(-11)	<5.4(-8)	<4.4(-8)
^{110m}Ag	<6.9(-10)	<1.8(-7)	<4.1(-7)
^{124}Sb	<2.7(-10)	<2.2(-7)	<1.1(-8)
^{125}Sb	<8.5(-11)	<6.4(-8)	<7.0(-8)
^{129}Te	*	<1.1(-6)	<1.4(-5)
^{129m}Te	<1.0(-10)	<1.3(-7)	<3.6(-8)
^{131m}Te	<7.8(-10)	<5.0(-8)	<2.5(-8)
^{132}Te	<8.8(-11)	<7.1(-8)	<1.5(-7)
^{139}Ba	<4.4(-10)	1.3 ± 0.2(-6)	<2.1(-7)
^{140}Ba	<1.1(-10)	<1.5(-8)	<2.8(-8)
^{140}La	<4.1(-11)	<1.2(-8)	<4.5(-8)
^{141}Ce	<5.5(-11)	<9.6(-8)	<1.4(-7)
^{143}Ce	<5.6(-11)	<1.3(-7)	<2.7(-7)
^{144}Ce	<7.4(-11)	<1.1(-7)	<7.4(-8)
^{152}Eu	<1.1(-10)	<1.2(-7)	<1.4(-7)
^{154}Eu	<1.4(-10)	<4.1(-8)	<1.4(-7)
^{187}W	<5.8(-11)	<1.4(-7)	<1.2(-7)
^{239}Np	<5.8(-11)	<5.1(-8)	<2.3(-7)

* Radionuclide not detected.

TABLE B.52

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR AND BLOWDOWN FLASH TANK SAMPLES, UNIT #4, 1/20/78

	Main Steam Air Ejector		Unit 4 Blowdown Flash Tank	
Nuclide	AgX 1/20/78; 11:10 to 11:25 (μCi/cc)	Whole Gas 1/20/78; 11:35 (μCi/cc)	AgX 1/20/78; 10:35 to 10:55 (μCi/cc)	Whole Gas 1/20/78; 11:00 (μCi/cc)
^{82}Br	<2.0(-11)	<6.4(-7)	<1.6(-9)	<3.8(-7)
^{131}I	2.3 ± 0.2(-10)	<3.1(-8)	<5.8(-11)	<9.7(-8)
^{132}I	*	*	*	*
^{133}I	3.5 ± 0.9(-10)	<6.3(-7)	<9.8(-10)	<2.2(-7)
^{134}I	*	*	*	*
^{135}I	<2.9(-8)	*	*	*
^{88}Rb	*	*	*	*
^{89}Rb	*	*	*	*
^{134}Cs	<5.1(-11)	2.0 ± 0.5(-7)	2.2 ± 2.1(-10)	6.4 ± 3.8(-8)
^{136}Cs	<4.7(-11)	<1.4(-7)	<4.5(-10)	<5.0(-8)
^{137}Cs	<4.9(-11)	2.2 ± 0.7(-7)	5.8 ± 1.8(-10)	7.9 ± 3.8(-8)
^{138}Cs	*	*	*	*
^{24}Na	<8.9(-10)	<1.3(-5)	<1.7(-10)	<3.8(-6)
^{41}Ar	*	*	*	*
^{51}Cr	<3.2(-12)	<4.1(-9)	<3.8(-10)	<1.2(-8)
^{54}Mn	<3.1(-11)	1.2 ± 0.3(-7)	<3.4(-10)	<2.6(-8)
^{56}Mn	*	*	*	*
^{59}Fe	<4.2(-11)	<1.2(-7)	<1.3(-10)	<1.0(-7)
^{57}Co	<2.2(-11)	<7.2(-8)	<1.3(-10)	<3.0(-9)
^{58}Co	<4.8(-11)	9.7 ± 3.9(-8)	3.9 ± 1.1(-10)	<6.3(-8)
^{60}Co	1.0 ± 0.7(-10)	1.2 ± 0.8(-7)	<1.1(-9)	<1.5(-7)
^{65}Zn	<6.4(-12)	<2.0(-7)	<2.1(-10)	<1.8(-7)
^{91}Sr	<6.0(-9)	*	1.9 ± 0.6(-7)	<1.3(-5)
^{93}Y	<1.1(-9)	*	<2.7(-8)	<1.7(-6)
^{95}Zr	<2.2(-11)	<3.1(-8)	<2.5(-10)	<2.1(-8)
^{95}Nb	<4.7(-12)	<9.9(-8)	<4.7(-10)	9.0 ± 2.3(-8)
^{99}Mo	<1.7(-11)	<1.2(-7)	<2.4(-10)	<5.3(-8)

TABLE B.52 (cont'd)

RADIONUCLIDE CONCENTRATIONS IN AIR EJECTOR AND BLOWDOWN FLASH TANK SAMPLES, UNIT #4, 1/20/78

	Main Steam Air Ejector		Unit 4 Blowdown Flash Tank	
Nuclide	AgX 1/20/78; 11:10 to 11:25 (μCi/cc)	Whole Gas 1/20/78; 11:35 (μCi/cc)	AgX 1/20/78; 10:35 to 10:55 (μCi/cc)	Whole Gas 1/20/78; 11:00 (μCi/cc)
^{103}Ru	<4.2(-13)	<6.8(-9)	<9.8(-11)	<7.4(-8)
^{106}RuD	<9.7(-13)	<4.0(-8)	<1.5(-11)	<3.8(-9)
^{110m}Ag	<7.6(-11)	<4.0(-7)	<6.0(-10)	<3.2(-7)
^{124}Sb	<4.3(-12)	<3.9(-7)	<1.3(-10)	<2.0(-9)
^{125}Sb	<3.4(-11)	<2.3(-8)	<6.2(-11)	<6.2(-8)
^{129}Te	*	*	*	*
^{129m}Te	<3.7(-11)	<1.1(-8)	<1.3(-10)	<6.7(-8)
^{131m}Te	4.7 ± 3.8(-10)	<1.0(-6)	<8.8(-10)	<1.1(-7)
^{132}Te	<9.4(-12)	<1.3(-8)	<3.7(-10)	<1.8(-9)
^{139}Ba	<1.1(-10)	<1.7(-6)	<1.7(-9)	<6.8(-7)
^{140}Ba	<3.3(-11)	<1.1(-8)	<4.0(-10)	<7.6(-9)
^{140}La	<5.1(-11)	<1.3(-7)	<1.6(-10)	<3.2(-7)
^{141}Ce	<2.7(-11)	<1.9(-8)	<9.4(-11)	<3.6(-8)
^{143}Ce	<3.7(-11)	<1.4(-6)	<5.1(-10)	<7.8(-7)
^{144}Ce	<1.6(-11)	<3.5(-8)	1.4 ± 0.7(-9)	<9.0(-8)
^{152}Eu	<1.6(-11)	<7.5(-8)	<1.4(-10)	<3.8(-9)
^{154}Eu	<2.9(-13)	<8.1(-8)	<1.3(-10)	<1.4(-8)
^{187}W	<4.5(-10)	<2.6(-7)	<3.1(-9)	<6.0(-8)
^{239}Np	<8.2(-12)	<1.1(-7)	<2.9(-10)	<1.2(-7)

* Radionuclide not detected.

TABLE B.53

IODINE SPECIES IN AIR EJECTOR SAMPLES
UNIT #4, 1/24/78

Nuclide	Particulate Filter 1/24/78; 12:10 to 13:10 (μCi/cc)	CDI$_2$ 1/24/78; 12:10 to 13:10 (μCi/cc)	IpH 1/24/78; 12:10 to 13:10 (μCi/cc)	AgX 1/24/78; 12:10 to 13:10 (μCi/cc)	Charcoal 1/24/78; 12:10 to 13:10 (μCi/cc)
^{82}Br	<2.8(-10)	<1.1(-11)	4.7 ± 1.5(-10)	<1.4(-10)	<9.7(-10)
^{131}I	1.1 ± 0.5(-11)	<2.3(-11)	<2.1(-10)	5.5 ± 0.2(-9)	<1.6(-10)
^{132}I	<7.6(-8)	<1.5(-9)	<3.7(-9)	<2.2(-8)	<7.4(-8)
^{133}I	<2.6(-10)	<3.5(-10)	<4.2(-10)	6.8 ± 0.4(-9)	<5.5(-10)
^{134}I	*	*	*	*	*
^{135}I	<3.7(-10)	<1.4(-9)	<4.2(-9)	<3.9(-9)	<1.4(-9)
^{88}Rb	*	*	*	*	*
^{89}Rb	*	*	*	*	*
^{134}Cs	<2.8(-10)	<2.0(-10)	2.6 ± 1.3(-10)	<1.1(-10)	<2.3(-10)
^{136}Cs	<5.5(-11)	<2.0(-10)	<1.8(-12)	<2.2(-10)	<5.9(-11)
^{137}Cs	1.7 ± 0.9(-10)	1.3 ± 1.0(-10)	2.8 ± 1.2(-10)	<1.1(-10)	1.9 ± 1.1(-10)
^{138}Cs	*	*	*	*	*
^{24}Na	*	<4.4(-10)	<7.3(-10)	<2.2(-10)	<2.6(-10)
^{41}Ar	*	*	*	*	*
^{51}Cr	<3.1(-11)	<1.1(-10)	<1.5(-10)	<3.1(-11)	<1.2(-10)
^{54}Mn	<1.8(-10)	<2.7(-10)	<3.4(-10)	<7.2(-11)	<1.3(-10)
^{56}Mn	<4.3(-8)	<6.0(-8)	<2.7(-8)	<5.7(-8)	<5.6(-8)
^{59}Fe	<4.5(-11)	<1.4(-11)	<7.4(-11)	<1.3(-10)	<1.5(-10)
^{57}Co	<5.7(-11)	<2.3(-12)	<3.2(-11)	<9.8(-11)	<1.5(-10)
^{58}Co	<1.5(-10)	<2.6(-11)	<9.3(-11)	<1.9(-11)	<3.2(-10)
^{60}Co	<4.5(-10)	<5.1(-10)	<5.6(-10)	<5.0(-10)	<5.5(-10)
^{65}Zn	<4.1(-11)	<1.4(-10)	<3.9(-10)	<3.3(-10)	<1.3(-10)
^{91}Sr	<8.2(-10)	<2.4(-9)	<1.2(-9)	<4.8(-10)	<1.0(-9)
^{93}Y	<1.9(-10)	<3.7(-10)	<6.4(-10)	<6.0(-11)	<4.8(-10)
^{95}Zr	<6.4(-11)	<7.3(-11)	<1.6(-10)	<7.3(-11)	<1.5(-10)
^{95}Nb	<1.0(-10)	<1.9(-10)	<1.1(-10)	<6.4(-11)	<1.6(-10)
^{99}Mo	<1.5(-10)	<9.3(-11)	<1.0(-10)	<1.1(-11)	<4.0(-11)

TABLE B.53 (cont'd)

IODINE SPECIES IN AIR EJECTOR SAMPLES
UNIT #4, 1/24/78

Nuclide	Particulate Filter 1/24/78; 12:10 to 13:10 (μCi/cc)	CDI$_2$ 1/24/78; 12:10 to 13:10 (μCi/cc)	IpH 1/24/78; 12:10 to 13:10 (μCi/cc)	AgX 1/24/78; 12:10 to 13:10 (μCi/cc)	Charcoal 1/24/78; 12:10 to 13:10 (μCi/cc)
^{103}Ru	<2.1(-11)	<7.4(-11)	<2.8(-11)	<1.2(-10)	<4.9(-11)
^{106}RuD	<2.0(-10)	<2.2(-10)	<6.8(-11)	<2.6(-10)	<1.6(-10)
^{110m}Ag	<7.8(-10)	<9.0(-11)	<3.4(-10)	<2.7(-10)	<1.4(-10)
^{124}Sb	<9.1(-11)	<8.0(-11)	<3.8(-11)	<2.0(-10)	<4.1(-10)
^{125}Sb	<3.0(-12)	<6.9(-11)	2.4 ± 1.3(-10)	<1.2(-10)	<1.2(-10)
^{129}Te	*	*	*	*	*
^{129m}Te	<1.7(-10)	<5.4(-10)	<1.4(-10)	<1.8(-10)	<4.1(-10)
^{131m}Te	<3.5(-10)	<4.8(-10)	<1.1(-10)	<1.2(-10)	<1.8(-10)
^{132}Te	<6.1(-11)	<5.4(-11)	<1.0(-10)	<4.5(-11)	<1.8(-10)
^{139}Ba	<3.9(-11)	<6.7(-10)	<1.5(-10)	<3.0(-10)	<1.2(-9)
^{140}Ba	<6.9(-11)	<1.6(-11)	<1.1(-10)	<2.6(-10)	<7.8(-11)
^{140}La	<7.5(-11)	<1.9(-10)	<4.2(-10)	<1.1(-10)	<3.5(-10)
^{141}Ce	<2.3(-11)	<1.7(-10)	<1.2(-10)	<6.9(-11)	<1.2(-10)
^{143}Ce	<3.4(-11)	<2.3(-11)	<1.9(-10)	<4.9(-11)	<1.5(-10)
^{144}Ce	<1.2(-11)	<1.3(-10)	<3.3(-11)	<1.7(-10)	<2.8(-10)
^{152}Eu	<8.2(-11)	<3.0(-11)	<5.7(-11)	<1.6(-10)	<1.4(-11)
^{154}Eu	<3.6(-11)	<5.9(-11)	<2.4(-10)	<2.2(-10)	<7.0(-11)
^{187}W	<7.6(-11)	<2.6(-10)	<9.6(-11)	<9.7(-11)	<6.5(-12)
^{239}Np	<2.2(-10)	<2.2(-10)	<4.4(-11)	<1.2(-10)	<5.6(-11)

* Radionuclide not detected.

TABLE B.54

RESULTS OF BETA ANALYSIS OF SECONDARY SAMPLES

			Isotopes Measured (μCi/sec)							
Date	Unit	Sample Name	^{3}H	^{14}C	^{91}Y	^{89}Sr	^{90}Sr	^{55}Fe	^{63}Ni	^{32}P
11/9/77	3	Blowdown Flash Tank	6.3 ± 0.1	1.5 ± 0.7 (-3)	4.4 ± 4.4 (-4)	4.7 ± 0.3 (-2)	5.8 ± 2.9 (-4)	<2.2(-3)	1.5 ± 2.9 (-3)	4.9 ± 4.7 (-3)
11/9/77	3C	Steam Generator Blowdown	3.1 ± 0.03	<3.6(-4)	2.9 ± 1.8 (-4)	4.2 ± 0.2 (-2)	8.0 ± 1.8 (-4)	3.6 ± 10.9 (-4)	-1.5 ± 1.5 (-3)	2.1 ± 2.4 (-3)
11/9/77	3B	Steam Generator Blowdown	1.6 ± 0.05	<7.3(-5)	<1.8(-4)	<5.5(-4)	1.6 ± 0.4 (-4)	<3.6(-3)	<7.3(-4)	**
11/9/77	3	Main Condensate	7.7 ± 0.3 (1)	1.6 ± 0.4 (-2)	<8.7(-3)	<2.6(-2)	8.7 ± 1.7 (-3)	<1.7(-1)	<5.2(-2)	**
11/9/77	3A	Main Steam	1.1 ± 0.4 (2)	<4.8(-3)	<1.2(-2)	<3.6(-2)	1.1 ± 0.2 (-2)	<2.4(-1)	<7.3(-2)	**
11/9/77	3	Main Feed	1.1 ± 0.4 (2)	2.7 ± 0.2 (-3)	<1.2(-2)	<4.8(-2)	2.4 ± 0.4 (-2)	<2.4(-1)	<3.6(-2)	**
1/24/78	4	Main Condensate	1.4 ± 0.04 (2)	<3.5(-2)	<5.2(-3)	<7.8(-3)	1.1 ± 0.2 (-2)	3.5 ± 1.7 (-1)	<5.2(-2)	**
1/24/78	4	Main Feed	2.0 ± 0.1 (2)	9.8 ± 1.0 (-2)	<7.8(-3)	<1.2(-1)	1.5 ± 0.4 (-2)	<2.4(-1)	<1.2(-1)	**
1/24/78	4	Blowdown Flash Tank	8.7 ± 0.3	8.7 ± 1.6 (-4)	<3.3(-4)	<5.5(-4)	9.8 ± 1.6 (-4)	7.6 ± 1.1 (-2)	<3.8(-3)	**

TABLE B.54 (cont'd)

RESULTS OF BETA ANALYSIS OF SECONDARY SAMPLES

Date	Unit	Sample Name	Isotopes Measured (µCi/sec)							
			^{3}H	^{14}C	^{91}Y	^{89}Sr	^{90}Sr	^{55}Fe	^{63}Ni	^{32}P
1/24/78	4A	Steam Generator Blowdown	2.9 ± 0.1	<7.3(-5)	<1.1(-4)	5.5 ± 1.8 (-4)	2.4 ± 0.4 (-4)	3.6 ± 0.4 (-3)	<1.1(-3)	**
1/24/78	4B	Steam Generator Blowdown	2.9 ± 0.1	<7.3(-5)	<1.1(-4)	<1.8(-4)	2.0 ± 0.4 (-4)	7.1 ± 0.6 (-2)	2.2 ± 0.2 (-2)	**
1/24/78	4C	Steam Generator Blowdown	2.9 ± 0.1	<7.3(-5)	<1.1(-4)	7.3 ± 1.8 (-4)	2.2 ± 0.4 (-4)	3.6 ± 0.4 (-3)	<3.6(-3)	**

** Radionuclide not measured.

TABLE B.55

RESULTS OF ^{14}C - ^{3}H ANALYSIS OF AIR EJECTOR SAMPLES

			^{14}C (μCi/sec)			^{3}H (μCi/sec)		
Date	Unit	Sample Name	CO_2	Organic	Total	H_2O	Organic	Total
11/9/77	3	Steam Jet Air Ejectors	1.6 ± 0.6(-7)	8.5 ± 0.4(-8)	2.5(-7)	*	*	*
11/30/77	4	Steam Jet Air Ejectors	1.9 ± 0.3(-6)	*	1.9 ± 0.3(-6)	9.9 ± 4.3(-5)	4.3 ± 1.7(-4)	5.3(-4)
1/24/78	4	Steam Jet Air Ejectors	3.4 ± 0.4(-5)	3.1 ± 1.1(-5)	6.5(-5)	5.0 ± 1.0(-5)	*	5.0 ± 1.0(-5)

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* Radionuclide not detected.

TABLE B.56

WASTE GAS DECAY TANK AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc)

Nuclide	WGDT #5 Isolated 1/31/78	WGDT #3 Isolated 2/3/78	WGDT #6 Isolated 2/6/78	WGDT #5 Isolated 2/7/78	WGDT #2 Isolated 2/14/78
^{41}Ar	**	**	<2.9(-7)	<1.6(-6)	<3.9(-7)
^{85m}Kr	**	**	1.68 ± 0.05(-5)	1.38 ± 0.07(-4)	<4.1(-7)
^{85}Kr	**	**	1.61 ± 0.08(-3)	1.0 ± 0.1(-3)	1.00 ± 0.08(-3)
^{87}Kr	**	**	<7.3(-7)	3.7 ± 0.8(-6)	<7.6(-7)
^{88}Kr	**	**	3.3 ± 1.2(-6)	9.1 ± 0.9(-5)	<1.5(-6)
^{131m}Xe	**	**	5.5 ± 0.6(-4)	4.0 ± 0.4(-4)	3.8 ± 0.1(-4)
^{133m}Xe	**	**	7.8 ± 0.2(-4)	7.7 ± 0.1(-4)	4.3 ± 0.1(-5)
^{133}Xe	**	**	6.17 ± 0.03(-2)	4.9 ± 0.2(-2)	1.72 ± 0.03(-2)
^{135m}Xe	**	**	<1.2(-6)	<3.3(-6)	<4.6(-5)
^{135}Xe	**	**	6.8 ± 0.1(-4)	2.5 ± 0.1(-3)	1.8 ± 0.8(-7)
^{137}Xe	**	**	*	*	*
^{138}Xe	**	**	<4.3(-6)	<1.0(-5)	<2.5(-4)
^{84}Br	*	<1.3(-9)	<7.0(-10)	*	<6.5(-12)
^{131}I	1.38 ± 0.02(-7)	6.7 ± 0.1(-7)	2.23 ± 0.03(-7)	1.67 ± 0.04(-7)	3.50 ± 0.06(-7)
^{132}I	*	*	*	*	*
^{133}I	1.5 ± 0.1(-9)	5.5 ± 0.5(-10)	*	*	2.5 ± 0.7(-10)
^{134}I	*	*	*	*	*
^{135}I	*	*	*	*	*
^{134}Cs	<1.9(-11)	1.3 ± 0.8(-11)	<2.0(-10)	<1.3(-11)	<3.6(-11)
^{136}Cs	<1.6(-11)	<8.0(-12)	<8.6(-12)	<9.5(-12)	<1.3(-11)
^{137}Cs	<3.3(-11)	<1.4(-11)	2.8 ± 2.0(-11)	2.6 ± 0.8(-11)	1.9 ± 1.4(-11)
^{138}Cs	*	<1.7(-10)	<8.7(-11)	*	*
^{3}H	3.9 ± 1.2(-6)	**	2.2 ± 0.6(-6)	4.7 ± 1.7(-6)	**
^{14}C	2.8 ± 0.4(-5)	**	3.5 ± 0.4(-4)	5.09 ± 0.07(-4)	**
^{24}Na	<6.4(-11)	<1.3(-11)	<1.4(-11)	<2.2(-11)	<1.8(-11)
^{51}Cr	<1.1(-10)	<3.7(-11)	<4.7(-11)	<4.8(-11)	<8.4(-11)
^{54}Mn	<1.8(-11)	<8.6(-12)	<1.0(-11)	<1.6(-11)	<1.6(-11)
^{59}Fe	<3.8(-11)	<1.8(-11)	<2.3(-11)	2.9 ± 1.1(-11)	<2.4(-11)
^{57}Co	<1.0(-11)	4.1 ± 0.2(-12)	<7.1(-12)	<5.1(-12)	<1.2(-11)
^{58}Co	8.8 ± 0.5(-10)	2.6 ± 0.8(-11)	2.8 ± 1.0(-10)	1.8 ± 0.6(-12)	<2.8(-11)
^{60}Co	<1.0(-10)	2.0 ± 1.9(-11)	4.5 ± 3.1(-11)	4.8 ± 1.9(-12)	<6.8(-11)

TABLE B.56 (cont'd)

WASTE GAS DECAY TANK AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc)

Nuclide	WGDT #5 Isolated 1/31/78	WGDT #3 Isolated 2/3/78	WGDT #6 Isolated 2/6/78	WGDT #5 Isolated 2/7/78	WGDT #2 Isolated 2/14/78
^{65}Zn	<5.1(-11)	<2.3(-11)	<1.5(-11)	<2.6(-11)	<4.1(-11)
^{91}Sr	<6.3(-11)	<3.2(-11)	<3.2(-11)	<6.0(-11)	<9.1(-11)
^{91m}Y	*	<7.3(-11)	<3.6(-11)	*	*
^{93}Y	<1.3(-10)	<7.0(-11)	<7.9(-11)	<1.1(-10)	<2.6(-10)
^{95}Zr	<3.1(-11)	<1.6(-11)	<1.6(-11)	<1.8(-11)	<2.2(-11)
^{95}Nb	<1.6(-11)	<1.1(-11)	<1.1(-11)	<8.7(-12)	<2.1(-11)
^{99}Mo	<9.3(-12)	<4.0(-12)	<4.3(-12)	<8.8(-12)	<1.8(-11)
^{103}Ru	*	<6.4(-12)	<8.1(-12)	<8.3(-12)	<1.5(-11)
^{106}Ru	<1.1(-10)	<7.5(-11)	<7.9(-12)	<1.5(-10)	<1.3(-10)
^{110m}Ag	<2.3(-11)	<1.3(-11)	<1.5(-11)	<1.7(-12)	<3.2(-11)
^{124}Sb	<6.8(-11)	<1.4(-11)	<1.7(-11)	<1.7(-11)	<2.1(-11)
^{125}Sb	<4.2(-11)	<1.5(-11)	<2.2(-11)	<1.9(-11)	<3.0(-11)
^{129m}Te	<4.4(-10)	<1.9(-10)	<2.4(-10)	<2.4(-10)	<3.5(-10)
^{129}Te	<2.8(-10)	<3.2(-10)	<2.3(-10)	<3.3(-8)	*
^{131m}Te	<6.9(-11)	<4.1(-11)	<4.5(-11)	<4.3(-11)	<8.3(-11)
^{131}Te	*	<1.4(-9)	<8.2(-10)	<9.1(-11)	*
^{132}Te	<9.1(-12)	<5.9(-12)	<5.8(-12)	<4.6(-12)	<1.1(-11)
^{139}Ba	<4.9(-11)	<5.9(-11)	<5.8(-11)	<1.9(-9)	<7.7(-5)
^{140}Ba	<5.6(-11)	<2.3(-12)	<5.8(-11)	<2.7(-11)	<5.3(-11)
^{140}La	<3.3(-11)	<6.6(-12)	<9.3(-12)	<9.0(-12)	<1.1(-11)
^{141}Ce	<2.3(-11)	<7.0(-12)	<8.9(-12)	<1.2(-11)	<3.5(-11)
^{143}Ce	<1.9(-11)	<8.2(-12)	<1.0(-11)	<1.1(-11)	<2.2(-11)
^{144}Ce	<6.1(-11)	<3.0(-11)	<5.4(-11)	<5.2(-11)	<9.5(-11)
^{152}Eu	<2.8(-11)	<1.7(-11)	<2.0(-11)	<1.5(-11)	<2.9(-11)
^{154}Eu	<6.5(-11)	<1.7(-11)	<2.3(-11)	<1.9(-11)	<3.3(-11)
^{155}Eu	<4.3(-11)	<1.6(-11)	<2.3(-11)	<2.6(-11)	<8.1(-11)
^{187}W	<9.4(-11)	<3.0(-11)	<2.2(-11)	<3.3(-11)	<8.3(-11)
^{239}Np	<4.1(-11)	<1.5(-11)	<1.5(-11)	<1.9(-11)	<8.4(-11)

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* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.56 (cont'd)

WASTE GAS DECAY TANK AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc)

Nuclide	WGDT #6 Isolated 4/11/78	WGDT #1 Isolated 4/15/78	WGDT #2 Isolated 4/17/78	WGDT #3 Isolated 4/28/78	WGDT #3 Isolated 5/2/78
^{41}Ar	<3.7(-5)	<6.4(-7)	<3.8(-7)	<5.0(-7)	**
^{85m}Kr	4.4 ± 1.5(-6)	<5.8(-7)	<4.6(-7)	<3.7(-7)	**
^{85}Kr	4.9 ± 0.5(-4)	6.8 ± 0.5(-4)	1.09 ± 0.06(-3)	7.8 ± 0.6(-4)	**
^{87}Kr	*	<3.4(-7)	<8.0(-7)	<9.8(-7)	**
^{88}Kr	<3.4(-5)	<1.3(-6)	<1.4(-6)	<2.3(-6)	**
^{131m}Xe	4.5 ± 0.2(-4)	4.0 ± 0.1(-4)	5.8 ± 0.1(-4)	2.5 ± 0.1(-4)	**
^{133m}Xe	3.8 ± 0.3(-4)	5.5 ± 0.4(-5)	1.07 ± 0.04(-4)	<2.2(-6)	**
^{133}Xe	3.9 ± 0.3(-2)	2.05 ± 0.03(-2)	3.42 ± 0.02(-2)	6.52 ± 0.02(-3)	**
^{135m}Xe	*	<7.6(-7)	<1.1(-5)	<4.2(-5)	**
^{135}Xe	3.0 ± 0.3(-4)	3.0 ± 0.2(-6)	<1.9(-7)	2.6 ± 0.1(-7)	**
^{137}Xe	*	*	*	*	**
^{138}Xe	*	<6.7(-7)	<3.9(-5)	<1.3(-4)	**
^{84}Br	*	<3.2(-9)	<2.5(-9)	**	<1.6(-8)
^{131}I	5.5 ± 0.1(-8)	3.67 ± 0.06(-8)	2.00 ± 0.04(-8)	2.18 ± 0.04(-3)	6.5 ± 0.1(-8)
^{132}I	*	*	*	**	*
^{133}I	5.3 ± 0.9(-10)	*	*	**	1.73 ± 0.07(-9)
^{134}I	*	*	*	**	*
^{135}I	*	*	*	**	*
^{134}Cs	3.2 ± 0.8(-11)	<1.2(-10)	<3.0(-11)	**	1.5 ± 1.9(-11)
^{136}Cs	<1.5(-11)	<8.3(-11)	<2.3(-11)	**	<4.9(-11)
^{137}Cs	6.2 ± 0.5(-11)	<6.6(-11)	<2.8(-11)	**	<2.5(-11)
^{138}Cs	*	<1.8(-9)	*	**	<3.4(-9)
^{3}H	7.0 ± 2.4(-6)	2.1 ± 0.7(-6)	1.4 ± 0.6(-6)	1.2 ± 0.4(-6)	**
^{14}C	2.6 ± 0.1(-4)	2.8 ± 0.2(-4)	3.8 ± 0.2(-4)	2.9 ± 0.1(-4)	**
^{24}Na	<1.1(-10)	<1.9(-10)	<2.1(-11)	**	<9.6(-10)
^{51}Cr	<7.6(-11)	<5.6(-11)	<1.2(-10)	**	<2.4(-11)
^{54}Mn	<2.1(-11)	<1.9(-10)	<1.0(-10)	**	<1.2(-11)
^{59}Fe	<2.5(-11)	<1.1(-10)	<4.2(-11)	**	<6.4(-11)
^{57}Co	<6.9(-12)	<7.6(-11)	<1.7(-11)	**	<4.9(-11)
^{58}Co	2.1 ± 0.1(-10)	<9.4(-11)	<2.1(-11)	**	<4.8(-11)
^{60}Co	2.8 ± 0.4(-10)	7.9 ± 5.3(-11)	<5.2(-11)	**	5.2 ± 4.6(-11)

TABLE B.56 (cont'd)

WASTE GAS DECAY TANK AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc)

Nuclide	WGDT #6 Isolated 4/11/78	WGDT #1 Isolated 4/15/78	WGDT #2 Isolated 4/17/78	WGDT #3 Isolated 4/28/78	WGDT #3 Isolated 5/2/78
^{65}Zn	<3.7(-11)	<8.9(-11)	<4.2(-11)	**	<5.8(-11)
^{91}Sr	<1.5(-10)	<9.8(-11)	<7.2(-11)	**	<6.3(-11)
^{91m}Y	*	<1.9(-10)	<1.2(-10)	**	<7.6(-11)
^{93}Y	<3.9(-10)	<6.0(-11)	<1.9(-10)	**	<2.9(-11)
^{95}Zr	<7.8(-11)	<7.0(-11)	<4.4(-11)	**	<3.4(-11)
^{95}Nb	<1.3(-11)	<9.1(-11)	<1.9(-11)	**	<4.3(-11)
^{99}Mo	<1.3(-11)	<8.9(-11)	<1.3(-11)	**	<2.7(-11)
^{103}Ru	<1.5(-11)	<6.2(-11)	<1.5(-11)	**	<2.8(-11)
^{106}Ru	<9.3(-11)	<7.7(-11)	<1.3(-10)	**	<3.5(-11)
^{110m}Ag	<1.9(-11)	4.5 ± 1.6(-11)	<2.2(-11)	**	<7.1(-11)
^{124}Sb	<2.1(-11)	<9.1(-10)	<2.4(-11)	**	<4.4(-11)
^{125}Sb	<2.3(-11)	<6.5(-11)	<5.8(-11)	**	<3.9(-11)
^{129m}Te	<3.8(-11)	<8.7(-11)	<6.1(-10)	**	<2.9(-10)
^{129}Te	*	<1.8(-10)	<9.5(-10)	**	<6.8(-11)
^{131m}Te	<1.2(-10)	<7.0(-11)	<1.1(-10)	**	*
^{131}Te	*	<2.2(-9)	<4.1(-9)	**	*
^{132}Te	<1.3(-11)	<5.8(-11)	<1.1(-11)	**	<2.2(-11)
^{139}Ba	*	<6.3(-11)	<2.0(-10)	**	*
^{140}Ba	<5.5(-11)	<7.9(-11)	<5.5(-11)	**	<3.3(-11)
^{140}La	<3.6(-11)	<1.7(-10)	<1.2(-11)	**	<4.3(-11)
^{141}Ce	<1.2(-11)	<9.5(-11)	<2.3(-11)	**	<1.9(-11)
^{143}Cs	<3.0(-11)	<6.7(-11)	<3.5(-11)	**	<3.5(-11)
^{144}Ce	<5.4(-11)	<6.2(-11)	<1.1(-10)	**	<1.9(-11)
^{152}Eu	<2.4(-11)	<5.7(-11)	<4.5(-11)	**	<2.0(-11)
^{154}Eu	<3.7(-11)	<1.1(-10)	<4.6(-11)	**	<2.9(-11)
^{155}Eu	<2.6(-11)	<1.3(-10)	<6.1(-11)	**	<3.6(-11)
^{187}W	<1.1(-10)	<8.0(-11)	<7.0(-11)	**	<3.4(-11)
^{239}Np	<4.8(-11)	<6.8(-11)	<5.1(-11)	**	<1.9(-11)

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* Radionuclide not detected.

** Radionuclide not measured.

TABLE B.57

IODINE SPECIES - MEASUREMENTS OF WASTE GAS PROCESSING SYSTEM

Sample Location	Source Term Sample Date	Corrected to			Fractional Distribution (%) Part. Filter	I_2	HOI	Organic	Total (μCi/cc)
Waste Gas Decay Tank #5 Isolated 1/31/78	1/31/78	0533	2/1/78	^{131}I	*	2.5	8.1	89.4	1.29 ± 0.02(-7)
				^{133}I	*	*	22.9	77.0	8.0 ± 0.5(-10)
Waste Gas Decay Tank #5 Isolated 2/4/78	2/4/78	0205	2/5/78	^{131}I	*	0.3	2.9	96.8	6.35 ± 0.9(-7)
				^{133}I	*	*	*	100	3.2 ± 0.3(-10)
Waste Gas Decay Tank #6 Isolated 2/6/78	2/6/78	1100	2/7/78	^{131}I	*	1.2	4.4	95.2	2.08 ± 0.03(-7)
Waste Gas Decay Tank #5 Isolated 2/7/78	2/7/78	1436	2/7/78	^{131}I	*	1.1	4.3	94.6	1.67 ± 0.04(-7)
Waste Gas Decay Tank #2 Isolated 2/14/78	2/21/78	1431	2/21/78	^{131}I	*	0.4	6.9	92.7	3.50 ± 0.06(-7)
				^{133}I	*	4.4	0	56	2.5 ± 0.7(-10)
				^{135}I	*	*	*	100	4.7 ± 2.6(-10)
Waste Gas Decay Tank #6 Isolated 4/11/78	4/11/78	0155	4/12/78	^{131}I	*	0.7	6.8	92.6	5.4 ± 0.1(-8)
				^{133}I	*	*	*	100	4.4 ± 0.8(-10)
Waste Gas Decay Tank #1 Isolated 4/15/78	4/18/78	1345	4/20/78	^{131}I	0.1	0.2	1.9	97.9	2.86 ± 0.05(-9)
Waste Gas Decay Tank #2 Isolated 4/17/78	4/26/78	1000	4/28/78	^{131}I	*	0.3	5.8	93.9	1.68 ± 0.03(-8)
Waste Gas Decay Tank #3 Isolated 4/28/78	4/28/78	0023	5/2/78	^{131}I	*	0.1	9.0	90.9	1.55 ± 0.02(-8)
Waste Gas Decay Tank #3 Isolated 5/2/78	5/2/78	0645	5/4/78	^{131}I	*	0.8	6.2	93.1	5.6 ± 0.1(-8)
				^{133}I		*	*	100	4.4 ± 0.2(-10)

* - Iodine activity not detected on this sampler component.

TABLE B.58

WASTE GAS DECAY TANK ^{14}C AND ^{3}H CONCENTRATIONS

Waste Gas Decay Tank #	Date	Total ^{14}C (μCi/cc)	Fraction Not Oxidized (%)	HTO (μCi/cc)	HT or RT (μCi/cc)
6	2/6/78	3.5 ± 0.4(-4)	96	8.1 ± 2.4(-7)	1.4 ± 0.6(-6)
5	2/7/78	5.09 ± 0.07(-4)	97	6.0 ± 2.4(-7)	4.1 ± 1.7(-6)
5	1/31/78	2.8 ± 0.4(-5)	93	9.1 ± 3.6(-7)	3.0 ± 1.2(-6)
6	4/11/78	2.6 ± 0.1(-4)	93	1.0 ± 0.3(-6)	6.0 ± 2.4(-6)
1	4/18/78	2.8 ± 0.2(-4)	91	7.1 ± 2.8(-7)	1.4 ± 0.6(-6)
2	4/26/78	3.8 ± 0.2(-4)	92	6.7 ± 2.7(-7)	7.0 ± 2.8(-7)
3	4/28/78	2.9 ± 0.1(-4)	90	4.1 ± 1.7(-7)	8.0 ± 3.2(-7)

TABLE B.59

UNIT #3 CONTAINMENT AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc) BEFORE REFUELING

Days After Last Purge Nuclide	2.7 11/10/77
^{41}Ar	5.9 ± 0.7(-6)
^{85m}Kr	<2.8(-7)
^{85}Kr	<3.3(-5)
^{87}Kr	<4.3(-7)
^{88}Kr	<1.5(-6)
^{131m}Xe	<3.0(-6)
^{133m}Xe	3.8 ± 0.5(-6)
^{133}Xe	2.04 ± 0.09(-4)
^{135m}Xe	<1.8(-6)
^{135}Xe	7.3 ± 0.4(-6)
^{138}Xe	<5.3(-6)
^{84}Br	*
^{131}I	1.45 ± 0.06(-8)
^{132}I	8.0 ± 1.0(-10)
^{133}I	7.4 ± 0.2(-9)
^{134}I	*
^{135}I	2.0 ± 0.3(-9)
^{134}Cs	1.1 ± 0.2(-10)
^{136}Cs	<3.9(-11)
^{137}Cs	1.7 ± 0.5(-10)
^{138}Cs	*
^{3}H	9.9 ± 0.5(-7)
^{14}C	4.4 ± 0.2(-8)
^{24}Na	<3.9(-10)
^{51}Cr	<1.2(-10)
^{54}Mn	<2.9(-11)
^{59}Fe	<5.7(-11)
^{57}Co	<9.9(-12)
^{58}Co	<3.5(-12)
^{60}Co	<1.6(-10)
^{65}Zn	<6.9(-11)
^{91}Sr	<3.1(-9)

TABLE B.59 (cont'd)

UNIT #3 CONTAINMENT AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc) BEFORE REFUELING

Days After Last Purge	2.7
Nuclide	11/10/77
^{91m}Y	*
^{93}Y	<5.8(-9)
^{95}Zr	<3.4(-11)
^{95}Nb	<2.4(-11)
^{99}Mo	4.0 ± 1.0(-11)
^{103}Ru	<2.1(-11)
^{106}Ru	<1.6(-10)
^{110m}Ag	<2.8(-11)
^{124}Sb	<4.1(-11)
^{125}Sb	<6.5(-11)
^{129m}Te	<5.8(-10)
^{129}Te	*
^{131m}Te	<2.9(-10)
^{131}Te	*
^{132}Te	<2.0(-11)
^{139}Ba	*
^{140}Ba	<8.3(-11)
^{140}La	<4.2(-11)
^{141}Ce	<2.0(-11)
^{143}Ce	<7.4(-11)
^{144}Ce	<8.6(-11)
^{152}Eu	<4.4(-11)
^{154}Eu	<4.5(-11)
^{155}Eu	<4.0(-11)
^{187}W	<2.9(-10)
^{239}Np	<7.1(-11)

*** Radionuclide not detected.**

TABLE B.60

UNIT #3 CONTAINMENT AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc) AFTER REFUELING

Days After Last Purge	4.3	19.3	5.8	12.5
Nuclide	2/23/78	3/15/78	4/18/78	5/3/78
^{41}Ar	1.52 ± 0.09(-5)	1.50 ± 0.06(-5)	4.0 ± 0.7(-6)	1.3 ± 0.1(-5)
^{85m}Kr	3.0 ± 1.2(-7)	<2.1(-7)	4.8 ± 1.8(-7)	<4.0(-7)
^{85}Kr	<4.4(-5)	<5.7(-5)	<6.2(-5)	<3.2(-4)
^{87}Kr	<4.9(-7)	<3.0(-7)	<4.7(-7)	<1.1(-6)
^{88}Kr	<1.0(-6)	<6.0(-7)	<2.9(-6)	<2.0(-6)
^{131m}Xe	<6.1(-6)	<5.6(-6)	<1.5(-5)	<1.3(-5)
^{133m}Xe	<1.7(-6)	<9.5(-7)	<2.7(-6)	<2.8(-6)
^{133}Xe	6.4 ± 0.4(-6)	5.64 ± 0.07(-5)	<1.6(-6)	1.42 ± 0.08(-4)
^{135m}Xe	<8.3(-7)	<8.9(-7)	<8.2(-7)	<3.8(-6)
^{135}Xe	2.2 ± 0.3(-6)	1.54 ± 0.09(-6)	<2.7(-7)	3.4 ± 0.3(-6)
^{137}Xe	<3.4(-5)	<6.2(-5)	<1.8(-5)	4.5 ± 3.1(-4)
^{138}Xe	<1.6(-6)	<2.1(-6)	<1.8(-6)	1.3 ± 0.4(-5)
^{84}Br	*	*	*	*
^{131}I	8.0 ± 0.2(-10)	6.8 ± 0.1(-9)	3.52 ± 0.04(-9)	6.0 ± 0.1(-9)
^{132}I	1.6 ± 0.4(-10)	*	*	6.4 ± 0.5(-10)
^{133}I	3.1 ± 0.1(-9)	5.2 ± 0.2(-9)	5.1 ± 0.1(-9)	5.6 ± 0.1(-9)
^{134}I	*	*	*	*
^{135}I	1.3 ± 0.1(-9)	*	3.2 ± 0.1(-9)	6.3 ± 0.4(-10)
^{134}Cs	5.4 ± 2.4(-12)	3.0 ± 0.2(-11)	2.3 ± 0.2(-11)	3.7 ± 0.2(-11)
^{136}Cs	<2.9(-12)	<3.6(-9)	<2.2(-12)	<1.8(-12)
^{137}Cs	1.7 ± 0.4(-11)	6.5 ± 0.2(-11)	5.2 ± 0.4(-11)	4.4 ± 0.3(-11)
^{138}Cs	3.6 ± 0.5(-9)	*	*	*
^{3}H	1.9 ± 0.2(-7)	7.6 ± 0.4(-6)	**	9.6 ± 0.5(-6)
^{14}C	5.0 ± 0.3(-9)	6.2 ± 0.3(-8)	**	1.59 ± 0.08(-7)
^{24}Na	<6.1(-12)	<1.2(-6)	7.3 ± 0.7(-11)	1.41 ± 0.08(-10)
^{51}Cr	1.6 ± 0.7(-11)	<1.4(-9)	<9.2(-12)	<9.4(-12)
^{54}Mn	4.9 ± 2.0(-12)	2.9 ± 0.5(-12)	<1.6(-12)	<1.9(-12)
^{59}Fe	<6.4(-12)	<2.0(-9)	<2.3(-12)	<4.4(-12)
^{57}Co	<1.9(-12)	<5.4(-13)	<9.8(-13)	<9.0(-13)
^{58}Co	1.0 ± 0.3(-11)	1.6 ± 0.5(-12)	<2.8(-12)	*
^{60}Co	2.6 ± 0.8(-11)	1.4 ± 0.2(-11)	2.7 ± 1.8(-12)	1.1 ± 0.2(-11)
^{65}Zn	<2.0(-11)	<2.2(-9)	<3.5(-12)	<4.0(-12)
^{91}Sr	3.4 ± 0.8(-11)	*	2.0 ± 1.0(-11)	4.4 ± 1.1(-11)

TABLE B.60 (cont'd)

UNIT #3 CONTAINMENT AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc) AFTER REFUELING

Days After Last Purge	4.3	19.3	5.8	12.5
Nuclide	2/23/78	3/15/78	4/18/78	5/3/78
^{91m}Y	3.2 ± 0.6(-10)	*	*	2.9 ± 0.2(-9)
^{93}Y	<3.1(-11)	*	<3.3(-11)	<3.0(-11)
^{95}Zr	<5.8(-12)	<1.6(-9)	<2.4(-12)	<2.5(-12)
^{95}Nb	<4.3(-12)	<1.5(-9)	<1.4(-12)	<1.9(-12)
^{99}Mo	<1.6(-12)	2.5 ± 1.0(-12)	3.5 ± 0.6(-12)	9.5 ± 0.5(-12)
^{103}Ru	<2.3(-12)	<1.4(-9)	<1.4(-12)	<1.3(-12)
^{106}Ru	<2.0(-11)	<1.3(-9)	<1.2(-11)	<1.3(-11)
^{110m}Ag	<4.7(-12)	<2.3(-8)	<1.6(-12)	<2.3(-12)
^{124}Sb	<4.8(-12)	<1.5(-9)	<2.9(-12)	<2.4(-12)
^{125}Sb	9.9 ± 4.2(-12)	<1.1(-9)	<6.8(-12)	<3.5(-12)
^{129m}Te	<7.2(-11)	<1.6(-9)	<5.7(-11)	<4.0(-11)
^{129}Te	<2.9(-10)	*	*	*
^{131m}Te	<1.1(-11)	<4.2(-8)	<8.9(-12)	<9.1(-12)
^{131}Te	*	*	*	*
^{132}Te	<1.6(-12)	<2.7(-9)	<9.2(-13)	<9.3(-12)
^{139}Ba	<4.4(-11)	<1.1(-6)	*	*
^{140}Ba	<1.1(-11)	1.5 ± 0.2(-11)	1.5 ± 0.4(-11)	3.7 ± 0.3(-11)
^{140}La	<2.6(-12)	1.1 ± 0.1(-10)	3.1 ± 1.6(-12)	1.2 ± 0.2(-11)
^{141}Ce	<3.4(-12)	<8.1(-10)	<1.7(-12)	<2.1(-12)
^{143}Ce	<4.2(-12)	<1.7(-8)	<2.7(-12)	<3.3(-12)
^{144}Ce	<1.1(-11)	<7.3(-10)	<7.4(-12)	<8.1(-12)
^{152}Eu	<5.7(-12)	<1.1(-9)	<3.2(-12)	<3.3(-12)
^{154}Eu	1.1 ± 0.4(-11)	<1.1(-9)	<3.5(-12)	<4.2(-12)
^{155}Eu	<5.9(-12)	*	<4.2(-12)	<3.9(-12)
^{187}W	<8.9(-12)	<5.8(-8)	<7.7(-12)	<9.5(-12)
^{239}Np	<5.3(-12)	<4.4(-9)	<4.5(-12)	<4.0(-12)

* Radionuclide not detected.
** Radionuclide not measured.

TABLE B.61

IODINE SPECIES MEASUREMENTS OF UNIT #3 CONTAINMENT ATMOSPHERE

		Fractional Distribution (%)				
Sample Date	Nuclide	Part. Filter	I_2	HOI	Organic	Total (μCi/cc)
11/10/77	^{131}I	2.1	4.8	8.3	84.7	1.45 ± 0.06(-8)
	^{132}I	*	*	*	100	8.0 ± 1.0(-10)
	^{133}I	3.2	*	10.8	86	7.4 ± 0.2(-9)
	^{135}I	*	*	*	100	2.0 ± 0.3(-9)
2/23/78	^{131}I	0.5	0.3	6.8	92.5	8.0 ± 0.2(-10)
	^{132}I	*	24.5	*	75.5	1.6 ± 0.4(-10)
	^{133}I	0.6	3.2	8.1	88.1	3.10 ± 0.07(-9)
	^{135}I	1.4	*	13.9	84.8	1.3 ± 0.1(-9)
3/16/78	^{131}I	0.3	1.2	0.1	98.4	6.8 ± 0.1(-9)
	^{133}I	*	2.5	0.1	91.3	5.2 ± 0.2(-9)
4/18/78	^{131}I	0.3	2.2	2.8	94.6	3.52 ± 0.04(-9)
	^{132}I	*	25.3	73.7	*	3.8 ± 1.2(-10)
	^{133}I	0.7	3.6	4.3	94.5	5.1 ± 0.1(-9)
	^{135}I	1.2	5.3	7.8	85.7	3.2 ± 0.1(-9)
5/4/78	^{131}I	0.4	1.6	2.0	95.9	6.0 ± 0.1(-9)
	^{132}I	*	8.7	9.5	81.9	6.4 ± 0.5(-10)
	^{133}I	0.9	1.2	2.9	95.1	5.6 ± 0.1(-9)
	^{135}I	8.1	23.8	28.5	39.7	6.3 ± 0.4(-10)

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* - Iodine activity not detected on this sample component.

TABLE B.62

UNIT #3 CONTAINMENT AIRBORNE ^{14}C AND ^{3}H CONCENTRATIONS

Date	Total ^{14}C (μCi/cc)	Fraction Not Oxidized (%)	HTO (μCi/cc)	HT or RT (μCi/cc)
11/10/77	4.4 ± 0.2(-8)	89	9.9 ± 0.5(-7)	5.5 ± 2.2(-9)
2/23/77	5.0 ± 0.3(-9)	76	1.4 ± 0.2(-7)	5.5 ± 1.1(-8)
3/15/77	6.2 ± 0.3(-8)	93	7.6 ± 0.4(-6)	2.8 ± 1.1(-9)
5/3/77	1.59 ± 0.08(-7)	87	9.6 ± 0.5(-6)	3.5 ± 0.7(-8)
Ave	6.8(-8)		4.6(-6)	2.5(-8)

TABLE B.63

UNIT #4 CONTAINMENT AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc)

Days After Last Purge	27.0	0.7	26.5
Nuclide	1/12/78	4/11/78	5/10/78
^{41}Ar	1.45 ± 0.09(-5)	1.33 ± 0.08(-5)	1.1 ± 0.1(-5)
^{85m}Kr	1.4 ± 0.2(-6)	6.0 ± 1.5(-7)	3.0 ± 0.2(-6)
^{85}Kr	<4.7(-5)	<4.4(-5)	<5.5(-5)
^{87}Kr	<5.0(-7)	<3.1(-7)	<1.2(-6)
^{88}Kr	<1.6(-6)	<1.5(-6)	<1.9(-6)
^{131m}Xe	<4.1(-5)	<7.6(-6)	<2.8(-5)
^{133m}Xe	4.0 ± 0.2(-5)	7.8 ± 1.7(-6)	2.4 ± 0.2(-5)
^{133}Xe	3.2 ± 0.6(-3)	2.4 ± 0.2(-4)	2.15 ± 0.04(-3)
^{135m}Xe	8.7 ± 3.9(-7)	<5.7(-7)	<6.1(-6)
^{135}Xe	4.1 ± 0.2(-5)	1.2 ± 0.1(-5)	5.6 ± 0.2(-5)
^{137}Xe	<4.9(-5)	<6.8(-6)	*
^{138}Xe	<1.8(-6)	<1.3(-6)	<1.1(-5)
^{84}Br	*	*	<1.3(-8)
^{131}I	7.3 ± 0.1(-9)	2.46 ± 0.03(-9)	6.6 ± 0.1(-10)
^{132}I	*	*	*
^{133}I	9.5 ± 0.5(-10)	5.1 ± 0.1(-10)	3.1 ± 0.2(-10)
^{134}I	*	*	*
^{135}I	2.5 ± 0.6(-10)	4.0 ± 1.5(-11)	1.3 ± 0.2(-10)
^{134}Cs	7.3 ± 0.8(-11)	5.0 ± 0.9(-12)	1.23 ± 0.09(-11)
^{136}Cs	<8.6(-12)	<1.0(-12)	<3.9(-12)
^{137}Cs	1.4 ± 0.1(-10)	1.1 ± 0.1(-11)	2.6 ± 0.1(-11)
^{138}Cs	<3.3(-9)	*	<1.7(-9)
^{3}H	3.4 ± 0.2(-6)	1.20 ± 0.07(-6)	7.4 ± 0.4(-6)
^{14}C	7.7 ± 0.4(-7)	7.4 ± 0.3(-9)	5.7 ± 0.4(-8)
^{24}Na	4.4 ± 1.0(-11)	2.2 ± 0.4(-11)	<3.3(-11)
^{51}Cr	<8.2(-12)	<5.5(-12)	<3.6(-11)
^{54}Mn	<2.1(-11)	<1.2(-12)	2.3 ± 1.2(-12)
^{59}Fe	<1.2(-11)	<1.9(-12)	<9.5(-12)
^{57}Co	<7.4(-12)	<4.7(-13)	<3.9(-12)
^{58}Co	<2.3(-11)	<2.1(-12)	7.1 ± 6.8(-12)
^{60}Co	2.0 ± 1.2(-11)	<3.1(-12)	3.8 ± 1.7(-12)
^{65}Zn	<1.4(-11)	<2.5(-12)	<1.1(-11)
^{91}Sr	<1.8(-11)	<7.1(-12)	<2.3(-11)

TABLE B.63 (cont'd)

UNIT #4 CONTAINMENT AIRBORNE RADIONUCLIDE CONCENTRATIONS (μCi/cc)

Days After Last Purge	27.0	0.7	26.5
Nuclide	1/12/78	4/11/78	5/10/78
^{91m}Y	<1.4(-10)	<2.6(-11)	<1.4(-10)
^{93}Y	<9.0(-12)	<1.4(-11)	<5.3(-11)
^{95}Zr	<1.5(-11)	<1.4(-12)	<7.9(-12)
^{95}Nb	<1.6(-11)	<9.1(-13)	<6.1(-12)
^{99}Mo	<7.2(-12)	<5.9(-13)	<3.0(-12)
^{103}Ru	<8.4(-12)	<8.4(-13)	<5.2(-12)
^{106}Ru	<9.4(-12)	<1.0(-11)	<4.1(-11)
^{110m}Ag	<4.4(-11)	<1.7(-12)	<7.9(-12)
^{124}Sb	<1.8(-11)	<2.5(-12)	<1.5(-11)
^{125}Sb	<1.0(-11)	<2.1(-12)	<1.4(-11)
^{129m}Te	<1.1(-11)	<4.0(-11)	<1.3(-10)
^{129}Te	<1.3(-10)	<1.6(-10)	<7.5(-10)
^{131m}Te	<1.6(-11)	<6.3(-12)	<2.5(-11)
^{131}Te	*	*	*
^{132}Te	3.9 ± 1.4(-12)	<5.7(-13)	<3.2(-12)
^{139}Ba	<7.5(-12)	<3.3(-11)	<9.2(-11)
^{140}Ba	<9.6(-12)	<3.2(-12)	<1.6(-11)
^{140}La	<1.8(-11)	<1.4(-12)	<7.7(-12)
^{141}Ce	<6.6(-12)	<9.8(-13)	<5.1(-12)
^{143}Ce	<1.0(-11)	<1.7(-12)	<7.8(-12)
^{144}Ce	<6.1(-12)	<6.7(-12)	<2.4(-11)
^{152}Eu	<8.3(-12)	<2.2(-12)	<1.3(-11)
^{154}Eu	<1.4(-11)	<3.1(-12)	<1.6(-11)
^{155}Eu	<1.1(-12)	<1.9(-12)	<1.1(-11)
^{187}W	<8.9(-12)	<4.3(-12)	<1.5(-11)
^{239}Np	<6.4(-12)	<1.9(-12)	<1.2(-11)

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* Radionuclide not detected.

TABLE B.64

IODINE SPECIES MEASUREMENTS OF UNIT #4 CONTAINMENT ATMOSPHERE

		Fractional Distribution (%)				
Sample Date	Nuclide	Part. Filter	I_2	HOI	Organic	Total (µCi/cc)
1/12/78	^{131}I	0.3	4.4	9.2	86.2	7.3 ± 0.1(-9)
	^{133}I	1.2	13.2	22.0	63.7	9.5 ± 0.5(-10)
	^{135}I	*	*	*	100	2.5 ± 0.6(-10)
4/11/78	^{131}I	1.6	9.4	54.0	35.0	2.46 ± 0.06(-9)
	^{133}I	2.0	8.8	58.4	30.8	5.1 ± 0.1(-10)
	^{135}I	*	*	*	100	4.0 ± 1.5(-11)
5/10/78	^{131}I	0.6	5.0	5.2	86.7	6.6 ± 0.1(-10)
	^{133}I	1.2	8.1	8.1	82.7	3.1 ± 0.2(-10)
	^{135}I	*	17.9	*	82.1	1.3 ± 0.2(-10)

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* - Iodine activity not detected on this sample component.

TABLE B.65

UNIT #4 CONTAINMENT AIRBORNE ^{14}C AND ^{3}H CONCENTRATIONS

Date	Total ^{14}C (μCi/cc)	Fraction Not Oxidized (%)	HTO (μCi/cc)	HT or RT (μCi/cc)
1/12/78	7.7 ± 0.4(-7)	94	3.4 ± 0.2(-6)	3.9 ± 0.6(-8)
4/11/78	7.4 ± 0.3(-9)	86	1.18 ± 0.06(-6)	2.4 ± 0.7(-8)
5/10/78	5.7 ± 0.4(-8)	40	7.4 ± 0.4(-6)	3.9 ± 0.8(-8)

TABLE B.66

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #1
(μCi/sec)

Nuclide	11/10-11/21/77	11/21-12/4/77	12/4-12/14/77
^{131}I	2.08 ± 0.09(-4)	7.6 ± 0.5(-5)	7.6 ± 0.5(-5)
^{134}Cs	<2.1(-7)	<2.7(-6)	<5.9(-7)
^{136}Cs	<6.4(-7)	<2.2(-6)	<7.9(-7)
^{137}Cs	2 ± 1(-7)	1.4 ± 0.6(-6)	3 ± 1(-7)
^{51}Cr	<5.5(-7)	<9.0(-6)	<5.4(-6)
^{54}Mn	<8.0(-8)	<1.1(-6)	<4.5(-7)
^{59}Fe	<1.0(-6)	<2.9(-6)	<8.2(-7)
^{57}Co	<9.0(-8)	<5.0(-7)	<3.1(-7)
^{58}Co	<1.3(-7)	<2.3(-6)	<8.8(-7)
^{60}Co	<1.7(-7)	<7.9(-7)	<6.5(-7)
^{65}Zn	<3.2(-7)	<1.2(-6)	<1.4(-6)
^{95}Zr	<2.9(-7)	<2.8(-6)	<1.0(-6)
^{95}Nb	<1.7(-7)	<5.3(-7)	<7.4(-7)
^{103}Ru	<2.0(-7)	<9.0(-7)	<7.1(-7)
^{106}Ru	<5.8(-7)	<1.0(-5)	<1.5(-6)
^{110m}Ag	<2.5(-7)	<8.5(-7)	<1.0(-6)
^{124}Sb	<1.5(-7)	<9.9(-7)	<8.8(-7)
^{125}Sb	<2.6(-7)	<1.9(-6)	<2.2(-6)
^{140}Ba	<5.8(-7)	<2.4(-6)	<2.2(-6)
^{140}La	<3.2(-8)	<2.9(-4)	<1.4(-5)
^{141}Ce	<2.1(-7)	<7.6(-7)	<6.5(-7)
^{152}Eu	<1.6(-7)	<1.3(-6)	<2.3(-6)
^{154}Eu	<5.1(-7)	<2.9(-6)	<1.1(-6)

TABLE B.66 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #1
(μCi/sec)

Nuclide	12/14-12/28/77	12/28-1/11/78	1/11-1/25/78
^{131}I	1.46 ± 0.06(-4)	1.06 ± 0.04(-4)	2.2 ± 0.2(-5)
^{134}Cs	2.8 ± 0.6(-7)	<1.8(-7)	<6.7(-8)
^{136}Cs	<2.6(-7)	<6.2(-8)	<1.2(-7)
^{137}Cs	8 ± 2(-7)	7 ± 2(-7)	6 ± 3(-8)
^{51}Cr	<2.4(-6)	<1.9(-6)	<5.6(-7)
^{54}Mn	<3.4(-7)	<1.7(-7)	<7.6(-8)
^{59}Fe	<3.4(-7)	<2.0(-7)	<5.3(-8)
^{57}Co	6 ± 2(-8)	<4.8(-8)	<6.7(-9)
^{58}Co	4.2 ± 0.3(-6)	1.9 ± 0.3(-6)	<1.1(-7)
^{60}Co	4.5 ± 0.3(-6)	2.5 ± 0.2(-6)	<1.8(-7)
^{65}Zn	<9.1(-7)	<6.2(-7)	<5.6(-8)
^{95}Zr	<5.9(-7)	<1.4(-7)	<8.5(-8)
^{95}Nb	2.0 ± 0.8(-7)	<4.0(-7)	<7.6(-8)
^{103}Ru	7 ± 2(-7)	2.8 ± 0.8(-7)	<2.3(-8)
^{106}Ru	<3.7(-6)	<2.0(-6)	<3.5(-7)
^{110m}Ag	<4.0(-7)	<2.0(-7)	<3.5(-8)
^{124}Sb	<5.4(-7)	<2.8(-7)	<4.1(-8)
^{125}Sb	<7.9(-7)	<3.4(-7)	<1.9(-7)
^{140}Ba	<1.1(-6)	<4.8(-7)	<2.5(-7)
^{140}La	<7.6(-6)	<5.9(-7)	<1.3(-6)
^{141}Ce	<2.2(-7)	5 ± 2(-8)	4 ± 1(-8)
^{152}Eu	<6.5(-7)	<1.8(-7)	<1.6(-7)
^{154}Eu	<5.1(-7)	<4.5(-7)	<2.1(-7)

TABLE B.66 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #1
(μCi/sec)

Nuclide	1/23-2/8/78	2/8-2/22/78	2/22-3/9/78
^{131}I	4.4 ± 0.1(-4)	1.73 ± 0.05(-4)	1.06 ± 0.04(-4)
^{134}Cs	8.4 ± 0.1(-5)	<1.8(-7)	<2.3(-7)
^{136}Cs	<7.9(-6)	<9.7(-8)	<3.1(-7)
^{137}Cs	1.43 ± 0.02(-4)	<1.4(-7)	2 ± 1(-7)
^{51}Cr	<1.2(-4)	<4.8(-7)	1.4 ± 0.5(-6)
^{54}Mn	<7.1(-6)	<6.7(-8)	<3.4(-7)
^{59}Fe	<8.2(-6)	<2.6(-7)	<7.1(-8)
^{57}Co	<5.9(-6)	<1.3(-8)	5 ± 2(-8)
^{58}Co	6.8 ± 0.6(-6)	4 ± 1(-7)	7.1 ± 0.6(-6)
^{60}Co	1.6 ± 0.2(-6)	3 ± 1(-7)	1.8 ± 0.2(-6)
^{65}Zn	<8.2(-6)	<3.0(-7)	<5.7(-7)
^{95}Zr	<1.3(-6)	<4.0(-8)	<1.9(-7)
^{95}Nb	<6.8(-6)	<4.3(-8)	<2.1(-7)
^{103}Ru	<1.5(-6)	<1.6(-7)	<3.1(-6)
^{106}Ru	<9.6(-6)	<6.7(-7)	<6.5(-6)
^{110m}Ag	<9.3(-7)	<7.8(-8)	<4.8(-7)
^{124}Sb	<6.8(-5)	<2.4(-7)	3 ± 1(-7)
^{125}Sb	<3.7(-6)	<1.9(-7)	2 ± 1(-7)
^{140}Ba	<5.9(-6)	<2.7(-7)	<1.1(-6)
^{140}La	<9.3(-7)	<8.6(-7)	<4.8(-7)
^{141}Ce	<9.1(-7)	<4.3(-8)	9 ± 3(-8)
^{152}Eu	<4.0(-6)	<6.7(-8)	<4.5(-7)
^{154}Eu	<6.2(-7)	<3.8(-7)	<1.8(-7)

TABLE B.66 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #1
(μCi/sec)

Nuclide	3/9-3/21/78	3/21-4/3/78	4/3-4/20/78
^{131}I	5.2 ± 0.4(-5)	9 ± 2(-6)	1.8 ± 0.2(-5)
^{134}Cs	<2.8(-7)	<1.3(-7)	<1.9(-7)
^{136}Cs	<1.6(-7)	<1.7(-7)	<3.2(-8)
^{137}Cs	<2.9(-7)	<2.4(-7)	1.5 ± 0.6(-7)
^{51}Cr	<1.8(-6)	<5.3(-7)	<3.2(-7)
^{54}Mn	<2.4(-7)	<8.0(-8)	<5.3(-8)
^{59}Fe	<5.1(-7)	<2.1(-7)	<1.9(-7)
^{57}Co	<3.8(-8)	<2.4(-8)	<1.7(-8)
^{58}Co	<5.8(-7)	<3.3(-7)	<1.2(-7)
^{60}Co	<4.5(-7)	<2.5(-7)	<1.2(-7)
^{65}Zn	<4.5(-7)	<2.4(-7)	<1.3(-7)
^{95}Zr	2.3 ± 1.2(-7)	<1.3(-7)	<8.2(-8)
^{95}Nb	<2.0(-7)	<1.3(-7)	<5.8(-8)
^{103}Ru	1 ± 0.5(-7)	<5.6(-8)	<4.1(-8)
^{106}Ru	<4.8(-7)	<4.3(-7)	<9.5(-7)
^{110m}Ag	<4.8(-7)	<6.0(-8)	<4.2(-8)
^{124}Sb	<1.1(-7)	<1.7(-8)	<2.1(-8)
^{125}Sb	3 ± 2(-7)	<3.8(-7)	<1.3(-7)
^{140}Ba	<4.8(-7)	<2.9(-7)	<1.7(-8)
^{140}La	<1.3(-6)	<6.6(-7)	<1.3(-6)
^{141}Ce	2.0 ± 0.6(-7)	<6.9(-8)	<8.1(-8)
^{152}Eu	<7.1(-7)	<2.9(-7)	<3.9(-7)
^{154}Eu	<7.1(-7)	<4.2(-7)	<2.4(-7)

TABLE B.66 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #1
(μCi/sec)

Nuclide	4/20-5/4/78	5/4-5/18/78	5/18-6/1/78
^{131}I	4.8 ± 0.3(-5)	1.2 ± 0.1(-5)	3.1 ± 0.8(-6)
^{134}Cs	<2.7(-8)	<7.0(-8)	<2.9(-7)
^{136}Cs	<3.5(-8)	<3.6(-8)	<1.2(-7)
^{137}Cs	<1.1(-7)	<9.8(-8)	1.5 ± 0.8(-7)
^{51}Cr	<1.6(-8)	<2.0(-7)	<7.6(-7)
^{54}Mn	<7.8(-8)	<5.4(-8)	<1.4(-7)
^{59}Fe	<1.4(-7)	<5.3(-8)	<1.1(-7)
^{57}Co	<1.6(-8)	<5.0(-8)	<8.8(-8)
^{58}Co	<4.9(-8)	7 ± 4(-8)	<8.6(-8)
^{60}Co	<2.1(-7)	<1.7(-7)	3 ± 1(-7)
^{65}Zn	<2.4(-7)	<1.5(-7)	<1.8(-7)
^{95}Zr	<1.0(-7)	<9.3(-8)	<3.1(-7)
^{95}Nb	<2.6(-7)	<6.2(-8)	<9.4(-8)
^{103}Ru	<4.4(-8)	<1.8(-8)	<7.8(-8)
^{106}Ru	<7.9(-7)	<7.0(-7)	<1.2(-6)
^{110m}Ag	<6.6(-8)	<3.1(-8)	<1.0(-7)
^{124}Sb	<5.6(-8)	<1.0(-7)	<7.7(-8)
^{125}Sb	<2.2(-8)	<1.8(-7)	<2.6(-7)
^{140}Ba	<7.2(-7)	<2.4(-7)	<7.9(-7)
^{140}La	<3.9(-7)	<4.0(-8)	<3.2(-7)
^{141}Ce	<2.3(-8)	<1.1(-7)	1.0 ± 0.5(-7)
^{152}Eu	<4.2(-7)	<2.4(-8)	<4.0(-7)
^{154}Eu	<2.9(-7)	<4.0(-7)	<1.7(-7)

TABLE B.67

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #2
(μCi/sec)

Nuclide	11/10-11/21/77	11/21-12/4/77	12/4-12/14/77
^{131}I	5.8 ± 0.2(-4)	3.1 ± 0.1(-4)	6.1 ± 0.2(-4)
^{134}Cs	<5.7(-7)	6.8 ± 0.2(-5)	1.0 ± 0.3(-6)
^{136}Cs	<5.1(-7)	<1.8(-6)	<2.2(-7)
^{137}Cs	9 ± 2(-7)	1.22 ± 0.03(-4)	3 ± 2(-7)
^{51}Cr	<5.4(-6)	<1.7(-5)	5.3 ± 0.9(-6)
^{54}Mn	<2.1(-7)	4 ± 1(-6)	<5.4(-7)
^{59}Fe	<1.0(-6)	<1.3(-6)	<3.0(-7)
^{57}Co	1.1 ± 0.5(-7)	<6.2(-7)	1.9 ± 0.2(-6)
^{58}Co	1.3 ± 0.3(-6)	5.6 ± 0.5(-6)	<6.8(-7)
^{60}Co	<4.3(-7)	2.3 ± 0.1(-5)	<7.8(-7)
^{65}Zn	<4.0(-7)	<2.5(-6)	<1.3(-6)
^{95}Zr	<5.4(-7)	<2.0(-6)	<4.1(-7)
^{95}Nb	<9.7(-7)	<1.4(-6)	<2.8(-7)
^{103}Ru	<4.6(-7)	<1.9(-6)	<5.8(-7)
^{106}Ru	<2.4(-6)	<1.3(-5)	<2.3(-6)
^{110m}Ag	<3.1(-7)	<1.6(-6)	<4.9(-7)
^{124}Sb	<5.6(-7)	<2.4(-5)	<3.5(-7)
^{125}Sb	<7.2(-7)	<6.2(-6)	<1.6(-6)
^{140}Ba	<1.1(-6)	<1.1(-5)	<2.0(-6)
^{140}La	<5.7(-8)	<1.5(-5)	<8.3(-6)
^{141}Ce	<1.1(-6)	<1.7(-6)	<7.8(-7)
^{152}Eu	<4.0(-7)	<5.1(-6)	<2.4(-6)
^{154}Eu	<5.0(-7)	<1.6(-6)	<6.8(-7)

TABLE B.67 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #2
(μCi/sec)

Nuclide	12/14-12/28/77	12/28-1/11/78	1/11-1/25/78
^{131}I	5.82 ± 0.05(-3)	1.08 ± 0.02(-3)	1.52 ± 0.08(-4)
^{134}Cs	7.0 ± 0.1(-5)	<2.4(-7)	2 ± 1(-7)
^{136}Cs	2.0 ± 0.9(-6)	<1.3(-7)	<9.9(-8)
^{137}Cs	1.22 ± 0.02(-4)	4 ± 1(-7)	7 ± 2(-7)
^{51}Cr	<1.8(-5)	<2.8(-6)	<2.2(-6)
^{54}Mn	6.8 ± 0.2(-7)	<2.8(-7)	<1.0(-7)
^{59}Fe	<1.7(-6)	<8.2(-7)	<2.2(-7)
^{57}Co	<7.8(-7)	<2.4(-7)	<3.3(-9)
^{58}Co	9.7 ± 0.9(-6)	1.6 ± 0.4(-6)	4 ± 2(-7)
^{60}Co	2.7 ± 0.3(-6)	2.1 ± 0.3(-6)	<4.9(-7)
^{65}Zn	<1.8(-6)	<5.3(-7)	<7.3(-8)
^{95}Zr	<1.7(-6)	<4.3(-7)	<6.2(-8)
^{95}Nb	<1.3(-6)	<1.4(-7)	<7.3(-8)
^{103}Ru	<2.3(-6)	2 ± 1(-7)	<1.1(-7)
^{106}Ru	<8.7(-6)	<3.7(-6)	<9.3(-7)
^{110m}Ag	<1.7(-6)	<3.2(-7)	<1.2(-7)
^{124}Sb	<3.3(-5)	<3.0(-7)	<3.0(-7)
^{125}Sb	<5.8(-6)	<4.9(-7)	<1.7(-7)
^{140}Ba	<7.8(-6)	<8.2(-7)	<5.7(-7)
^{140}La	<2.3(-5)	<4.4(-7)	<8.8(-6)
^{141}Ce	<1.6(-6)	<6.3(-7)	<1.1(-7)
^{152}Eu	<4.6(-6)	<1.4(-6)	<1.1(-7)
^{154}Eu	<6.8(-7)	<3.0(-7)	<2.6(-7)

TABLE B.67 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #2
(μCi/sec)

Nuclide	1/25-2/8/78	2/8-2/22/78	2/22-3/9/78
^{131}I	1.09 ± 0.02(-3)	1.46 ± 0.02(-3)	7.5 ± 0.2(-4)
^{134}Cs	1.3 ± 0.2(-6)	1.4 ± 0.2(-6)	5 ± 2(-7)
^{136}Cs	<3.6(-7)	<2.0(-7)	<7.3(-7)
^{137}Cs	2.5 ± 0.3(-6)	3.0 ± 0.4(-6)	2.5 ± 0.8(-6)
^{51}Cr	<2.4(-6)	<2.7(-6)	4 ± 2(-6)
^{54}Mn	2 ± 1(-7)	4 ± 1(-7)	8 ± 2(-7)
^{59}Fe	<2.6(-7)	<7.5(-7)	<4.4(-7)
^{57}Co	<1.3(-7)	8 ± 4(-8)	9 ± 7(-8)
^{58}Co	6.3 ± 0.5(-6)	5.3 ± 0.4(-6)	5.7 ± 0.9(-5)
^{60}Co	3.2 ± 0.3(-6)	3.4 ± 0.4(-6)	9.7 ± 0.5(-6)
^{65}Zn	<4.9(-7)	<3.9(-7)	<1.2(-6)
^{95}Zr	<4.8(-7)	<4.0(-7)	<1.3(-6)
^{95}Nb	<4.0(-7)	<3.3(-7)	<9.7(-7)
^{103}Ru	<4.9(-7)	<3.7(-7)	<4.1(-5)
^{106}Ru	<7.3(-6)	3 ± 1(-6)	<8.8(-7)
^{110m}Ag	<2.7(-7)	<3.5(-7)	<2.5(-6)
^{124}Sb	<1.5(-6)	<1.6(-6)	3 ± 1(-6)
^{125}Sb	<9.7(-7)	<1.3(-6)	<2.5(-6)
^{140}Ba	<1.9(-6)	<1.6(-6)	<3.8(-6)
^{140}La	<4.0(-5)	<9.3(-7)	<2.4(-6)
^{141}Ce	<2.4(-7)	3.1 ± 0.9(-7)	<5.8(-7)
^{152}Eu	5 ± 3(-7)	<1.3(-6)	<3.0(-6)
^{154}Eu	<4.9(-7)	<5.3(-7)	<1.3(-6)

TABLE B.67 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #2
(μCi/sec)

Nuclide	3/9-3/21/78	3/21-4/3/78	4/3-4/20/78
^{131}I	9.3 ± 0.2(-4)	5.0 ± 0.4(-5)	3.1 ± 0.1(-4)
^{134}Cs	<5.8(-7)	<4.3(-7)	1.1 ± 0.1(-6)
^{136}Cs	<9.7(-7)	<1.0(-7)	<2.6(-7)
^{137}Cs	7 ± 2(-6)	5 ± 2(-7)	2.5 ± 0.3(-6)
^{51}Cr	<4.2(-6)	<2.0(-6)	1.0 ± 0.5(-6)
^{54}Mn	<4.0(-7)	<3.7(-7)	1.3 ± 0.6(-7)
^{59}Fe	<4.3(-7)	<3.1(-7)	<3.3(-7)
^{57}Co	<5.6(-8)	<8.3(-8)	<1.6(-7)
^{58}Co	<4.2(-6)	2.0 ± 0.4(-6)	3.0 ± 0.4(-6)
^{60}Co	<1.4(-6)	1.3 ± 0.2(-6)	1.5 ± 0.2(-6)
^{65}Zn	<7.2(-7)	<1.4(-7)	<4.2(-7)
^{95}Zr	<6.6(-7)	<3.5(-7)	<2.6(-7)
^{95}Nb	<3.8(-7)	<1.4(-7)	<5.1(-7)
^{103}Ru	<3.8(-7)	<3.6(-7)	<3.2(-7)
^{106}Ru	<6.6(-6)	<3.9(-6)	<3.7(-6)
^{110m}Ag	<6.6(-7)	<5.1(-7)	<3.5(-7)
^{124}Sb	<6.0(-7)	<7.4(-7)	<6.8(-7)
^{125}Sb	<1.1(-6)	<4.5(-7)	<7.5(-7)
^{140}Ba	<9.1(-7)	<4.9(-7)	<1.2(-6)
^{140}La	<2.7(-6)	<1.2(-6)	<2.8(-6)
^{141}Ce	<1.8(-7)	1.0 ± 0.5(-7)	<3.3(-7)
^{152}Eu	<1.3(-6)	<1.6(-7)	<8.6(-7)
^{154}Eu	<2.9(-7)	<8.6(-7)	<2.4(-7)

TABLE B.67 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #2
(μCi/sec)

Nuclide	4/20-5/4/78	5/4-5/18/78	5/18-6/1/78
^{131}I	6.0 ± 0.4(-5)	2.4 ± 0.4(-5)	9 ± 2(-6)
^{134}Cs	3.4 ± 0.8(-7)	4 ± 2(-7)	<4.6(-7)
^{136}Cs	<5.7(-8)	<1.5(-7)	<1.4(-7)
^{137}Cs	9 ± 2(-7)	9 ± 2(-7)	4 ± 2(-7)
^{51}Cr	<3.0(-7)	<9.8(-7)	<2.6(-6)
^{54}Mn	<2.2(-7)	<2.1(-7)	<1.5(-7)
^{59}Fe	<2.4(-7)	<5.8(-7)	<9.4(-7)
^{57}Co	2 ± 1(-8)	<3.2(-8)	<1.2(-7)
^{58}Co	9 ± 2(-7)	9 ± 2(-7)	4 ± 2(-7)
^{60}Co	<4.4(-7)	6 ± 2(-7)	4 ± 1(-7)
^{65}Zn	<1.1(-6)	<6.4(-7)	<5.0(-7)
^{95}Zr	<1.8(-7)	<3.6(-7)	<2.7(-7)
^{95}Nb	<1.7(-7)	<1.4(-7)	<2.2(-7)
^{103}Ru	<3.0(-7)	<1.4(-7)	<8.8(-8)
^{106}Ru	<1.7(-6)	<1.5(-6)	<2.1(-6)
^{110m}Ag	<1.7(-7)	<1.8(-7)	<2.8(-7)
^{124}Sb	<9.3(-8)	<3.1(-7)	<3.4(-7)
^{125}Sb	<2.1(-7)	<3.1(-7)	<1.4(-6)
^{140}Ba	<4.6(-7)	<6.8(-7)	<3.2(-7)
^{140}La	<9.5(-7)	<1.5(-6)	<1.2(-6)
^{141}Ce	<6.6(-8)	<6.7(-8)	<3.2(-7)
^{152}Eu	<1.3(-7)	<9.8(-8)	<5.8(-7)
^{154}Eu	<1.1(-7)	<4.4(-7)	<1.0(-6)

TABLE B.68

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #3
(μCi/sec)

Nuclide	11/10-11/21/77	11/21-12/4/77[A]	12/4-12/14/77
^{131}I	1.65 ± 0.03(-3)	3.0 ± 0.1(-4)	6.9 ± 0.5(-5)
^{134}Cs	<3.9(-7)	5 ± 2(-7)	<3.8(-7)
^{136}Cs	<1.1(-6)	<2.8(-7)	<2.4(-9)
^{137}Cs	1.1 ± 0.2(-6)	7 ± 3(-7)	1.4 ± 0.3(-6)
^{51}Cr	<2.0(-6)	<2.5(-6)	<2.1(-6)
^{54}Mn	<1.1(-7)	<3.6(-7)	<7.6(-8)
^{59}Fe	<6.3(-7)	<5.4(-7)	<5.2(-7)
^{57}Co	<8.6(-8)	<1.4(-7)	<8.0(-8)
^{58}Co	7 ± 3(-7)	2.1 ± 0.4(-6)	9 ± 2(-7)
^{60}Co	<6.7(-7)	7 ± 3(-7)	1.4 ± 0.2(-6)
^{65}Zn	<2.9(-7)	<4.6(-7)	<4.2(-7)
^{95}Zr	<4.7(-7)	<6.8(-7)	<2.6(-7)
^{95}Nb	<3.9(-7)	<5.7(-7)	<8.0(-8)
^{103}Ru	<1.4(-7)	<3.6(-7)	<9.7(-8)
^{106}Ru	<2.2(-6)	<3.6(-6)	<3.5(-6)
^{110m}Ag	<4.7(-7)	<3.0(-7)	<1.3(-9)
^{124}Sb	<5.9(-7)	<5.4(-7)	<3.1(-7)
^{125}Sb	<3.6(-7)	<6.8(-7)	<2.8(-7)
^{140}Ba	<1.2(-6)	<9.3(-7)	<1.6(-6)
^{140}La	<2.3(-7)	<2.5(-5)	<7.6(-8)
^{141}Ce	<1.0(-6)	<2.7(-7)	<1.8(-7)
^{152}Eu	<3.8(-7)	<9.6(-7)	<7.6(-7)
^{154}Eu	<1.8(-7)	<3.6(-7)	<2.0(-7)

[A] Sampler off for brief period during sample period.

TABLE B.68 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #3
(μCi/sec)

Nuclide	12/14-12/28/77	12/28-1/11/78	1/11-1/25/78
^{131}I	1.35 ± 0.02(-3)	1.15 ± 0.02(-3)	1.16 ± 0.06(-4)
^{134}Cs	<2.6(-7)	<2.4(-7)	1.8 ± 0.2(-6)
^{136}Cs	<2.9(-7)	<5.1(-8)	<1.9(-7)
^{137}Cs	1.4 ± 0.7(-7)	1.0 ± 0.7(-7)	4.3 ± 0.4(-6)
^{51}Cr	<1.4(-6)	<6.5(-7)	<1.3(-6)
^{54}Mn	<8.9(-8)	1.4 ± 0.7(-7)	<2.8(-8)
^{59}Fe	<4.5(-7)	<3.8(-7)	<3.4(-7)
^{57}Co	<5.2(-8)	<4.1(-8)	<1.2(-7)
^{58}Co	2.1 ± 0.7(-7)	8 ± 2(-7)	1.1 ± 0.7(-7)
^{60}Co	7 ± 1(-7)	1.5 ± 0.2(-6)	4 ± 1(-7)
^{65}Zn	<5.5(-7)	<2.8(-7)	<1.5(-7)
^{95}Zr	<3.1(-7)	<2.3(-7)	<1.1(-7)
^{95}Nb	<1.9(-7)	<1.7(-7)	<1.4(-7)
^{103}Ru	<1.0(-7)	<9.6(-8)	1.8 ± 0.7(-7)
^{106}Ru	<1.3(-6)	<1.3(-6)	<7.1(-7)
^{110m}Ag	<8.9(-8)	<7.2(-8)	<2.1(-7)
^{124}Sb	<1.5(-7)	2 ± 1(-7)	<1.1(-6)
^{125}Sb	<2.2(-7)	3 ± 1(-7)	<1.6(-7)
^{140}Ba	<8.6(-8)	<2.8(-7)	<3.4(-7)
^{140}La	<1.9(-6)	<1.2(-6)	<8.6(-7)
^{141}Ce	<1.5(-6)	<1.6(-7)	<1.3(-7)
^{152}Eu	<2.3(-7)	<2.5(-7)	<2.9(-7)
^{154}Eu	<1.4(-7)	<3.4(-7)	<1.7(-7)

TABLE B.68 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #3
(μCi/sec)

Nuclide	1/25-2/8/78[A]	2/8-2/22/78[A]	2/22-3/9/78
^{131}I	6.2 ± 0.2(-4)	1.01 ± 0.02(-3)	6.7 ± 0.1(-4)
^{134}Cs	2.2 ± 0.3(-6)	7 ± 1(-7)	5 ± 1(-7)
^{136}Cs	<6.9(-7)	<2.9(-7)	<1.2(-7)
^{137}Cs	4.1 ± 0.7(-6)	1.5 ± 0.3(-6)	9 ± 2(-7)
^{51}Cr	<6.6(-6)	1.6 ± 0.7(-6)	1.3 ± 0.5(-6)
^{54}Mn	<7.2(-7)	<2.6(-7)	1.0 ± 0.5(-7)
^{59}Fe	<2.3(-7)	<2.8(-7)	<2.6(-7)
^{57}Co	1.4 ± 0.3(-7)	<1.1(-8)	<6.9(-8)
^{58}Co	2.1 ± 0.1(-5)	3.6 ± 0.3(-6)	3.2 ± 0.3(-6)
^{60}Co	6.9 ± 0.7(-6)	2.4 ± 0.3(-6)	1.7 ± 0.3(-6)
^{65}Zn	<7.9(-7)	<2.0(-7)	<1.1(-7)
^{95}Zr	<7.9(-7)	<2.8(-7)	<9.7(-8)
^{95}Nb	7.3 ± 0.2(-6)	5.6 ± 0.2(-7)	<1.8(-7)
^{103}Ru	<8.3(-7)	<3.6(-7)	<2.1(-7)
^{106}Ru	<2.2(-5)	<3.9(-6)	<4.5(-6)
^{110m}Ag	<4.8(-7)	<2.7(-7)	<2.5(-7)
^{124}Sb	<2.5(-6)	<7.9(-7)	<5.5(-7)
^{125}Sb	<2.0(-6)	<6.6(-7)	<2.8(-7)
^{140}Ba	<4.1(-6)	<1.0(-6)	<8.3(-7)
^{140}La	<2.0(-6)	<9.2(-7)	<2.4(-6)
^{141}Ce	<5.2(-7)	<1.3(-7)	1.2 ± 0.5(-7)
^{152}Eu	<1.6(-6)	<3.9(-7)	<2.7(-7)
^{154}Eu	<2.4(-7)	<6.6(-7)	<7.6(-8)

TABLE B.68 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #3
(μCi/sec)

Nuclide	3/9-3/21/78	3/21-4/3/78	4/3-4/20/78
^{131}I	6.0 ± 0.1(-4)	9.5 ± 0.5(-5)	1.23 ± 0.05(-4)
^{134}Cs	7 ± 2(-7)	2.1 ± 0.7(-7)	2.0 ± 0.2(-6)
^{136}Cs	<1.4(-7)	<7.4(-8)	<4.9(-6)
^{137}Cs	2.1 ± 0.3(-6)	7 ± 2(-7)	3.3 ± 0.3(-6)
^{51}Cr	2.2 ± 0.6(-6)	<2.7(-7)	<2.6(-6)
^{54}Mn	3.1 ± 0.8(-7)	<9.8(-8)	1.0 ± 0.2(-6)
^{59}Fe	<7.1(-7)	<1.6(-7)	2 ± 1(-7)
^{57}Co	7 ± 2(-8)	<4.7(-9)	5 ± 2(-8)
^{58}Co	7.9 ± 0.7(-6)	9 ± 2(-7)	1.17 ± 0.05(-5)
^{60}Co	5.3 ± 0.3(-6)	2 ± 1(-7)	1.36 ± 0.04(-5)
^{65}Zn	<1.1(-6)	<6.7(-8)	<8.3(-7)
^{95}Zr	<1.3(-6)	<2.2(-7)	2 ± 1(-7)
^{95}Nb	2 ± 1(-7)	<1.2(-7)	6 ± 2(-7)
^{103}Ru	<4.3(-7)	<2.4(-7)	1.2 ± 0.7(-7)
^{106}Ru	<7.1(-6)	<1.9(-6)	<6.8(-6)
^{110m}Ag	2.7 ± 0.8(-7)	<1.6(-7)	<6.0(-7)
^{124}Sb	<1.1(-6)	<4.1(-7)	<1.1(-6)
^{125}Sb	<1.0(-6)	<8.2(-8)	7± 2(-7)
^{140}Ba	<1.9(-6)	<2.2(-7)	<1.5(-6)
^{140}La	<2.9(-6)	<9.6(-7)	<6.6(-7)
^{141}Ce	8 ± 4(-8)	<2.2(-7)	<2.6(-7)
^{152}Eu	<1.7(-6)	<4.0(-7)	<1.1(-6)
^{154}Eu	<1.3(-9)	<2.6(-7)	<4.3(-7)

TABLE B.68 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #3
(μCi/sec)

Nuclide	4/20-5/4/78	5/4-5/18/78[B]	5/18-6/1/78
^{131}I	6.5 ± 0.1(-4)	1.6 ± 0.2(-5)	5 ± 2(-6)
^{134}Cs	7 ± 1(-7)	7 ± 1(-7)	1.0 ± 0.2(-6)
^{136}Cs	<4.1(-7)	<2.0(-7)	<3.2(-7)
^{137}Cs	1.1 ± 0.2(-6)	1.2 ± 0.2(-6)	1.9 ± 0.4(-6)
^{51}Cr	<2.3(-6)	<1.3(-6)	<3.4(-6)
^{54}Mn	1.2 ± 0.6(-7)	3 ± 1(-7)	2 ± 1(-7)
^{59}Fe	<3.6(-7)	<4.3(-7)	<3.3(-7)
^{57}Co	<1.4(-7)	<5.5(-8)	<2.0(-7)
^{58}Co	4.2 ± 0.4(-6)	3.3 ± 0.4(-6)	1.7 ± 0.3(-6)
^{60}Co	6.1 ± 0.4(-6)	3.1 ± 0.3(-6)	3.8 ± 0.4(-6)
^{65}Zn	<1.0(-6)	<2.3(-7)	<8.9(-7)
^{95}Zr	<7.8(-7)	<5.7(-7)	<4.7(-7)
^{95}Nb	<2.4(-7)	<2.3(-7)	<4.0(-7)
^{103}Ru	8 ± 5(-8)	<1.7(-7)	<3.5(-7)
^{106}Ru	<3.7(-6)	<3.3(-6)	<2.6(-6)
^{110m}Ag	<7.0(-7)	<5.4(-7)	<5.8(-7)
^{124}Sb	<7.4(-7)	<5.7(-7)	<1.0(-6)
^{125}Sb	<7.2(-7)	<7.4(-7)	<1.3(-6)
^{140}Ba	<1.2(-6)	<6.9(-7)	<1.8(-6)
^{140}La	<4.3(-7)	<6.1(-7)	<1.2(-6)
^{141}Ce	<1.8(-7)	<7.4(-8)	<2.8(-7)
^{152}Eu	<7.3(-7)	<6.9(-7)	<1.4(-6)
^{154}Eu	<1.5(-6)	<1.8(-6)	<4.2(-7)

[B] Sample line flow possibly off during portion of sampling period.

TABLE B.69

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4
(μCi/sec)

Nuclide	11/10-11/21/77	11/21-12/4/77	12/4-12/14/77
^{131}I	4.33 ± 0.03(-2)	3.45 ± 0.05(-3)	1.69 ± 0.04(-3)
^{134}Cs	1.0 ± 0.4(-6)	4.0 ± 0.2(-5)	<2.8(-9)
^{136}Cs	<1.6(-6)	<1.8(-6)	<1.6(-7)
^{137}Cs	2.4 ± 0.5(-6)	8.9 ± 0.3(-5)	<6.5(-7)
^{51}Cr	6 ± 2(-6)	<1.8(-5)	<3.2(-6)
^{54}Mn	<6.2(-7)	1.5 ± 0.4(-6)	<1.7(-7)
^{59}Fe	<8.2(-7)	<1.3(-6)	<6.9(-7)
^{57}Co	3 ± 2(-7)	<6.9(-7)	<1.7(-7)
^{58}Co	3.9 ± 0.8(-6)	3.8 ± 0.2(-5)	1.4 ± 0.2(-6)
^{60}Co	<1.3(-6)	5.6 ± 0.7(-6)	<1.2(-6)
^{65}Zn	<3.5(-6)	<1.2(-6)	<1.2(-6)
^{95}Zr	<8.6(-7)	<2.0(-6)	<3.0(-7)
^{95}Nb	<1.1(-6)	<1.5(-6)	<7.1(-7)
^{103}Ru	<1.2(-6)	8 ± 4(-7)	<1.7(-7)
^{106}Ru	<8.0(-6)	<2.5(-5)	<5.3(-6)
^{110m}Ag	<1.7(-7)	<9.2(-7)	<2.5(-7)
^{124}Sb	<2.9(-6)	<1.6(-5)	<9.5(-7)
^{125}Sb	<1.3(-6)	<6.2(-6)	<2.1(-6)
^{140}Ba	<6.2(-6)	<9.2(-6)	<1.7(-6)
^{140}La	<3.4(-7)	<5.4(-5)	<5.3(-8)
^{141}Ce	1.5 ± 0.6(-6)	<1.4(-6)	<4.0(-7)
^{152}Eu	<2.0(-6)	<7.1(-6)	<7.7(-7)
^{154}Eu	<2.3(-7)	<1.1(-6)	<4.6(-7)

TABLE B.69 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4
(μCi/sec)

Nuclide	12/14-12/28/77	12/28-1/11/78	1/11-1/25/78
^{131}I	3.06 ± 0.01(-2)	3.37 ± 0.01(-2)	1.50 ± 0.03(-3)
^{134}Cs	1.0 ± 0.4(-6)	2.1 ± 0.6(-6)	1.4 ± 0.4(-6)
^{136}Cs	<1.2(-6)	<1.7(-6)	<5.2(-7)
^{137}Cs	2.9 ± 0.5(-6)	2.9 ± 0.7(-6)	3.4 ± 0.6(-6)
^{51}Cr	<7.1(-6)	<1.1(-5)	<1.3(-6)
^{54}Mn	<8.7(-7)	2.4 ± 0.6(-6)	<3.4(-7)
^{59}Fe	<7.3(-7)	<1.3(-6)	<5.5(-7)
^{57}Co	<2.9(-7)	<7.4(-7)	<1.7(-7)
^{58}Co	3.2 ± 0.6(-7)	2.9 ± 0.2(-5)	1.0 ± 0.3(-6)
^{60}Co	3.6 ± 0.4(-7)	4.2 ± 0.2(-5)	<7.0(-7)
^{65}Zn	<6.7(-7)	<4.0(-6)	<1.0(-6)
^{95}Zr	<7.0(-7)	<2.6(-6)	<5.5(-6)
^{95}Nb	<4.1(-7)	<2.5(-6)	<1.7(-7)
^{103}Ru	<7.9(-7)	<1.3(-6)	<3.2(-7)
^{106}Ru	<5.3(-6)	<1.6(-5)	<2.6(-6)
^{110m}Ag	<7.4(-7)	<2.2(-6)	<5.8(-8)
^{124}Sb	2.9 ± 0.4(-6)	<2.1(-6)	<1.6(-6)
^{125}Sb	9.5 ± 0.8(-6)	6 ± 2(-6)	<1.0(-6)
^{140}Ba	<3.2(-6)	<5.2(-6)	<1.0(-6)
^{140}La	<9.5(-6)	<7.1(-6)	<5.3(-6)
^{141}Ce	3 ± 2(-7)	<1.3(-6)	<6.4(-8)
^{152}Eu	<2.3(-6)	<3.3(-6)	<3.9(-7)
^{154}Eu	<1.5(-6)	<1.0(-6)	<6.8(-7)

TABLE B.69 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4
(μCi/sec)

Nuclide	1/25-2/8/78	2/8-2/22/78	2/22-3/9/78
^{131}I	6.93 ± 0.02(-2)	4.13 ± 0.01(-2)	1.03 ± 0.01(-2)
^{134}Cs	1.11 ± 0.07(-5)	1.2 ± 0.3(-6)	3 ± 2(-7)
^{136}Cs	<3.2(-6)	<4.2(-7)	<4.8(-7)
^{137}Cs	2.1 ± 0.2(-5)	4.2 ± 0.6(-6)	1.5 ± 0.5(-6)
^{51}Cr	<2.6(-5)	<7.2(-6)	3 ± 2(-6)
^{54}Mn	5 ± 1(-6)	2 ± 1(-7)	<2.8(-7)
^{59}Fe	<3.0(-6)	<1.8(-7)	<9.5(-7)
^{57}Co	2.2 ± 1.3(-6)	<4.9(-7)	<3.6(-7)
^{58}Co	1.07 ± 0.03(-4)	1.22 ± 0.01(-5)	2.5 ± 0.2(-5)
^{60}Co	6 ± 2(-5)	6.1 ± 0.6(-6)	3.9 ± 0.5(-6)
^{65}Zn	<4.8(-6)	<8.2(-7)	<5.4(-7)
^{95}Zr	<4.4(-6)	<5.6(-7)	<6.7(-7)
^{95}Nb	<2.8(-6)	<7.5(-7)	<5.4(-7)
^{103}Ru	<2.8(-6)	3 ± 1(-7)	<5.9(-7)
^{106}Ru	<7.9(-5)	<9.0(-6)	<2.1(-5)
^{110m}Ag	<2.8(-6)	<9.0(-7)	<6.1(-7)
^{124}Sb	<1.1(-5)	3.4 ± 0.6(-6)	2.6 ± 0.6(-6)
^{125}Sb	9 ± 1(-6)	<2.5(-6)	6 ± 3(-7)
^{140}Ba	<1.2(-5)	<2.4(-6)	<2.8(-6)
^{140}La	<2.1(-4)	<4.3(-6)	<3.1(-6)
^{141}Ce	<1.7(-6)	<1.0(-6)	<6.1(-7)
^{152}Eu	<5.6(-6)	<2.5(-6)	<1.9(-6)
^{154}Eu	<3.8(-7)	<4.6(-7)	<9.5(-7)

TABLE B.69 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4
(μCi/sec)

Nuclide	3/9-3/21/78	3/21-4/3/78	4/3-4/20/78
^{131}I	1.73 ± 0.01(-2)	9.4 ± 0.2(-4)	2.84 ± 0.04(-3)
^{134}Cs	<1.0(-6)	<7.8(-7)	1.0 ± 0.2(-6)
^{136}Cs	<1.7(-7)	<3.3(-7)	<2.0(-7)
^{137}Cs	9 ± 3(-7)	<8.9(-7)	2.2 ± 0.4(-6)
^{51}Cr	<5.2(-6)	<5.2(-6)	<2.6(-6)
^{54}Mn	<7.7(-7)	<5.4(-7)	<2.2(-7)
^{59}Fe	<1.2(-6)	<1.7(-6)	<8.8(-7)
^{57}Co	6 ± 4(-8)	<3.1(-7)	<8.5(-8)
^{58}Co	2.9 ± 0.5(-6)	6 ± 3(-7)	4 ± 2(-7)
^{60}Co	1.1 ± 0.3(-6)	<1.5(-6)	<7.0(-7)
^{65}Zn	<1.1(-6)	<5.0(-7)	<2.4(-7)
^{95}Zr	<1.3(-6)	<4.0(-7)	<4.4(-7)
^{95}Nb	<4.9(-7)	<6.7(-7)	<3.1(-7)
^{103}Ru	<3.5(-7)	<3.2(-7)	<2.0(-7)
^{106}Ru	<6.5(-6)	<2.4(-6)	<1.6(-6)
^{110m}Ag	<9.3(-7)	<2.6(-7)	<3.9(-7)
^{124}Sb	<1.3(-6)	<3.2(-7)	<1.0(-6)
^{125}Sb	<2.3(-6)	<1.8(-6)	6 ± 3(-7)
^{140}Ba	<6.1(-7)	<1.6(-6)	<8.7(-7)
^{140}La	<2.3(-4)	<1.9(-6)	<2.7(-6)
^{141}Ce	5 ± 2(-7)	4 ± 2(-7)	<2.3(-7)
^{152}Eu	<1.3(-6)	<1.4(-6)	<6.1(-7)
^{154}Eu	<1.1(-6)	<1.2(-6)	<4.1(-7)

TABLE B.69 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4
(μCi/sec)

Nuclide	4/20-5/4/78	5/4-5/18/78[B]	5/18-6/1/78[B]
^{131}I	2.72 ± 0.01(-2)	2.92 ± 0.07(-4)	2.9 ± 0.1(-4)
^{134}Cs	1.6 ± 0.3(-6)	<1.9(-8)	1.0 ± 0.2(-6)
^{136}Cs	<4.6(-7)	<7.5(-8)	<2.5(-7)
^{137}Cs	2.5 ± 0.5(-6)	<2.2(-7)	9.8 ± 3.7(-7)
^{51}Cr	<6.3(-6)	<6.2(-7)	<4.1(-6)
^{54}Mn	5 ± 2(-7)	<7.8(-8)	<2.8(-7)
^{59}Fe	<5.7(-7)	<1.1(-6)	<3.8(-6)
^{57}Co	<4.7(-7)	<3.0(-8)	<3.0(-7)
^{58}Co	9.5 ± 0.8(-6)	<1.4(-7)	<4.9(-7)
^{60}Co	7.7 ± 0.7(-6)	<2.8(-7)	4 ± 2(-7)
^{65}Zn	<1.2(-6)	<6.8(-8)	<5.6(-7)
^{95}Zr	<2.0(-7)	<1.4(-7)	<3.4(-7)
^{95}Nb	<7.7(-7)	<1.0(-7)	<1.8(-7)
^{103}Ru	<7.6(-7)	<4.2(-8)	<5.6(-7)
^{106}Ru	<7.8(-6)	<1.6(-7)	<2.5(-6)
^{110m}Ag	<5.4(-7)	<9.3(-8)	<1.8(-7)
^{124}Sb	<1.6(-6)	<8.6(-8)	<9.2(-7)
^{125}Sb	9 ± 5(-7)	<1.2(-7)	<2.1(-6)
^{140}Ba	<2.5(-6)	<1.8(-7)	1.1 ± 0.6(-6)
^{140}La	<5.5(-7)	<8.8(-7)	<1.1(-6)
^{141}Ce	<7.6(-7)	<6.2(-8)	<4.8(-7)
^{152}Eu	7 ± 2(-7)	<1.2(-7)	<8.4(-7)
^{154}Eu	<3.9(-7)	<2.2(-7)	<1.0(-6)

[B] Air flow to sampler off for part of sample period.

TABLE B.70

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4A
(μCi/sec)

Nuclide	1/20-1/25/78	1/25-1/26/78[C]	2/8-2/22/78
^{131}I	8.6 ± 0.3(-4)	2.50 ± 0.05(-2)	8.97 ± 0.06(-3)
^{134}Cs	<2.6(-6)	<2.8(-6)	1.8 ± 0.4(-6)
^{136}Cs	<1.2(-6)	<8.6(-6)	<3.6(-7)
^{137}Cs	8 ± 4(-7)	<3.4(-6)	4.1 ± 0.5(-6)
^{51}Cr	<5.2(-6)	7 ± 3(-5)	<5.9(-6)
^{54}Mn	<1.1(-6)	<5.7(-6)	<1.3(-6)
^{59}Fe	<1.9(-6)	<5.9(-6)	<6.4(-7)
^{57}Co	<3.4(-7)	1.2 ± 0.6(-6)	8 ± 6(-8)
^{58}Co	<2.7(-6)	6.6 ± 0.7(-5)	1.21 ± 0.06(-5)
^{60}Co	1 ± 0.5(-6)	2.7 ± 0.4(-5)	7.1 ± 0.6(-6)
^{65}Zn	<1.3(-6)	<1.4(-5)	<1.5(-6)
^{95}Zr	<1.3(-6)	<1.4(-5)	<1.1(-6)
^{95}Nb	<9.2(-7)	<1.1(-5)	<1.0(-6)
^{103}Ru	<3.8(-7)	3 ± 1(-6)	<5.7(-7)
^{106}Ru	<6.6(-6)	<7.9(-5)	<8.4(-6)
^{110m}Ag	<1.0(-6)	<3.9(-6)	<7.7(-7)
^{124}Sb	<5.6(-7)	4 ± 2(-6)	3.8 ± 0.5(-6)
^{125}Sb	<2.2(-6)	<1.3(-5)	2 ± 1(-6)
^{140}Ba	<4.6(-6)	<6.6(-5)	<3.6(-6)
^{140}La	<1.9(-5)	<1.3(-6)	<1.5(-6)
^{141}Ce	<1.3(-6)	<3.3(-6)	2 ± 1(-7)
^{152}Eu	<1.7(-6)	<5.8(-6)	<2.4(-6)
^{154}Eu	<3.2(-6)	<5.7(-6)	<1.6(-7)

[C] Short Sample Period.

TABLE B.70 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4A
(μCi/sec)

Nuclide	2/22-3/9/78	3/9-3/21/78	3/21-4/3/78
^{131}I	3.75 ± 0.04(-3)	3.22 ± 0.05(-3)	7.9 ± 0.2(-4)
^{134}Cs	<4.1(-7)	<6.5(-7)	4 ± 1(-7)
^{136}Cs	<1.4(-7)	<1.4(-7)	<2.8(-7)
^{137}Cs	1.1 ± 0.3(-6)	3 ± 1(-7)	5 ± 2(-7)
^{51}Cr	<4.0(-6)	<4.3(-6)	<2.2(-6)
^{54}Mn	<5.3(-7)	<3.0(-7)	<3.2(-7)
^{59}Fe	<3.4(-7)	<8.2(-7)	<8.9(-7)
^{57}Co	1.1 ± 0.6(-6)	<1.3(-7)	<2.5(-7)
^{58}Co	9.3 ± 0.6(-6)	1.0 ± 0.3(-6)	1.0 ± 0.3(-6)
^{60}Co	2.4 ± 0.3(-6)	<7.0(-7)	5 ± 3(-7)
^{65}Zn	<3.0(-7)	<5.5(-7)	<3.7(-7)
^{95}Zr	<5.9(-7)	<2.0(-6)	<4.2(-7)
^{95}Nb	<3.2(-7)	<1.6(-7)	<2.7(-7)
^{103}Ru	1 ± 0.5(-7)	<5.5(-7)	4 ± 1(-7)
^{106}Ru	<1.1(-5)	<2.3(-6)	<4.0(-6)
^{110m}Ag	<6.2(-7)	<5.2(-7)	<4.0(-7)
^{124}Sb	1.3 ± 0.3(-6)	<4.8(-7)	<8.4(-7)
^{125}Sb	6 ± 3(-7)	<2.0(-6)	1.2 ± 0.4(-6)
^{140}Ba	<2.2(-6)	<1.2(-6)	<1.6(-6)
^{140}La	<3.3(-6)	<1.4(-5)	<3.2(-6)
^{141}Ce	<5.8(-7)	4 ± 1(-7)	<4.2(-7)
^{152}Eu	<5.1(-7)	<7.5(-7)	<1.3(-6)
^{154}Eu	<2.6(-6)	<4.1(-7)	<8.3(-7)

TABLE B.70 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4A
(μCi/sec)

Nuclide	4/3-4/20/78	4/20-5/3/78	5/4-5/18/78
^{131}I	6.5 ± 0.2(-4)	9.61 ± 0.06(-3)	1.04 ± 0.02(-3)
^{134}Cs	8 ± 2(-7)	<2.0(-7)	4 ± 2(-7)
^{136}Cs	<1.4(-7)	<2.7(-8)	<3.9(-7)
^{137}Cs	1.4 ± 0.3(-6)	<5.3(-7)	1.5 ± 0.3(-6)
^{51}Cr	<1.7(-6)	<2.2(-6)	<1.7(-6)
^{54}Mn	<2.9(-7)	<1.0(-7)	<3.6(-7)
^{59}Fe	<3.9(-7)	<5.3(-7)	<4.7(-7)
^{57}Co	<7.3(-8)	<1.6(-7)	<1.8(-7)
^{58}Co	4 ± 2(-7)	<3.6(-7)	2.4 ± 0.4(-6)
^{60}Co	<4.2(-7)	<5.5(-7)	3.7 ± 0.8(-6)
^{65}Zn	<1.7(-6)	<4.4(-7)	<5.4(-7)
^{95}Zr	<2.7(-7)	<2.7(-7)	<9.7(-7)
^{95}Nb	<2.0(-7)	<2.5(-7)	<1.6(-7)
^{103}Ru	<3.0(-7)	<6.4(-8)	<3.2(-7)
^{106}Ru	<2.5(-6)	<3.0(-6)	<4.6(-6)
^{110m}Ag	<9.8(-7)	<2.5(-7)	<2.5(-7)
^{124}Sb	<1.7(-6)	<2.8(-7)	<1.2(-6)
^{125}Sb	<1.2(-6)	<5.3(-8)	9 ± 3(-7)
^{140}Ba	<3.7(-7)	<3.4(-7)	<1.0(-6)
^{140}La	<1.8(-6)	<6.1(-7)	<1.4(-6)
^{141}Ce	<1.7(-7)	<2.0(-7)	<1.8(-7)
^{152}Eu	<4.6(-7)	<4.3(-7)	<8.8(-7)
^{154}Eu	<1.6(-7)	<8.2(-7)	<6.8(-7)

TABLE B.70 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #4A
(μCi/sec)

Nuclide	5/18-6/1/78
^{131}I	3.5 ± 0.1(-4)
^{134}Cs	1.8 ± 0.2(-6)
^{136}Cs	<5.6(-7)
^{137}Cs	2.7 ± 0.4(-6)
^{51}Cr	<5.2(-6)
^{54}Mn	<5.4(-7)
^{59}Fe	<5.1(-7)
^{57}Co	<2.2(-7)
^{58}Co	<9.7(-7)
^{60}Co	6 ± 2(-7)
^{65}Zn	<6.0(-7)
^{95}Zr	<6.4(-7)
^{95}Nb	<4.4(-7)
^{103}Ru	<5.8(-7)
^{106}Ru	<1.6(-6)
^{110m}Ag	<3.9(-7)
^{124}Sb	<1.3(-6)
^{125}Sb	<1.3(-6)
^{140}Ba	<1.7(-6)
^{140}La	<3.8(-6)
^{141}Ce	<5.2(-7)
^{152}Eu	<1.1(-6)
^{154}Eu	<2.8(-7)

TABLE B.71

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #5
(μCi/sec)

Nuclide	11/10-11/21/77	11/21-12/4/77	12/4-12/14/77
^{131}I	5 ± 1(-5)	6.8 ± 1.5(-6)	1.68 ± 0.07(-4)
^{134}Cs	4.4 ± 0.9(-7)	4.7 ± 0.8(-7)	<2.1(-8)
^{136}Cs	<4.1(-7)	<6.1(-8)	<1.4(-7)
^{137}Cs	1.2 ± 0.2(-6)	1.1 ± 0.2(-6)	1.1 ± 0.5(-7)
^{51}Cr	<4.4(-6)	<5.3(-7)	<2.0(-6)
^{54}Mn	<8.5(-8)	<3.3(-8)	<1.4(-7)
^{59}Fe	<3.8(-7)	<2.8(-8)	<5.1(-7)
^{57}Co	<9.1(-8)	<3.0(-8)	<5.4(-8)
^{58}Co	<9.7(-8)	<9.1(-8)	<1.3(-7)
^{60}Co	<2.7(-7)	<2.3(-7)	<2.7(-7)
^{65}Zn	<3.1(-7)	<2.0(-7)	<4.3(-7)
^{95}Zr	<3.4(-7)	<1.9(-7)	<3.8(-7)
^{95}Nb	<2.4(-7)	<1.2(-7)	<1.5(-7)
^{103}Ru	<7.5(-8)	<1.0(-7)	<7.2(-8)
^{106}Ru	<1.3(-6)	<3.3(-7)	<1.0(-6)
^{110m}Ag	<2.9(-7)	<1.5(-7)	<2.1(-7)
^{124}Sb	<2.9(-7)	<2.7(-7)	<1.6(-7)
^{125}Sb	<2.8(-7)	<2.7(-7)	<2.0(-7)
^{140}Ba	<2.3(-6)	<6.1(-7)	<4.3(-7)
^{140}La	<1.5(-7)	<1.5(-6)	<2.0(-6)
^{141}Ce	<2.6(-7)	<1.9(-7)	<3.2(-7)
^{152}Eu	<2.6(-7)	<9.7(-8)	<5.6(-7)
^{154}Eu	<1.6(-7)	<5.5(-7)	<4.8(-7)

TABLE B.71 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #5
(μCi/sec)

Nuclide	12/14-12/28/77	12/28-1/11/78	1/11-1/25/78
^{131}I	2.4 ± 0.2(-5)	1.9 ± 0.2(-5)	3.1 ± 0.9(-6)
^{134}Cs	<6.7(-8)	<2.0(-8)	<1.4(-7)
^{136}Cs	<9.1(-8)	<7.8(-8)	<4.5(-8)
^{137}Cs	<8.6(-8)	8 ± 2(-8)	<2.2(-7)
^{51}Cr	<1.1(-6)	<1.1(-7)	<5.9(-7)
^{54}Mn	<8.3(-8)	<6.5(-8)	<7.0(-8)
^{59}Fe	<1.8(-7)	<2.7(-7)	<7.8(-8)
^{57}Co	<7.0(-9)	<6.7(-9)	<1.1(-8)
^{58}Co	<2.2(-7)	1.1 ± 0.5(-7)	<1.7(-7)
^{60}Co	4 ± 1(-7)	1.1 ± 0.5(-7)	<1.3(-7)
^{65}Zn	<2.6(-7)	<1.8(-8)	<8.1(-8)
^{95}Zr	<4.0(-8)	<1.9(-7)	<1.5(-7)
^{95}Nb	<4.0(-8)	<8.9(-7)	<7.8(-8)
^{103}Ru	<9.7(-8)	<7.3(-8)	<2.4(-7)
^{106}Ru	<6.2(-7)	<8.6(-7)	<5.0(-7)
^{110m}Ag	<1.2(-7)	<1.5(-7)	<5.3(-7)
^{124}Sb	<7.5(-8)	<1.3(-7)	<4.5(-8)
^{125}Sb	<1.2(-7)	<2.1(-7)	<5.9(-7)
^{140}Ba	<5.1(-7)	<3.0(-7)	<1.2(-7)
^{140}La	<2.7(-6)	<1.4(-7)	<3.6(-6)
^{141}Ce	<1.1(-8)	<4.3(-8)	<2.3(-8)
^{152}Eu	<2.3(-7)	<3.2(-7)	<2.0(-7)
^{154}Eu	<1.5(-7)	<1.1(-6)	<1.9(-7)

TABLE B.71 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #5
(μCi/sec)

Nuclide	1/25-2/8/78	2/8-2/22/78	2/22-3/9/78
^{131}I	1.47 ± 0.06(-4)	1.75 ± 0.06(-4)	1.87 ± 0.06(-4)
^{134}Cs	2.2 ± 0.8(-7)	2.2 ± 0.2(-6)	<4.6(-8)
^{136}Cs	<4.0(-7)	<1.1(-7)	<3.2(-8)
^{137}Cs	7 ± 2(-7)	3.9 ± 0.3(-6)	1.0 ± 0.5(-7)
^{51}Cr	<3.8(-6)	<1.5(-6)	<3.8(-8)
^{54}Mn	2 ± 1(-7)	3.1 ± 0.8(-7)	<4.3(-8)
^{59}Fe	<4.8(-7)	<3.1(-7)	<2.0(-7)
^{57}Co	<1.6(-7)	6 ± 3(-8)	<4.0(-8)
^{58}Co	1.77 ± 0.08(-5)	1.7 ± 0.2(-6)	7 ± 1(-7)
^{60}Co	4.6 ± 0.3(-6)	1.2 ± 0.2(-6)	<4.0(-7)
^{65}Zn	<7.0(-7)	<2.3(-7)	<1.5(-7)
^{95}Zr	<4.8(-7)	<1.6(-7)	<5.9(-8)
^{95}Nb	<4.6(-7)	<3.1(-7)	<9.4(-8)
^{103}Ru	<4.6(-7)	<2.8(-7)	<1.4(-7)
^{106}Ru	<1.4(-5)	<1.7(-6)	<1.2(-6)
^{110m}Ag	<4.8(-7)	1.3 ± 0.3(-7)	<3.8(-7)
^{124}Sb	<9.1(-7)	<1.9(-6)	<1.8(-7)
^{125}Sb	<1.3(-6)	<6.7(-7)	<1.4(-7)
^{140}Ba	<2.5(-6)	<9.5(-7)	<3.5(-7)
^{140}La	<1.0(-5)	<1.1(-6)	<1.1(-6)
^{141}Ce	<2.5(-7)	<1.8(-7)	<9.1(-8)
^{152}Eu	<1.3(-6)	<5.4(-7)	<1.5(-7)
^{154}Eu	<3.8(-7)	<3.1(-7)	<2.0(-7)

TABLE B.71 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #5
(μCi/sec)

Nuclide	3/9-3/21/78	3/21-4/3/78	4/3-4/20/78
^{131}I	2.2 ± 0.3(-5)	4 ± 1(-6)	7 ± 1(-6)
^{134}Cs	<1.7(-7)	<1.9(-7)	<9.3(-8)
^{136}Cs	<1.6(-7)	<6.7(-8)	<3.3(-7)
^{137}Cs	<1.7(-7)	<7.9(-8)	1.0 ± 0.4(-7)
^{51}Cr	<8.3(-7)	<2.5(-7)	<4.3(-7)
^{54}Mn	<7.4(-8)	<1.7(-7)	<4.0(-8)
^{59}Fe	<3.7(-7)	<4.8(-7)	<9.8(-7)
^{57}Co	<3.7(-8)	<4.6(-8)	<4.1(-8)
^{58}Co	<3.4(-7)	4 ± 1(-7)	<1.8(-7)
^{60}Co	1.3 ± 0.8(-7)	<6.3(-7)	<1.1(-7)
^{65}Zn	<1.5(-7)	<2.2(-7)	<1.6(-7)
^{95}Zr	<3.0(-7)	<2.7(-7)	<1.5(-7)
^{95}Nb	<3.7(-8)	7 ± 5(-8)	<1.2(-7)
^{103}Ru	<9.2(-8)	1.4 ± 0.6(-7)	<9.2(-9)
^{106}Ru	<5.5(-7)	<1.7(-6)	<9.4(-7)
^{110m}Ag	<1.6(-7)	<3.5(-7)	<2.9(-8)
^{124}Sb	<7.7(-8)	<1.4(-7)	<1.3(-7)
^{125}Sb	<1.8(-7)	<2.5(-7)	<1.8(-7)
^{140}Ba	<4.0(-7)	5 ± 2(-7)	<1.8(-7)
^{140}La	<1.8(-6)	<9.2(-7)	<9.9(-7)
^{141}Ce	<7.7(-8)	7 ± 4(-8)	<1.3(-8)
^{152}Eu	<2.7(-7)	<1.6(-7)	<6.9(-8)
^{154}Eu	<2.4(-7)	<5.4(-7)	<6.4(-8)

TABLE B.71 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Sample Station #5
(μCi/sec)

Nuclide	4/20-5/4/78	5/4-5/18/78	5/18-6/1/78
^{131}I	1.3 ± 0.1(-5)	2.6 ± 0.8(-6)	1.9 ± 0.2(-5)
^{134}Cs	<2.8(-7)	<1.1(-7)	<2.7(-7)
^{136}Cs	<6.0(-8)	<3.8(-7)	<2.9(-7)
^{137}Cs	1.1 ± 0.5(-7)	3.0 ± 0.8(-7)	1.8 ± 0.8(-7)
^{51}Cr	<1.8(-7)	<5.4(-8)	<9.0(-7)
^{54}Mn	<4.2(-8)	<1.7(-8)	<2.1(-7)
^{59}Fe	<7.2(-8)	<2.0(-7)	<2.0(-7)
^{57}Co	<1.1(-9)	<1.8(-8)	<9.0(-8)
^{58}Co	<9.6(-8)	1.4 ± 0.6(-7)	1.0 ± 0.6(-7)
^{60}Co	<7.8(-8)	<7.6(-8)	<4.4(-7)
^{65}Zn	<1.0(-7)	<6.8(-8)	<1.8(-7)
^{95}Zr	<4.1(-8)	<2.0(-7)	<2.9(-7)
^{95}Nb	<3.6(-8)	<1.6(-7)	<1.2(-7)
^{103}Ru	<3.3(-8)	<9.6(-8)	<1.1(-7)
^{106}Ru	<5.4(-7)	<6.7(-7)	<5.3(-7)
^{110m}Ag	<5.6(-8)	<5.5(-8)	<1.2(-7)
^{124}Sb	<7.3(-8)	<3.8(-8)	<2.6(-7)
^{125}Sb	<7.3(-8)	<7.2(-8)	<2.0(-7)
^{140}Ba	<3.1(-7)	<3.6(-7)	<6.6(-7)
^{140}La	<5.6(-7)	<1.3(-6)	<2.0(-6)
^{141}Ce	<2.2(-8)	<1.0(-7)	<2.1(-7)
^{152}Eu	<8.2(-8)	<4.6(-7)	<6.3(-7)
^{154}Eu	<2.5(-7)	<1.2(-7)	<3.5(-7)

TABLE B.72

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Unit #3 Fuel Pit Area Duct
(μCi/sec)

Nuclide	12/8-12/12/77	12/14-12/28/77	12/28-1/11/78
^{131}I	1.8 ± 0.3(-4)	1.6 ± 0.2(-4)	1.8 ± 0.1(-4)
^{134}Cs	<8.8(-7)	<1.5(-6)	<1.2(-7)
^{136}Cs	<2.0(-6)	<4.8(-7)	<6.1(-7)
^{137}Cs	<3.1(-6)	9 ± 3(-7)	<3.1(-7)
^{14}C	[E]	7 ± 1(-4) [D]	2.1 ± 0.3(-3)
^{3}H	[E]	1.1(-2) [D]	3.3 ± 0.6(-2)
^{51}Cr	<2.2(-5)	<7.2(-6)	<1.5(-6)
^{54}Mn	<9.5(-7)	<4.4(-7)	<2.6(-7)
^{59}Fe	<4.8(-6)	<9.7(-7)	<1.1(-6)
^{57}Co	<1.1(-6)	<4.2(-7)	<2.2(-8)
^{58}Co	<1.4(-6)	<6.3(-7)	<9.7(-8)
^{60}Co	<1.2(-6)	<1.6(-6)	<8.8(-7)
^{65}Zn	<2.8(-6)	<1.1(-6)	<4.3(-7)
^{95}Zr	<4.3(-6)	<1.3(-6)	<2.3(-7)
^{95}Nb	<8.9(-7)	<8.5(-8)	<2.6(-7)
^{103}Ru	<1.0(-6)	<6.1(-7)	<2.3(-7)
^{106}Ru	<8.5(-6)	<1.4(-6)	<1.2(-6)
^{110m}Ag	<2.7(-6)	<8.3(-7)	<2.0(-7)
^{124}Sb	<1.6(-6)	<5.9(-7)	<5.8(-7)
^{125}Sb	<2.9(-6)	<2.1(-6)	<3.6(-6)
^{140}Ba	<1.1(-5)	<1.9(-6)	<1.4(-6)
^{140}La	<5.0(-5)	<2.2(-5)	<2.0(-6)
^{141}Ce	<1.5(-6)	<5.3(-7)	<1.4(-7)
^{152}Eu	<2.8(-6)	<1.4(-6)	<6.5(-7)
^{154}Eu	<3.7(-6)	<1.1(-6)	<1.6(-6)

[E] No sample due to broken sample line.

[D] Oxidized ^{3}H and ^{14}C only.

TABLE B.72 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Unit #3 Fuel Pit Area Duct
(μCi/sec)

Nuclide	1/11-1/25/78	1/25-2/8/78	2/8-2/22/78
^{131}I	1.7 ± 0.2(-4)	1.17 ± 0.04(-3)	2.63 ± 0.05(-3)
^{134}Cs	6 ± 2(-7)	<1.9(-7)	<5.3(-7)
^{136}Cs	<7.3(-7)	<4.4(-7)	<2.8(-7)
^{137}Cs	6 ± 3(-7)	<6.4(-7)	3 ± 1(-7)
^{14}C	1.44 ± 0.07(-2)	1.3 ± 0.2(-2)	3.0 ± 0.5(-3) [D]
^{3}H	1.5 ± 0.3(-2)	3.9 ± 0.4(-2)	4.4 ± 0.2(-2) [D]
^{51}Cr	<4.3(-6)	<3.0(-6)	<1.3(-6)
^{54}Mn	<3.2(-7)	<4.2(-7)	<2.6(-7)
^{59}Fe	<9.4(-7)	<1.7(-6)	<8.8(-7)
^{57}Co	<2.4(-7)	<1.5(-7)	<6.1(-8)
^{58}Co	<1.4(-7)	<1.3(-7)	<1.2(-7)
^{60}Co	<5.1(-7)	<6.1(-7)	<1.2(-7)
^{65}Zn	<5.1(-7)	<4.6(-7)	<1.3(-6)
^{95}Zr	<5.8(-7)	<6.3(-7)	<2.3(-6)
^{95}Nb	<4.1(-7)	<4.1(-7)	<1.7(-7)
^{103}Ru	<7.9(-7)	<1.5(-7)	<3.6(-7)
^{106}Ru	<9.0(-7)	<3.6(-6)	<2.3(-6)
^{110m}Ag	<4.1(-7)	<5.0(-7)	<1.3(-7)
^{124}Sb	<9.9(-7)	<3.7(-7)	<3.6(-7)
^{125}Sb	<1.3(-6)	<8.7(-7)	<7.9(-7)
^{140}Ba	<7.1(-7)	<2.3(-6)	<1.2(-6)
^{140}La	<2.2(-6)	<3.9(-5)	<1.1(-5)
^{141}Ce	<2.0(-7)	<2.9(-7)	<4.1(-7)
^{152}Eu	<2.8(-6)	<8.7(-7)	<4.4(-7)
^{154}Eu	<2.1(-6)	<1.3(-6)	<1.2(-6)

[D] Oxidized ^{3}H and ^{14}C only.

TABLE B.72 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Unit #3 Fuel Pit Area Duct
(μCi/sec)

Nuclide	2/22-3/9/78	3/9-3/15/78[C]	3/21-4/3/78
^{131}I	1.0 ± 0.4(-3)	6.0 ± 0.4(-4)	1.0 ± 0.2(-4)
^{134}Cs	<8.2(-8)	<2.0(-6)	<6.4(-7)
^{136}Cs	<3.4(-7)	<5.6(-7)	<4.9(-7)
^{137}Cs	<9.4(-8)	<1.2(-6)	<3.2(-7)
^{14}C	6.1 ± 0.6(-3) [D]	1.5 ± 0.3(-3) [D]	3.1 ± 0.5(-3)
^{3}H	1.8 ± 0.2(-2) [D]	4.9 ± 0.9(-3) [D]	7 ± 2(-3)
^{51}Cr	<3.1(-6)	<2.1(-5)	<3.7(-6)
^{54}Mn	<4.1(-7)	<1.6(-6)	<5.4(-7)
^{59}Fe	<1.5(-6)	<2.1(-6)	<1.6(-6)
^{57}Co	<3.5(-8)	<1.7(-7)	<2.5(-7)
^{58}Co	<2.3(-7)	<2.3(-6)	3 ± 2(-8)
^{60}Co	<2.0(-6)	<2.6(-6)	<1.1(-6)
^{65}Zn	<4.8(-7)	<1.7(-6)	<9.7(-7)
^{95}Zr	<5.9(-7)	<1.7(-6)	<7.2(-7)
^{95}Nb	<1.3(-6)	<4.2(-6)	<5.5(-7)
^{103}Ru	<4.1(-7)	<1.4(-6)	<2.6(-7)
^{106}Ru	<5.2(-7)	<5.1(-6)	<4.0(-7)
^{110m}Ag	<4.5(-7)	<3.0(-6)	<5.4(-7)
^{124}Sb	<4.6(-7)	<1.1(-6)	<8.1(-7)
^{125}Sb	<4.1(-7)	<4.1(-6)	<1.2(-6)
^{140}Ba	<7.2(-7)	7.0 ± 3.7(-7)	<2.1(-6)
^{140}La	<3.6(-6)	<8.2(-4)	<2.5(-6)
^{141}Ce	<1.4(-7)	5.8 ± 3.0(-7)	<2.9(-7)
^{152}Eu	<7.7(-7)	<5.6(-6)	<1.6(-6)
^{154}Eu	<3.5(-7)	<3.9(-6)	<1.4(-6)

[D] Oxidized ^{3}H and ^{14}C only.

[C] Short sample period due to power failure.

TABLE B.72 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Unit #3 Fuel Pit Duct Area
(μCi/sec)

Nuclide	4/3-4/20/78	4/20-5/4/78	5/4-5/18/78
^{131}I	6 ± 3(-6)	6.2 ± 0.7(-5)	3.2 ± 0.6(-5)
^{134}Cs	<1.4(-6)	<8.2(-7)	<6.7(-7)
^{136}Cs	<7.6(-7)	<5.4(-7)	<6.1(-7)
^{137}Cs	4 ± 3(-7)	3 ± 2(-7)	<4.8(-7)
^{14}C	6.0 ± 0.3(-2)	1.4 ± 0.2(-3)	8 ± 2(-4)
^{3}H	4.3 ± 0.1(-1)	1.6 ± 0.2(-2)	1.2 ± 0.3(-2)
^{51}Cr	<1.0(-6)	<4.1(-6)	<8.3(-6)
^{54}Mn	<1.9(-7)	<3.6(-7)	<2.7(-7)
^{59}Fe	<8.6(-7)	<1.4(-6)	<7.7(-6)
^{57}Co	<2.2(-7)	<6.9(-7)	<1.5(-7)
^{58}Co	<3.9(-7)	<7.4(-7)	1.8 ± 0.6(-6)
^{60}Co	<1.0(-6)	<1.1(-6)	<1.5(-6)
^{65}Zn	<4.8(-7)	<1.1(-6)	<1.8(-6)
^{95}Zr	<7.8(-7)	<1.5(-6)	<7.3(-7)
^{95}Nb	<2.5(-7)	<6.8(-7)	<2.2(-7)
^{103}Ru	<5.4(-7)	<8.3(-7)	<1.5(-7)
^{106}Ru	<5.7(-6)	<4.4(-6)	<1.9(-6)
^{110m}Ag	<2.5(-7)	<3.6(-7)	<1.2(-6)
^{124}Sb	<3.0(-7)	<7.9(-7)	<4.9(-7)
^{125}Sb	<3.8(-7)	<1.9(-6)	<2.4(-7)
^{140}Ba	<3.3(-7)	<1.3(-6)	<1.8(-6)
^{140}La	<3.2(-6)	<8.2(-6)	<5.0(-6)
^{141}Ce	<4.9(-7)	5 ± 3(-7)	<7.1(-7)
^{152}Eu	<1.6(-6)	<9.7(-7)	<3.2(-7)
^{154}Eu	<1.3(-6)	<9.0(-7)	<1.6(-8)

TABLE B.72 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Unit #3 Fuel Pit Duct Area
(μCi/sec)

Nuclide	5/18-6/1/78
^{131}I	9 ± 4(-6)
^{134}Cs	<1.5(-6)
^{136}Cs	<4.2(-7)
^{137}Cs	<7.9(-7)
^{14}C	2.5 ± 0.4(-3)
^{3}H	5 ± 1(-3)
^{51}Cr	<6.0(-6)
^{54}Mn	<7.9(-8)
^{59}Fe	<1.2(-6)
^{57}Co	<3.0(-7)
^{58}Co	<9.8(-7)
^{60}Co	5 ± 3(-7)
^{65}Zn	<3.2(-7)
^{95}Zr	<1.0(-6)
^{95}Nb	<8.1(-7)
^{103}Ru	<3.0(-7)
^{106}Ru	<5.9(-7)
^{110m}Ag	<2.3(-7)
^{124}Sb	<1.7(-7)
^{125}Sb	<1.5(-6)
^{140}Ba	<2.0(-6)
^{140}La	<6.9(-6)
^{141}Ce	<6.9(-7)
^{152}Eu	<1.5(-6)
^{154}Eu	<1.5(-6)

TABLE B.73

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Unit #3 Sample Room
(μCi/sec)

Nuclide	4/14-4/20/78[G]	4/20-5/4/78[G]	5/4-5/18/78[G]
^{131}I	6.6 ± 0.3(-6)	3.25 ± 0.03(-5)	1.34 ± 0.07(-6)
^{134}Cs	1.7 ± 0.4(-8)	<5.4(-9)	<4.1(-9)
^{136}Cs	<8.8(-9)	<4.0(-9)	<8.7(-9)
^{137}Cs	5.1 ± 0.9(-8)	4 ± 2(-9)	<3.8(-9)
^{51}Cr	<2.2(-8)	<4.7(-8)	<2.3(-8)
^{54}Mn	<1.8(-8)	<4.2(-9)	<1.3(-9)
^{59}Fe	<1.7(-8)	<6.3(-9)	<2.0(-9)
^{57}Co	<2.7(-9)	<2.8(-9)	<1.1(-9)
^{58}Co	<1.4(-8)	<1.1(-8)	7 ± 2(-9)
^{60}Co	1.7 ± 0.7(-8)	<5.7(-9)	8 ± 2(-9)
^{65}Zn	<8.1(-9)	<4.7(-9)	<5.8(-9)
^{95}Zr	<6.6(-9)	<4.0(-9)	<2.5(-9)
^{95}Nb	<3.3(-9)	<4.2(-9)	<1.6(-9)
^{103}Ru	<4.1(-9)	2 ± 1(-9)	<5.4(-10)
^{106}Ru	<1.9(-8)	<3.7(-8)	<2.0(-8)
^{110m}Ag	<2.9(-9)	<1.0(-8)	<2.3(-9)
^{124}Sb	<1.6(-8)	<7.2(-9)	<2.6(-9)
^{125}Sb	<1.6(-8)	<1.6(-8)	<8.6(-9)
^{140}Ba	<2.8(-8)	<2.1(-8)	<8.3(-9)
^{140}La	<5.3(-8)	<3.3(-8)	<7.4(-9)
^{141}Ce	<2.7(-9)	<6.2(-9)	<9.0(-10)
^{152}Eu	<5.1(-9)	1.7 ± 0.6(-8)	<1.3(-9)
^{154}Eu	<1.0(-8)	<1.9(-8)	<2.9(-8)

[G] Sample room duct flow calculated proportionally from design and measured flows. Flow used was 150 cfm.

TABLE B.74

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Gas Stripper Room
(μCi/sec)

Nuclide	5/18-6/1/78[G]
^{131}I	8.6 ± 0.8(-7)
^{134}Cs	<9.7(-9)
^{136}Cs	<4.8(-9)
^{137}Cs	1.2 ± 0.3(-8)
^{51}Cr	<3.8(-8)
^{54}Mn	<5.2(-9)
^{59}Fe	<7.5(-9)
^{57}Co	<2.9(-9)
^{58}Co	<3.9(-9)
^{60}Co	1.4 ± 0.5(-8)
^{65}Zn	<9.2(-9)
^{95}Zr	<6.1(-9)
^{95}Nb	<3.0(-9)
^{103}Ru	<5.8(-9)
^{106}Ru	<3.9(-8)
^{110m}Ag	<5.1(-9)
^{124}Sb	<5.1(-9)
^{125}Sb	<1.5(-8)
^{140}Ba	<2.2(-8)
^{140}La	<5.7(-8)
^{141}Ce	<4.7(-9)
^{152}Eu	<1.1(-8)
^{154}Eu	<2.0(-8)

[G] Gas stripper room duct flow calculated proportionally from design and measured flows. Flow used was 205 cfm.

TABLE B.75

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES

Main Stack
(μCi/sec)

Nuclide	11/10-11/21/77	11/21-12/4/77	12/4-12/14/77
^{131}I	3.98 ± 0.07(-2)	1.04 ± 0.02(-2)	1.74 ± 0.03(-2)
^{134}Cs	2.4 ± 0.3(-5)	2.9 ± 0.3(-5)	1.3 ± 0.4(-5)
^{136}Cs	<1.1(-5)	9 ± 2(-6)	<1.4(-5)
^{137}Cs	5.9 ± 0.7(-5)	5.5 ± 0.4(-5)	5 ± 1(-5)
^{14}C	2.1 ± 0.2(-2)[D]	5.7 ± 0.3(-2)	2.05 ± 0.08(-1)
^{3}H	3.1 ± 0.5(-2)[D]	9 ± 1(-2)	4.9 ± 0.3(-1)
^{51}Cr	<4.9(-5)	<4.0(-5)	<9.7(-5)
^{54}Mn	<1.1(-6)	<4.8(-6)	<9.7(-6)
^{59}Fe	<6.5(-6)	<4.8(-6)	<2.4(-5)
^{57}Co	<2.9(-6)	<1.8(-6)	<4.3(-6)
^{58}Co	<2.0(-6)	1.2 ± 0.2(-5)	2.5 ± 0.4(-5)
^{60}Co	<2.8(-6)	7.5 ± 0.3(-6)	1.6 ± 0.4(-5)
^{65}Zn	<7.2(-6)	<3.4(-6)	<2.1(-5)
^{95}Zr	<7.5(-6)	<5.6(-6)	<2.2(-5)
^{95}Nb	<4.3(-6)	<3.2(-6)	<1.6(-5)
^{103}Ru	<2.4(-6)	<4.0(-6)	<1.4(-5)
^{106}Ru	<7.5(-6)	<2.9(-5)	<6.4(-5)
^{110m}Ag	<2.3(-6)	<3.6(-6)	<1.6(-5)
^{124}Sb	<1.3(-5)	<1.6(-5)	<1.6(-5)
^{125}Sb	<1.1(-5)	<1.3(-5)	<2.7(-5)
^{140}Ba	<4.9(-5)	2.0 ± 0.8(-5)	<4.2(-5)
^{140}La	<2.7(-6)	8 ± 1(-4)	<2.5(-4)
^{141}Ce	<6.2(-6)	<3.3(-6)	<1.1(-5)
^{152}Eu	<1.4(-5)	<1.7(-5)	<3.9(-5)
^{154}Eu	<8.5(-6)	<7.9(-6)	<2.4(-5)

[D] Oxidized ^{3}H and ^{14}C only.

TABLE B.75 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES

Main Stack
(μCi/sec)

Nuclide	12/14-12/28/77	12/28-1/11/78	1/11-1/25/78
^{131}I	6.60 ± 0.04(-2)	4.39 ± 0.04(-2)	3.39 ± 0.08(-3)
^{134}Cs	<4.3(-5)	<3.8(-5)	3 ± 1(-6)
^{136}Cs	<5.7(-5)	<4.2(-5)	<4.5(-6)
^{137}Cs	<5.5(-5)	<4.1(-5)	9 ± 2(-6)
^{14}C	2.6 ± 0.1(-1)	1.38 ± 0.08(-1)	9 ± 1(-3)[D]
^{3}H	6.8 ± 0.3(-1)	1.5 ± 0.2(-1)	1.9 ± 0.2(-1)[D]
^{51}Cr	3.3 ± 0.8(-4)	3 ± 1(-4)	<1.9(-5)
^{54}Mn	2.4 ± 0.3(-4)	1.6 ± 0.2(-4)	3 ± 1(-6)
^{59}Fe	5 ± 1(-5)	5 ± 1(-5)	<1.4(-5)
^{57}Co	2.5 ± 0.4(-5)	1.9 ± 0.4(-5)	<3.7(-7)
^{58}Co	5.60 ± 0.04(-3)	2.93 ± 0.04(-3)	3.5 ± 0.4(-5)
^{60}Co	6.19 ± 0.04(-3)	3.86 ± 0.04(-3)	4.0 ± 0.4(-5)
^{65}Zn	1.7 ± 0.4(-4)	6 ± 2(-5)	<8.7(-6)
^{95}Zr	2.3 ± 0.3(-4)	1.5 ± 0.2(-4)	<3.1(-6)
^{95}Nb	3.9 ± 0.3(-4)	2.4 ± 0.2(-4)	<4.6(-6)
^{103}Ru	5.8 ± 0.3(-4)	4.1 ± 0.2(-4)	<5.1(-6)
^{106}Ru	<3.2(-3)	<2.4(-5)	<4.0(-5)
^{110m}Ag	<6.4(-5)	<1.6(-3)	<5.4(-6)
^{124}Sb	7 ± 1(-5)	1.7 ± 0.8(-5)	<6.3(-6)
^{125}Sb	6 ± 2(-5)	5 ± 2(-5)	2 ± 1(-6)
^{140}Ba	<1.6(-4)	<3.6(-5)	<8.6(-6)
^{140}La	<4.9(-4)	<5.8(-5)	<8.1(-6)
^{141}Ce	9.2 ± 0.8(-5)	7 ± 1(-5)	<1.3(-6)
^{152}Eu	<8.7(-5)	<8.4(-5)	<3.4(-6)
^{154}Eu	<6.3(-5)	<4.0(-5)	<1.4(-6)

[D] Oxidized ^{3}H and ^{14}C only.

TABLE B.75 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES

Main Stack
(μCi/sec)

Nuclide	1/25-2/8/78	2/8-2/22/78	2/22-3/9/78
^{131}I	7.65 ± 0.04(-2)	5.07 ± 0.04(-2)	1.92 ± 0.02(-2)
^{134}Cs	2.43 ± 0.01(-3)	2.4 ± 0.3(-5)	<6.1(-5)
^{136}Cs	<1.5(-5)	<4.0(-6)	<7.5(-5)
^{137}Cs	4.24 ± 0.03(-3)	3.8 ± 0.4(-5)	<9.3(-5)
^{14}C	6.5 ± 0.3(-1)	4.8 ± 0.3(-1)	1.59 ± 0.08(-1)
^{3}H	2.4 ± 0.3(-1)	2.4 ± 0.2(-1)	4.6 ± 0.2(-1)
^{51}Cr	<1.8(-4)	2.6(-5)	4.22 ± 0.02(-3)
^{54}Mn	3.8 ± 0.4(-5)	6 ± 2(-6)	1.12 ± 0.03(-3)
^{59}Fe	<8.5(-6)	<3.3(-6)	3.7 ± 0.4(-4)
^{57}Co	3 ± 2(-6)	<1.2(-6)	1.03 ± 0.08(-4)
^{58}Co	8.8 ± 0.4(-5)	6.4 ± 0.4(-5)	3.82 ± 0.01(-2)
^{60}Co	1.03 ± 0.04(-4)	3.1 ± 0.3(-5)	9.07 ± 0.04(-3)
^{65}Zn	<1.7(-5)	<4.1(-6)	3.2 ± 0.5(-4)
^{95}Zr	1.7 ± 0.8(-5)	<5.5(-6)	2.8 ± 0.5(-4)
^{95}Nb	5 ± 2(-6)	<1.7(-6)	7.6 ± 0.4(-4)
^{103}Ru	<2.2(-5)	<5.0(-6)	1.3 ± 0.4(-4)
^{106}Ru	<1.1(-4)	<5.6(-5)	<2.2(-2)
^{110m}Ag	5 ± 3(-6)	<2.4(-6)	5.5 ± 0.3(-4)
^{124}Sb	<1.7(-3)	<2.1(-5)	1.04 ± 0.04(-3)
^{125}Sb	<5.6(-5)	<8.0(-6)	4.0 ± 0.6(-4)
^{140}Ba	<8.8(-5)	<1.1(-5)	<3.2(-4)
^{140}La	<8.1(-4)	<1.1(-5)	<2.0(-4)
^{141}Ce	<1.6(-5)	<4.8(-6)	4 ± 1(-5)
^{152}Eu	<5.2(-5)	<1.3(-5)	<2.4(-4)
^{154}Eu	<1.1(-5)	<1.5(-6)	<8.6(-5)

TABLE B.75 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES

Main Stack
(μCi/sec)

Nuclide	3/9-3/21/78	3/21-4/3/78	4/3-4/20/78
^{131}I	1.43 ± 0.02(-2)	2.52 ± 0.01(-3)	4.69 ± 0.09(-3)
^{134}Cs	<2.0(-6)	5.8 ± 0.3(-5)	<9.0(-6)
^{136}Cs	<4.9(-6)	<1.0(-5)	<3.8(-6)
^{137}Cs	<7.8(-7)	9.4 ± 0.6(-5)	1.0 ± 0.2(-5)
^{14}C	1.21 ± 0.06(-1)	8.2 ± 0.3(-2)	9.7 ± 0.3(-2)
^{3}H	2.2 ± 0.2(-1)	2.7 ± 0.3(-1)	1.69 ± 0.08(0)
^{51}Cr	<1.7(-6)	<4.9(-5)	<2.2(-5)
^{54}Mn	<3.7(-7)	5 ± 2(-6)	3 ± 1(-6)
^{59}Fe	<3.6(-6)	<4.3(-6)	<3.7(-6)
^{57}Co	<2.7(-7)	<2.2(-6)	<9.2(-7)
^{58}Co	1.1 ± 0.2(-5)	1.0 ± 0.7(-6)	8.2 ± 0.5(-5)
^{60}Co	4.6 ± 0.2(-6)	1.7 ± 0.2(-5)	2.0 ± 0.2(-5)
^{65}Zn	<2.0(-6)	<7.2(-6)	<1.4(-6)
^{95}Zr	<1.6(-6)	<3.3(-6)	<3.2(-6)
^{95}Nb	<1.0(-6)	2 ± 1(-6)	<3.9(-6)
^{103}Ru	<5.7(-7)	<6.9(-6)	1.0 ± 0.6(-6)
^{106}Ru	<9.1(-6)	<6.0(-5)	<6.4(-5)
^{110m}Ag	<1.3(-6)	<4.6(-6)	<2.7(-6)
^{124}Sb	<2.5(-7)	<3.9(-5)	<7.0(-6)
^{125}Sb	<1.0(-6)	<1.4(-5)	2 ± 1(-6)
^{140}Ba	<4.1(-6)	2.6 ± 0.6(-5)	5 ± 3(-6)
^{140}La	<1.5(-5)	1.0 ± 0.1(-4)	2.7 ± 0.9(-5)
^{141}Ce	<2.7(-7)	<5.6(-6)	2.2(-6)
^{152}Eu	<2.6(-6)	<1.6(-5)	<1.0(-5)
^{154}Eu	<1.4(-6)	<4.8(-6)	<9.0(-6)

TABLE B.75 (cont'd)

VENTILATION AIRBORNE RADIONUCLIDE RELEASE RATES
Main Stack
(μCi/sec)

Nuclide	4/20-5/4/78	5/4-5/18/78	5/18-6/1/78
^{131}I	2.56 ± 0.02(-2)	1.13 ± 0.05(-3)	1.83 ± 0.06(-3)
^{134}Cs	5 ± 1(-6)	2.0 ± 0.9(-6)	4.5 ± 0.3(-5)
^{136}Cs	<2.8(-6)	<9.8(-7)	<1.1(-5)
^{137}Cs	5 ± 1(-6)	2.5 ± 0.9(-6)	5.5 ± 0.4(-5)
^{14}C	4.3 ± 0.2(-1)	2.3 ± 0.2(-2)	3.5 ± 0.2(-1)
^{3}H	3.1 ± 0.1(-1)	2.1 ± 0.4(-2)	1.00 ± 0.03(0)
^{51}Cr	<2.2(-5)	<1.9(-6)	<4.5(-5)
^{54}Mn	1.9 ± 0.6(-6)	<2.6(-7)	1.6 ± 0.8(-6)
^{59}Fe	<3.6(-6)	<2.2(-6)	<1.3(-6)
^{57}Co	<8.7(-7)	<2.8(-7)	<1.7(-6)
^{58}Co	6.8 ± 0.4(-5)	1.1 ± 0.2(-5)	1.7 ± 0.3(-5)
^{60}Co	2.0 ± 0.2(-5)	3.0 ± 0.8(-6)	1.1 ± 0.2(-5)
^{65}Zn	<1.9(-6)	<9.5(-7)	<4.2(-6)
^{95}Zr	<2.4(-6)	<1.1(-6)	<3.7(-6)
^{95}Nb	2.3 ± 0.9(-6)	<4.9(-7)	<4.1(-6)
^{103}Ru	<2.9(-6)	<1.1(-6)	1.6 ± 0.9(-6)
^{106}Ru	<5.9(-5)	<2.3(-5)	<2.6(-5)
^{110m}Ag	<2.7(-6)	<1.3(-6)	<4.4(-6)
^{124}Sb	<5.2(-6)	<1.7(-6)	<1.8(-5)
^{125}Sb	<4.7(-6)	<2.1(-6)	<1.1(-5)
^{140}Ba	<1.1(-5)	<5.6(-6)	3.0 ± 0.6(-5)
^{140}La	<3.4(-6)	<4.9(-6)	2.1 ± 0.2(-4)
^{141}Ce	<1.6(-6)	<3.8(-7)	<3.8(-6)
^{152}Eu	<5.9(-6)	<1.6(-6)	<1.1(-5)
^{154}Eu	<1.8(-6)	<1.6(-6)	<2.7(-6)

TABLE B.76

^{131}I SPECIES DATA

Sample Station #1

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
11/10-11/21/77	2.5	11.6	35.9	50.0
11/21-12/4/77	13.3	10.1	22.2	54.4
12/4-12/14/77	4.4	19.7	33.4	42.5
12/14-12/28/77	0.8	10.8	24.3	64.0
12/28-1/11/78	1.1	7.0	23.1	68.7
1/11-1/25/78	1.4	14.5	46.9	37.2
1/25-2/8/78	0.4	1.9	11.4	86.3
2/8-2/22/78	0.5	5.9	32.2	61.5
2/22-3/9/78	0.6	5.3	32.9	60.0
3/9-3/21/78	*	3.4	20.5	76.0
3/21-4/3/78	4.1	14.3	42.4	39.2
4/3-4/20/78	0.7	16.6	36.0	46.8
4/20-5/4/78	*	2.6	7.6	89.8
5/4-5/18/78	*	8.8	20.6	70.6
5/18-6/1/78	*	*	19.2	80.7

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* - Iodine activity not detected on this component.

TABLE B.77

^{131}I SPECIES DATA

Sample Station #2

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
11/10-1/21/77	4.5	22.6	49.2	23.8
11/21-12/4/77	2.9	19.0	*	78.1
12/4-12/14/77	2.5	24.6	47.2	25.7
12/14-12/28/77	5.6	32.6	37.2	24.6
12/28-1/11/78	4.6	26.0	30.9	38.4
1/11-1/25/78	5.4	29.6	44.5	20.5
1/25-2/8/78	0.5	2.6	5.2	91.7
2/8-2/22/78	1.4	10.5	47.0	41.2
2/22-3/9/78	1.9	10.3	32.4	55.4
3/9-3/21/78	0.1	2.6	31.5	65.8
3/21-4/3/78	5.1	30.4	43.1	21.3
4/3-4/20/78	7.4	24.6	36.4	31.6
4/20-5/4/78	3.6	17.8	34.1	44.6
5/4-5/18/78	4.5	30.2	40.6	24.7
5/18-6/1/78	9.3	51.3	17.7	21.6

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* - Iodine activity not detected on this component.

TABLE B.78

^{131}I SPECIES DATA

Sample Station #3

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
11/10-11/21/77	0.5	3.4	14.4	81.7
11/21-12/4/77	0.3	5.2	8.8	79.1
12/4-12/14/77	0.5	7.7	22.4	69.4
12/14-12/28/77	0.1	1.5	8.3	90.1
12/28-1/11/78	0.2	1.8	12.1	85.9
1/11-1/25/78	0.9	10.0	43.5	45.6
1/25-2/8/78	0.3	3.0	29.2	67.5
2/8-2/22/78	0.5	4.5	39.2	55.8
2/22-3/9/78	0.3	2.7	36.9	60.2
3/9-3/21/78	0.1	2.6	31.5	65.8
3/21-4/3/78	0.7	6.8	65.3	27.2
4/3-4/20/78	0.8	2.8	29.8	66.5
4/20-5/4/78	0.1	1.4	9.7	88.9
5/4-5/18/78	*	15.6	46.2	38.3
5/18-6/1/78	9.6	22.7	67.8	*

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* - Iodine activity not detected on this component.

TABLE B.79

^{131}I SPECIES DATA

Sample Station #4

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
11/10-11/21/77	1.0	4.8	26.8	67.4
11/21-12/4/77	2.2	15.1	23.8	58.9
12/4-12/14/77	1.8	7.0	24.4	66.8
12/14-12/28/77	0.2	1.4	5.7	92.7
12/28-1/11/78	0.6	3.0	7.6	88.8
1/11-1/25/78	2.1	9.6	35.9	52.4
1/25-2/8/78	0.1	0.6	3.3	96.0
2/8-2/22/78	0.4	2.2	19.0	78.3
2/22-3/9/78	0.6	2.9	28.4	68.1
3/9-3/21/78	0.2	1.2	9.3	89.2
3/21-4/3/78	5.1	9.8	50.7	34.5
4/3-4/20/78	0.5	2.3	17.5	79.7
4/20-5/4/78	0.4	0.8	3.7	95.2
5/4-5/18/78	3.1	11.1	42.6	43.3
5/18-6/1/78	7.6	14.8	47.8	29.8

TABLE B.80

^{131}I SPECIES DATA

Sample Station #4A

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
1/20-1/25/78	2.0	9.2	73.6	15.1
1/25-1/26/78	0.6	5.4	36.9	57.2
2/8-2/22/78	0.8	3.2	66.5	29.5
2/22-3/9/78	0.7	4.6	68.6	26.0
3/9-3/21/78	1.0	5.1	67.5	26.4
3/21-4/3/78	3.1	0.04	74.4	14.5
4/3-4/20/78	2.3	7.4	46.9	43.5
4/20-5/3/78	0.4	1.9	12.6	85.1
5/4-5/18/78	2.0	13.6	67.3	17.0
5/18-6/1/78	7.7	12.6	63.8	15.8

TABLE B.81

^{131}I SPECIES DATA

Sample Station #5

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
11/10-11/21/77	2.1	9.5	16.7	71.7
11/21-12/4/77	14.8	24.9	19.3	41.0
12/4-12/14/77	0.3	1.6	4.2	93.9
12/14-12/28/77	*	*	13.6	86.4
12/28-1/11/78	*	3.2	11.8	85.0
1/11-1/25/78	8.0	40.4	26.6	25.0
1/25-2/8/78	*	3.0	24.4	72.6
2/8-2/22/78	1.4	8.2	24.4	65.9
2/22-3/9/78	*	1.9	5.6	92.5
3/9-3/21/78	*	*	10.9	89.1
3/21-4/3/78	*	*	26.4	73.6
4/3-4/20/78	2.7	*	31.6	65.7
4/20-5/4/78	*	*	4.6	95.4
5/4-5/18/78	*	*	*	100
5/18-6/1/78	0.9	*	*	99.1

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* - Iodine activity not detected on this component.

TABLE B.82

^{131}I SPECIES DATA

Unit #3 Fuel Pit Area Duct

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
12/8-12/12/77	1.0	*	77.4	21.6
12/14-12/28/77	3.9	14.7	40.4	41.0
12/28-1/11/78	0.5	24.0	30.6	44.8
1/11-1/25/78	0.5	15.6	69.3	14.7
1/25-2/8/78	1.0	14.6	70.8	13.6
2/8-2/22/78	0.5	12.2	70.2	17.1
2/22-3/9/78	0.7	10.4	66.2	22.7
3/9-3/21/78	2.1	22.4	60.7	14.8
3/21-4/3/78	1.6	11.2	74.4	12.7
4/3-4/20/78	*	*	*	100
4/20-5/4/78	*	16.7	49.5	33.9
5/4-5/18/78	*	*	73.7	26.3
5/18-6/1/78	10.7	*	89.3	*

---

* - Iodine activity not detected on this component.

TABLE B.83

^{131}I SPECIES DATA

Unit #3 Sample Room

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
4/14-4/20/78	0.6	5.0	36.2	58.2
4/20-5/4/78	0.1	1.5	13.7	84.7
5/4-5/18/78	4.1	20.1	37.2	38.6

TABLE B.84

^{131}I SPECIES DATA

Gas Stripper Room

	^{131}I species distribution (%)			
Sample Period	Particulate Filter	I_2	HOI	Organic
5/18-6/1/78	2.5	10.2	31.0	56.3

TABLE B.85

^{131}I SPECIES DATA

Main Stack

Sample Period	^{131}I species distribution (%) Particulate Filter	I_2	HOI	Organic
11/10-11/21/77	0.5	4.3	32.8	62.4
11/22-12/4/77	0.7	8.9	38.3	52.1
12/4-12/14/77	0.4	3.9	15.4	77.5
12/14-12/28/77	0.3	5.7	18.2	75.8
12/28-1/11/78	0.1	2.9	17.0	79.9
1/11-1/25/78	1.0	6.8	46.1	46.1
1/25-2/8/78	0.05	0.7	5.6	93.8
2/8-2/22/78	0.1	2.2	25.4	72.3
2/22-3/9/78	0.7	4.8	23.1	71.4
3/9-3/21/78	0.2	1.5	13.2	85.1
3/21-4/3/78	6.3	14.3	45.5	33.9
4/3-4/20/78	1.0	3.9	27.3	67.8
4/20-5/4/78	0.1	1.0	6.5	92.4
5/4-5/18/78	1.2	10.7	54.1	34.0
5/18-6/1/78	2.9	17.2	50.1	29.8

TABLE B.86

AUXILIARY BUILDING ^{131}I SOURCES

Sample Period	Stack (μCi/sec)	Auxiliary Building (total ^{131}I) (μCi/sec)	Station #1	Station #2	Station #3	Station #4	Station #4A	Station #5
11/10-11/21/77	4.00 ± 0.05(-2)	4.58 ± 0.03(-2)	0.5	1.3	3.6	94.5	N.S.	0.1
11/21-12/4/77	1.04 ± 0.02(-2)	4.14 ± 0.02(-3)	1.8	7.5	7.2	83.3	N.S.	0.2
12/4-12/14/77	1.74 ± 0.02(-2)	2.61 ± 0.04(-3)	2.9	23.3	2.6	64.8	N.S.	6.4
12/14-12/28/77	6.77 ± 0.04(-2)	3.79 ± 0.01(-2)	0.4	15.4	3.6	80.7	N.S.	0.06
12/28-1/11/78	4.39 ± 0.03(-2)	3.61 ± 0.01(-2)	0.3	3.0	3.2	93.4	N.S.	0.05
1/11-1/25/78	3.39 ± 0.09(-3)	1.79 ± 0.03(-3)	1.2	8.4	6.5	83.7	48.2[A]	0.2
1/25-2/8/78	7.66 ± 0.04(-2)	7.16 ± 0.02(-2)	0.6	1.5	0.9	96.8	34.9	0.2
2/8-2/22/78	5.08 ± 0.04(-2)	4.41 ± 0.01(-2)	0.4	3.3	2.3	93.6	20.3	0.4
2/22-3/9/78	1.93 ± 0.02(-2)	1.20 ± 0.01(-2)	0.9	6.2	5.6	85.7	31.3	1.6
3/9-3/21/78	1.43 ± 0.02(-2)	1.89 ± 0.01(-2)	0.3	5.0	3.2	91.4	17.0	0.1
3/21-4/3/78	2.52 ± 0.01(-3)	1.10 ± 0.02(-3)	0.8	4.6	8.6	85.6	72.0	0.4
4/3-4/20/78	4.69 ± 0.09(-3)	3.30 ± 0.04(-3)	0.5	9.4	3.7	86.1	19.7	0.2
4/20-5/4/78	2.56 ± 0.02(-2)	2.80 ± 0.01(-2)	0.2	0.2	2.3	97.2	34.3	0.05
5/4-5/18/78	1.13 ± 0.05(-3)	1.09 ± 0.02(-3)	1.1	2.2	1.5	26.7[B]	95.0	0.2
5/18-6/1/78	1.83 ± 0.06(-3)	3.9 ± 0.1(-4)	0.8	2.3	1.3	75.0[B]	90.6	4.9

[A] Short sample period.

[B] Auxiliary building ^{131}I total based on sample station #4A due to sampler malfunction at station #4.

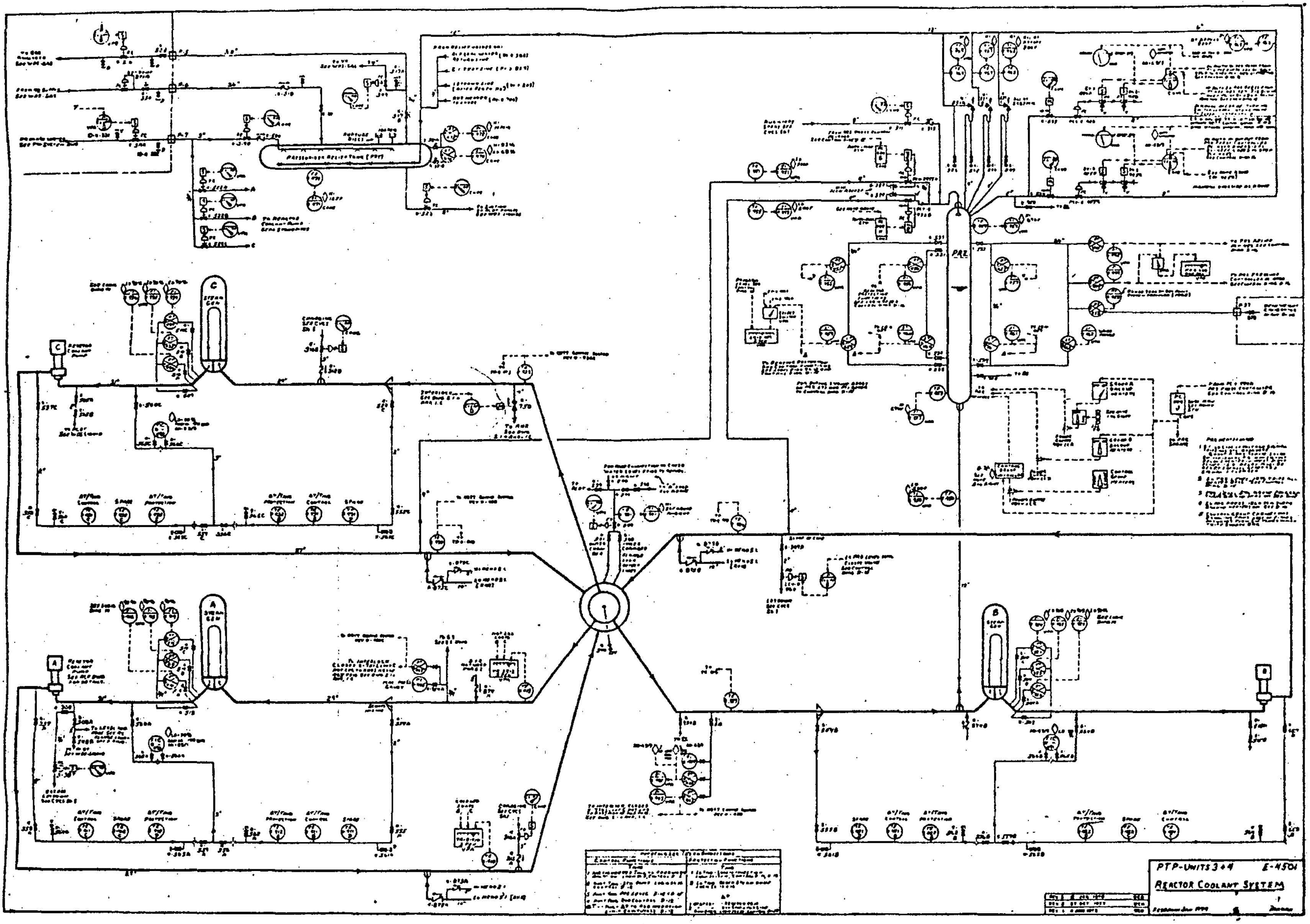
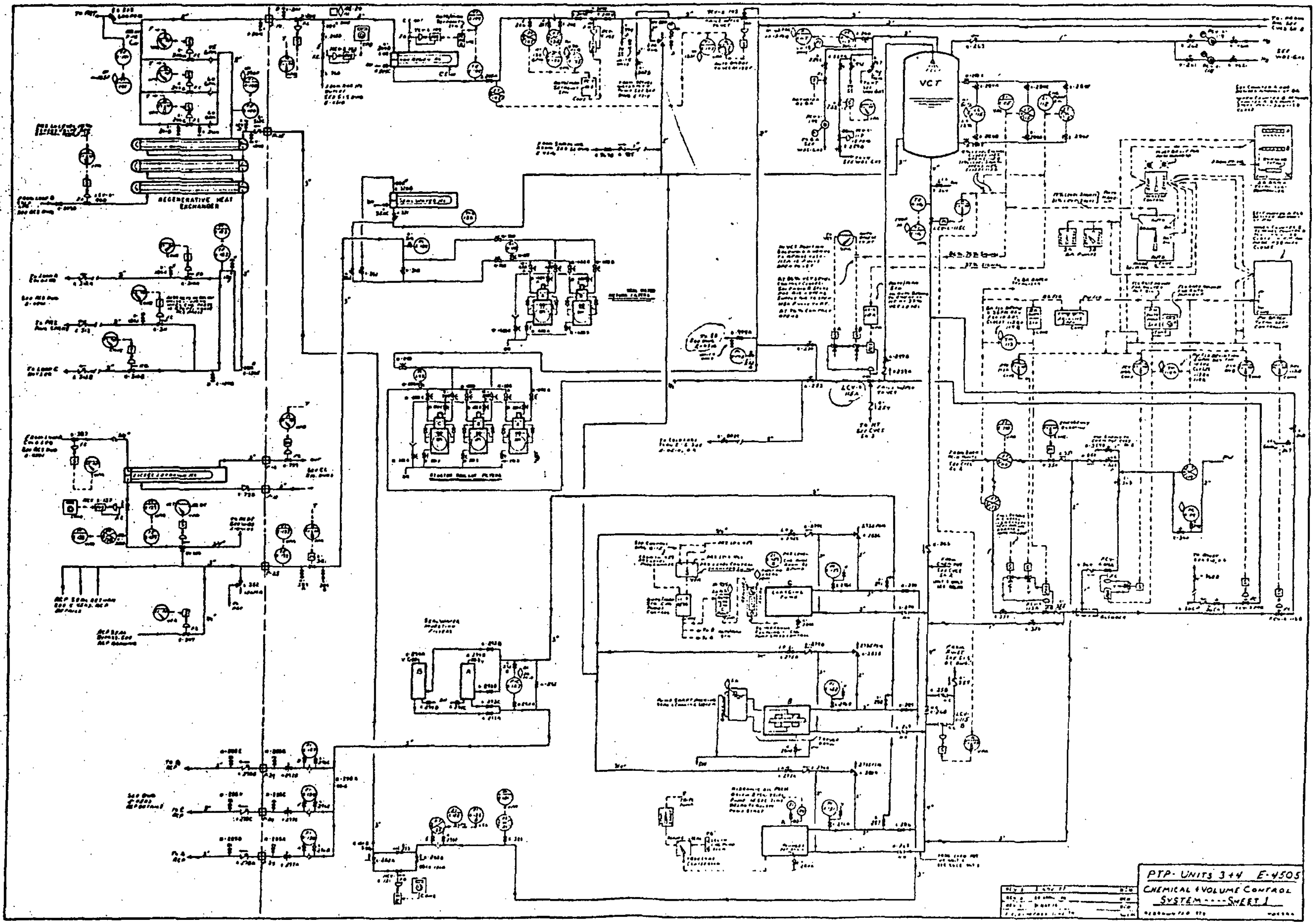


Figure B.1

Reactor Coolant System P&ID

Figure B.2

Chemical and Volume Control System P&ID



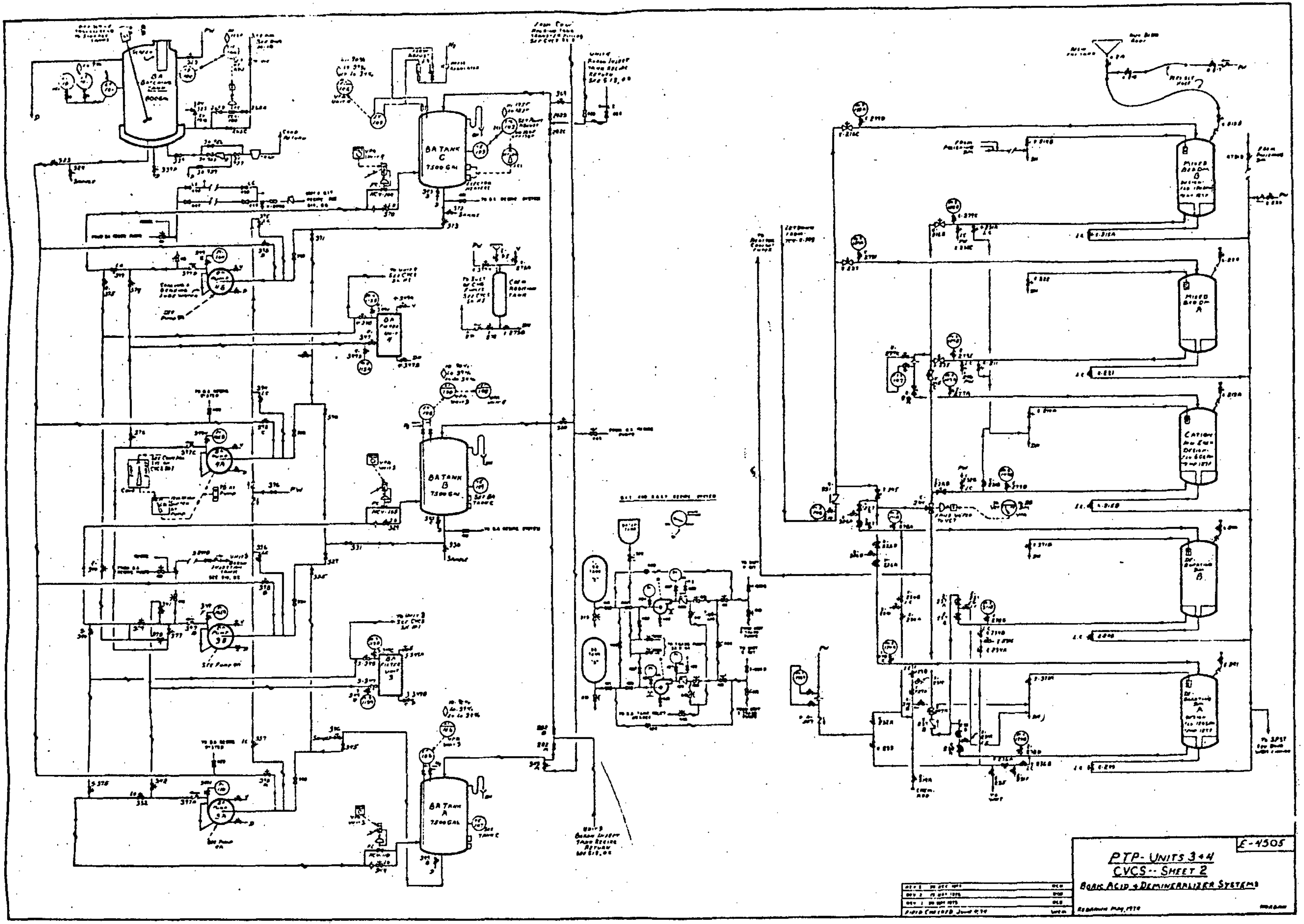


Figure B.3

Chemical and Volume Control System P&ID - Boric Acid and Demineralizer Systems

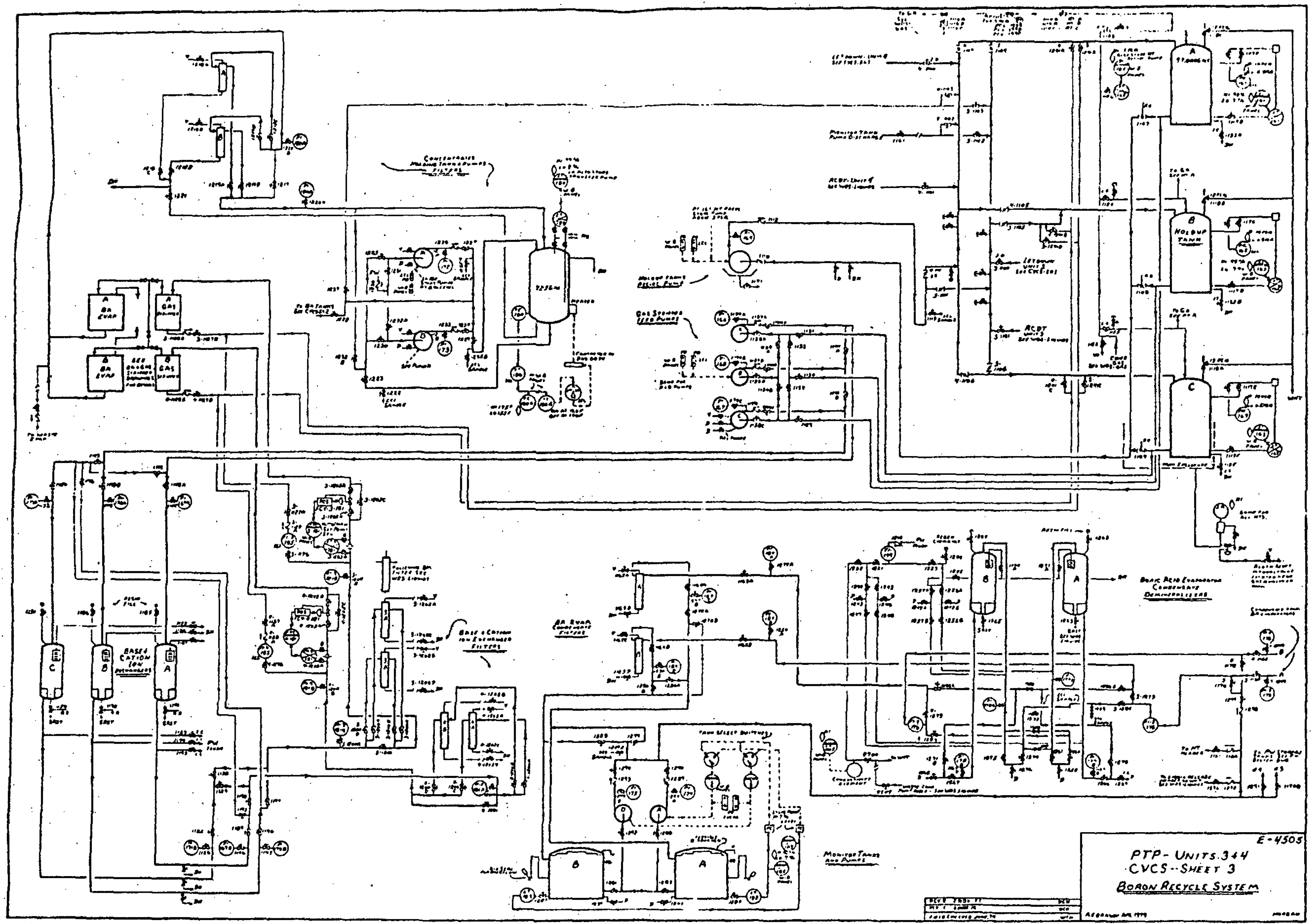


Figure B.4

Chemical and Volume Control System - Boron Recycle System

Figure B.5

Main Steam System P&ID

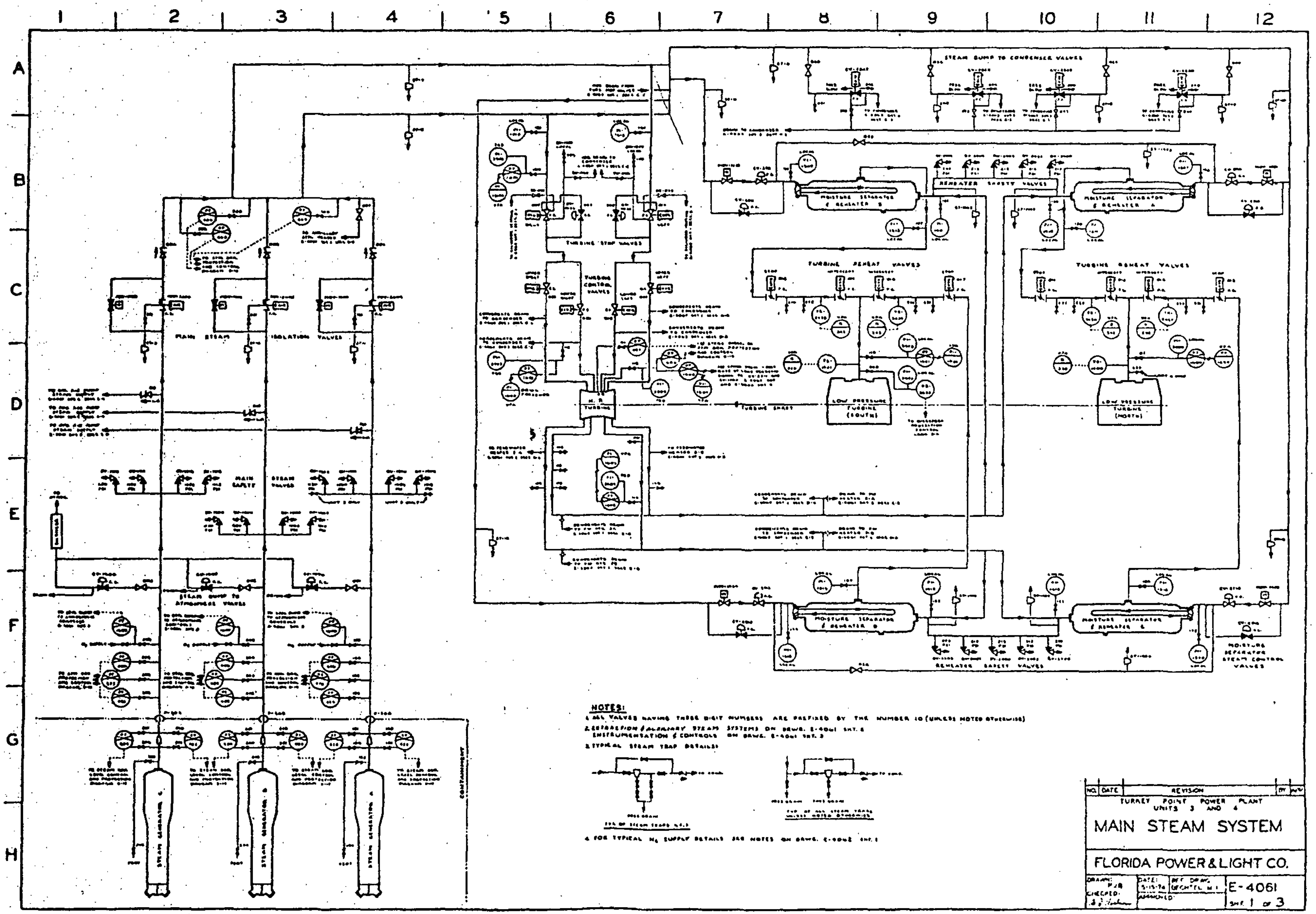


Figure B.6

Extraction and Auxiliary Systems P&ID

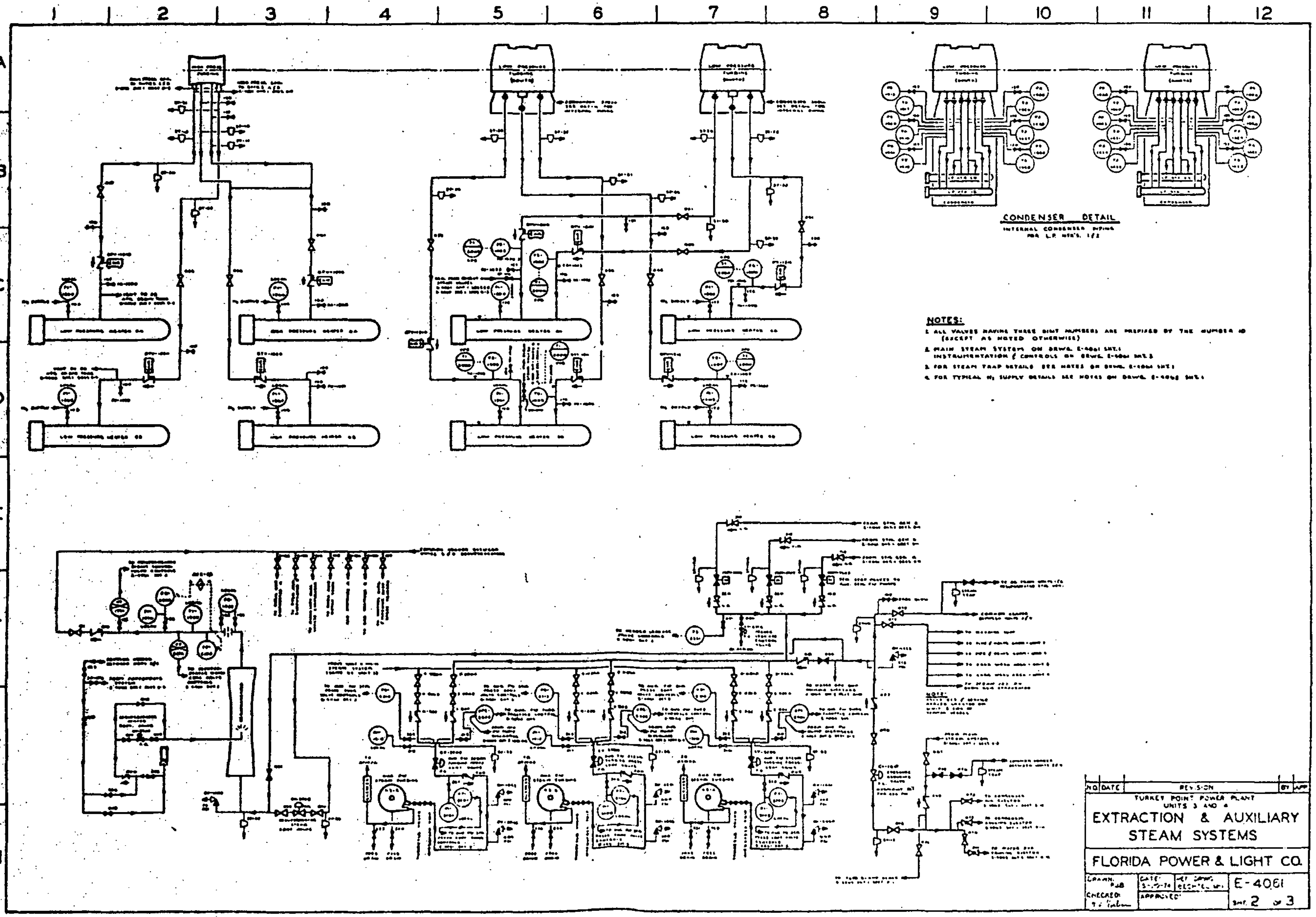
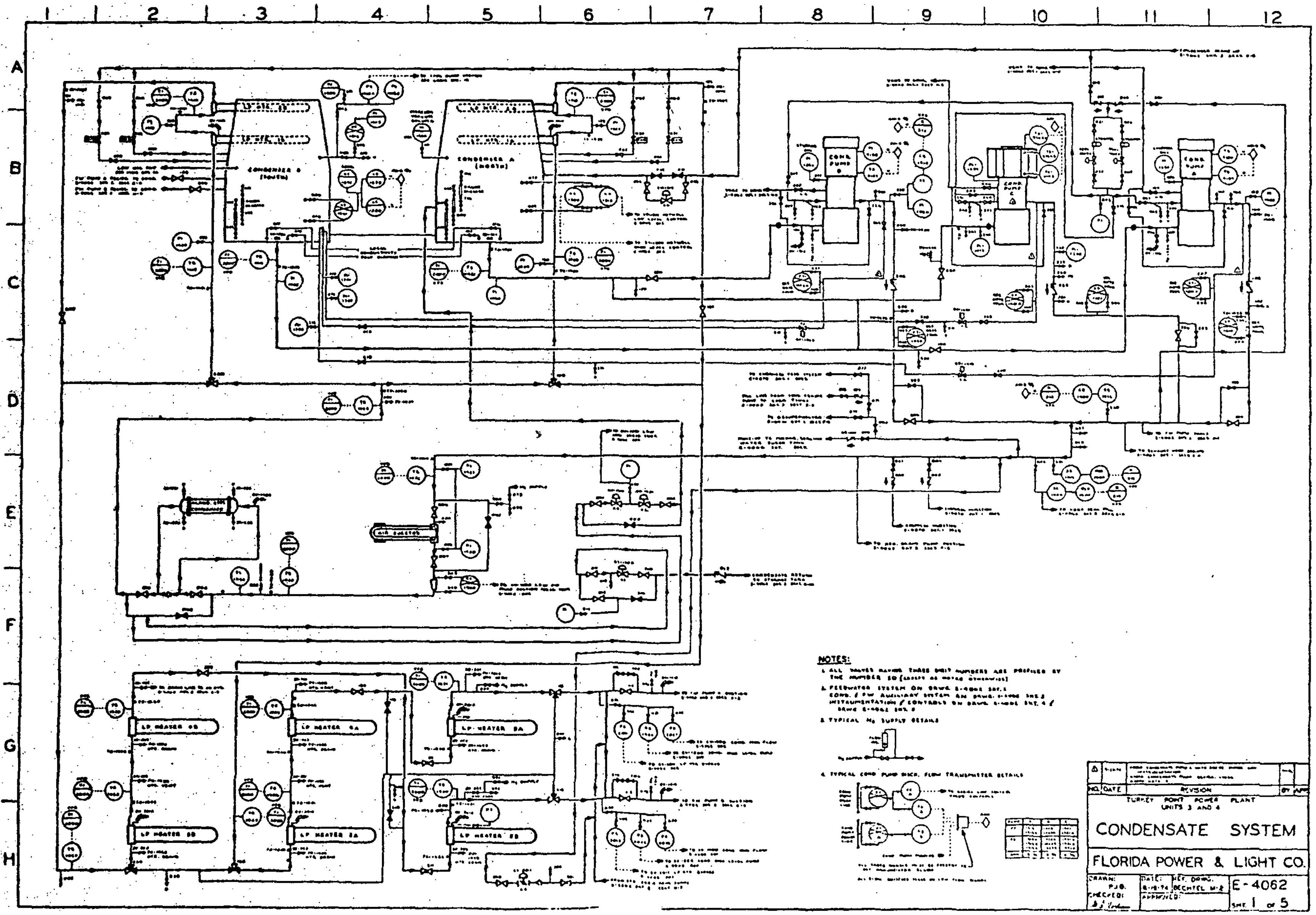


Figure B.7

Condensate System P&ID



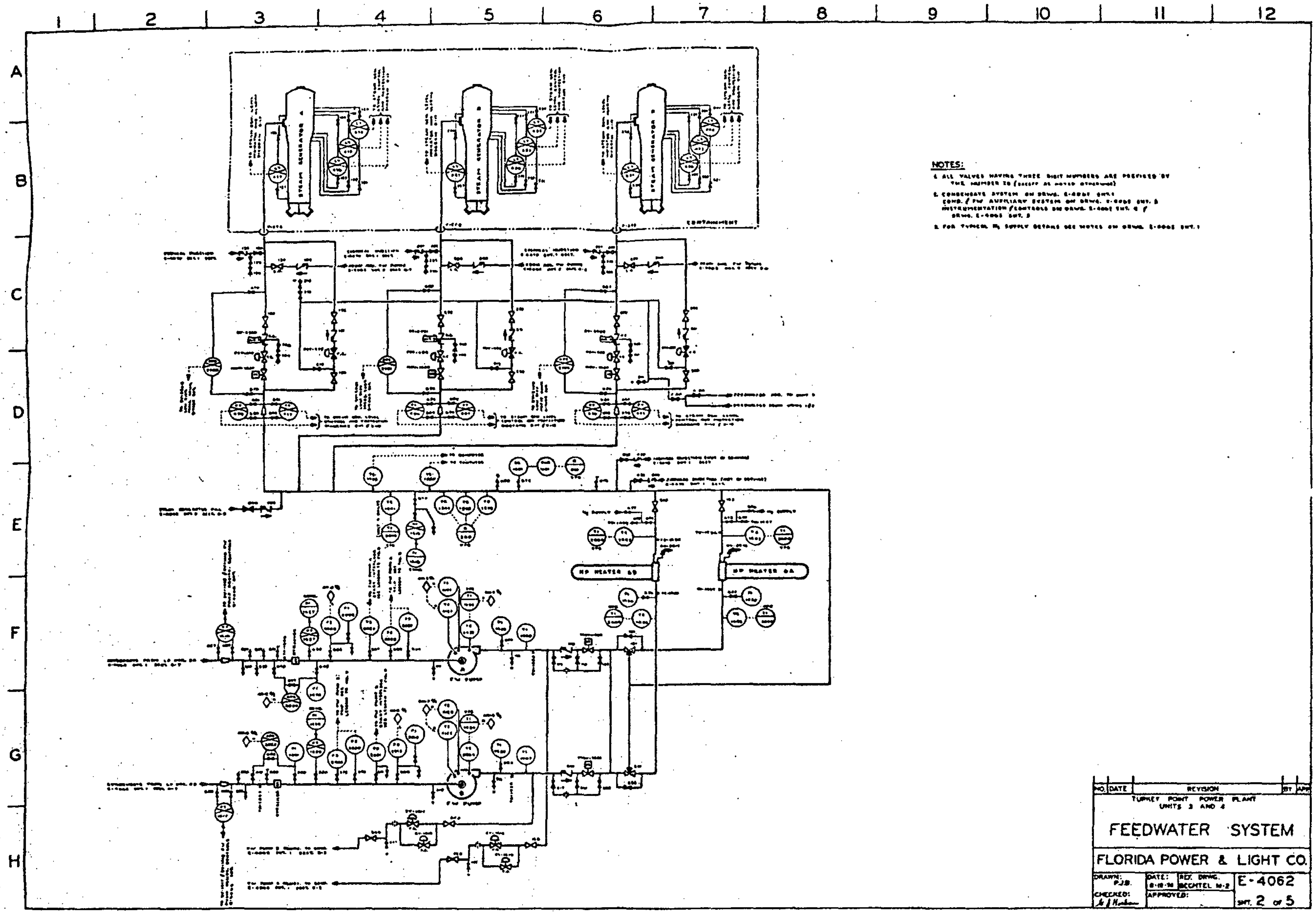


Figure B.8

Feedwater System P&ID

Figure B.9

Condensate and Feedwater Auxiliary Systems P&ID

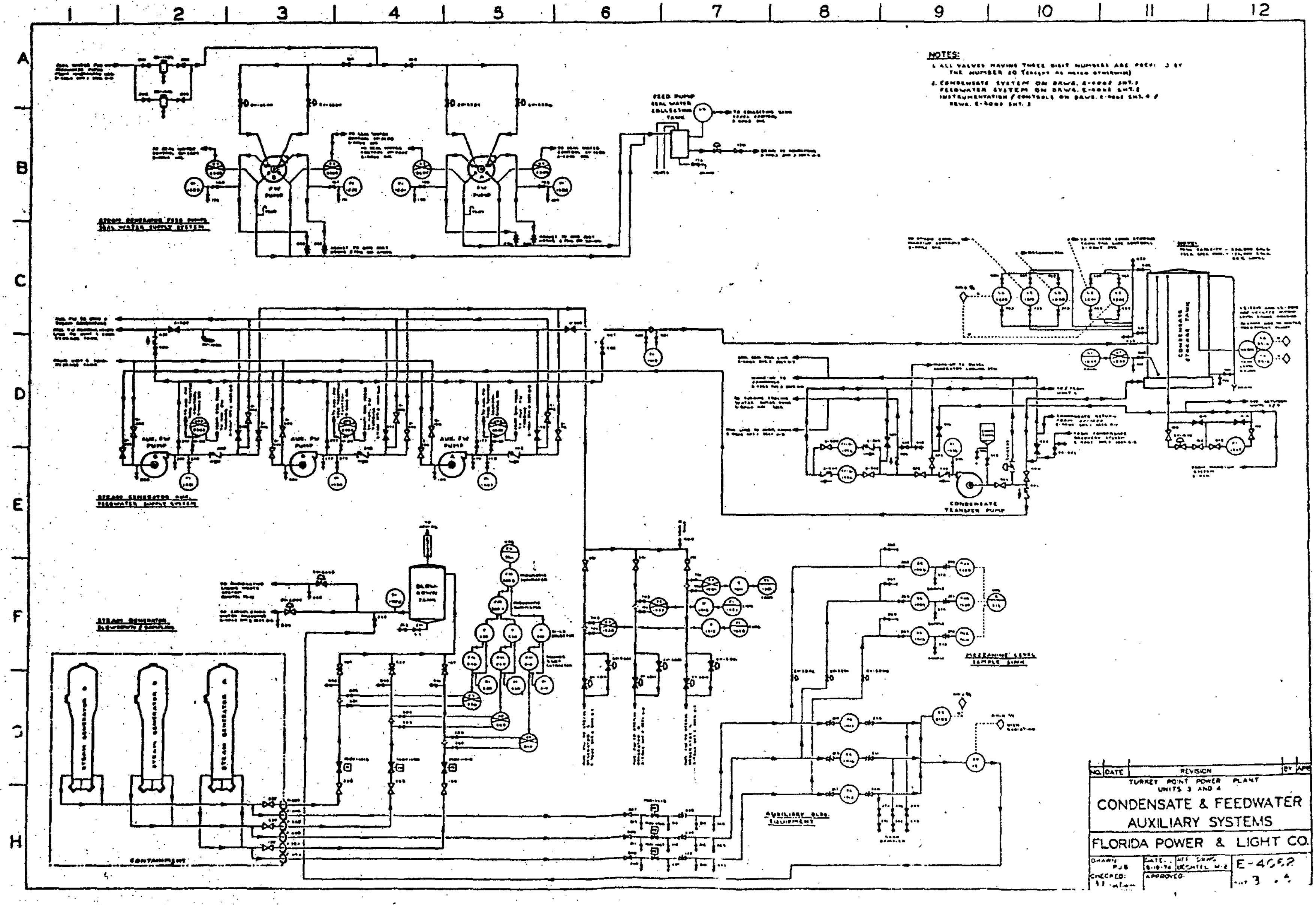
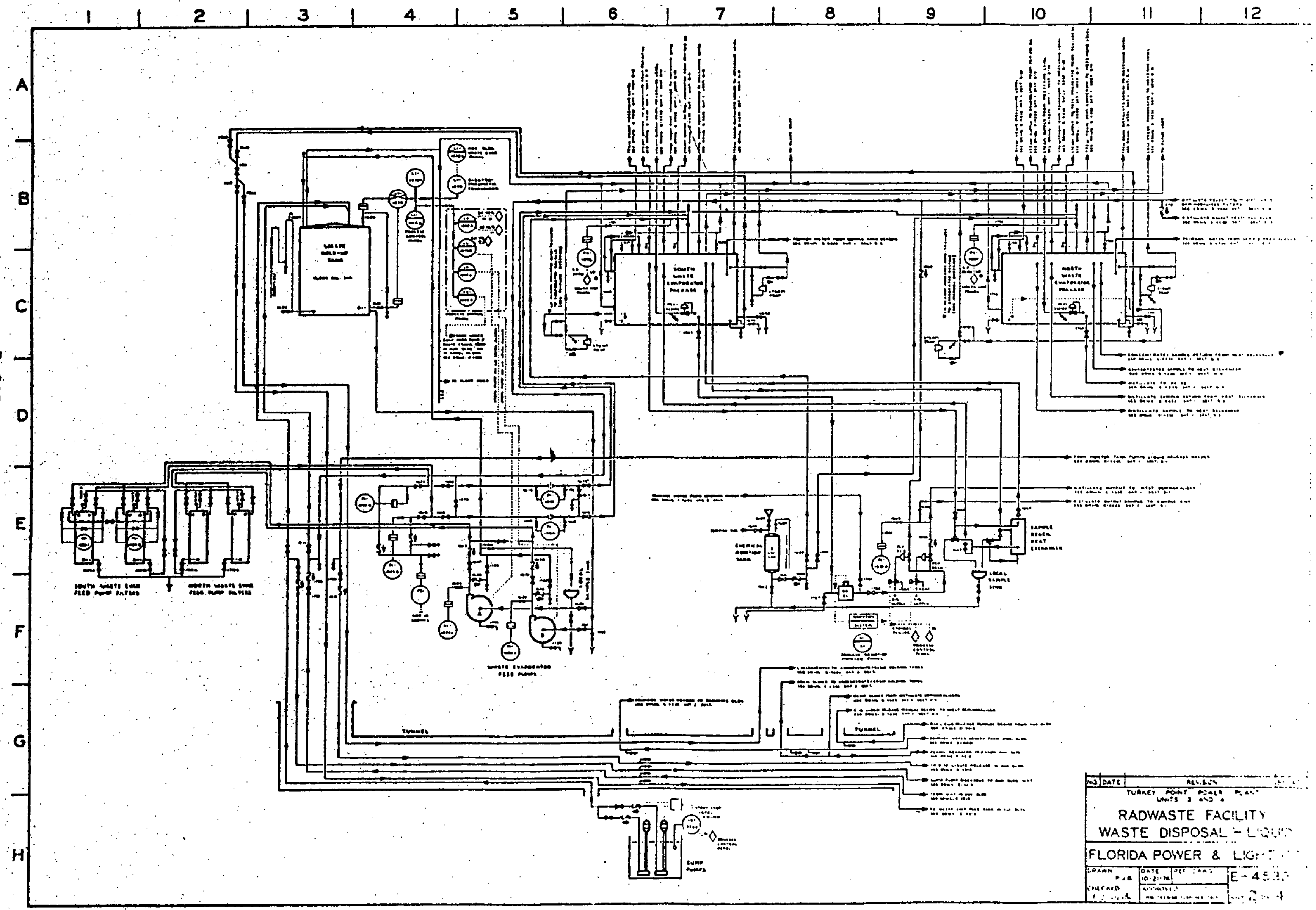


Figure B.10

Radwaste Facility Waste Disposal - Liquid System P&ID



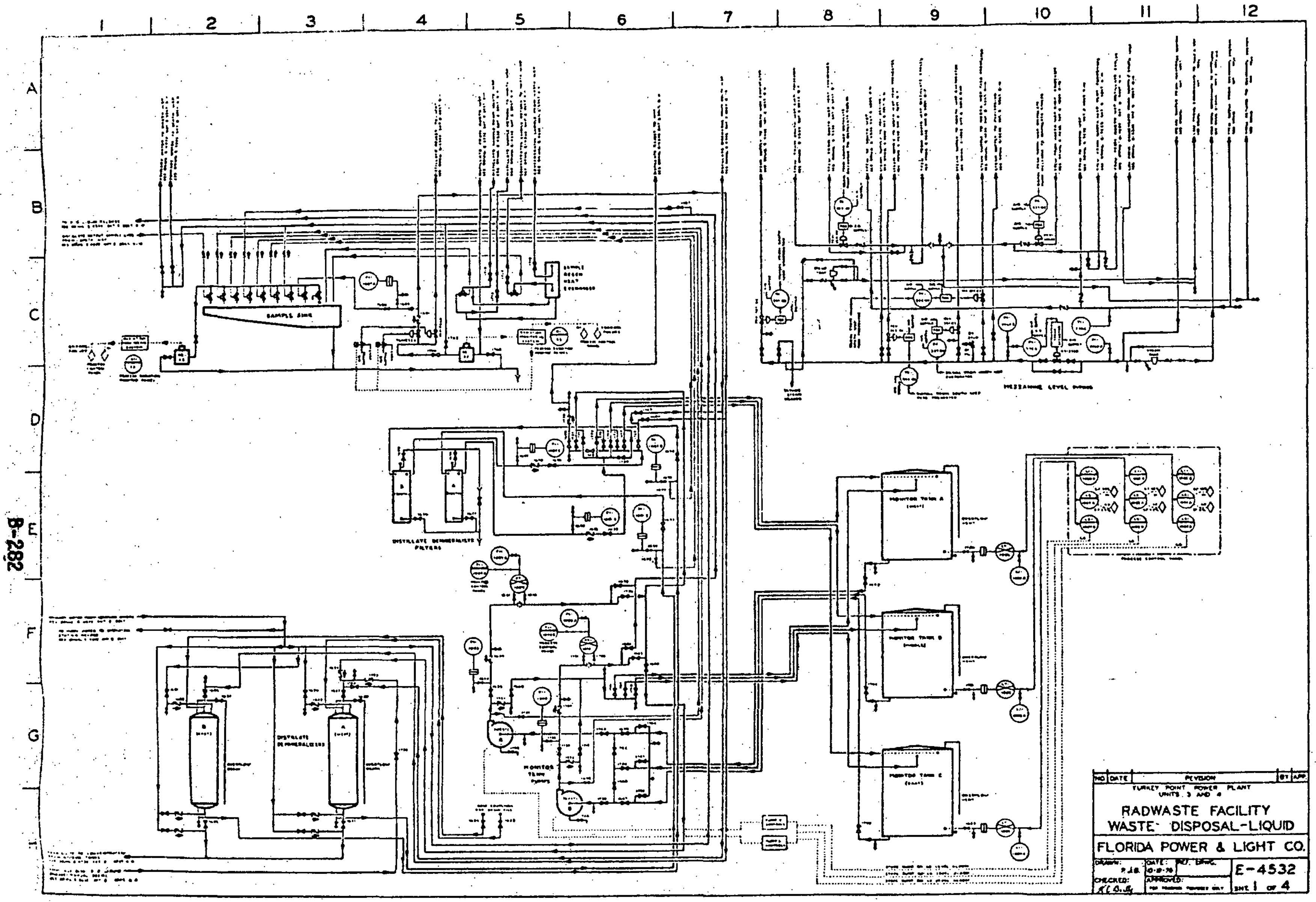


Figure B.11

Radwaste Facility Waste Disposal - Liquid System P&ID

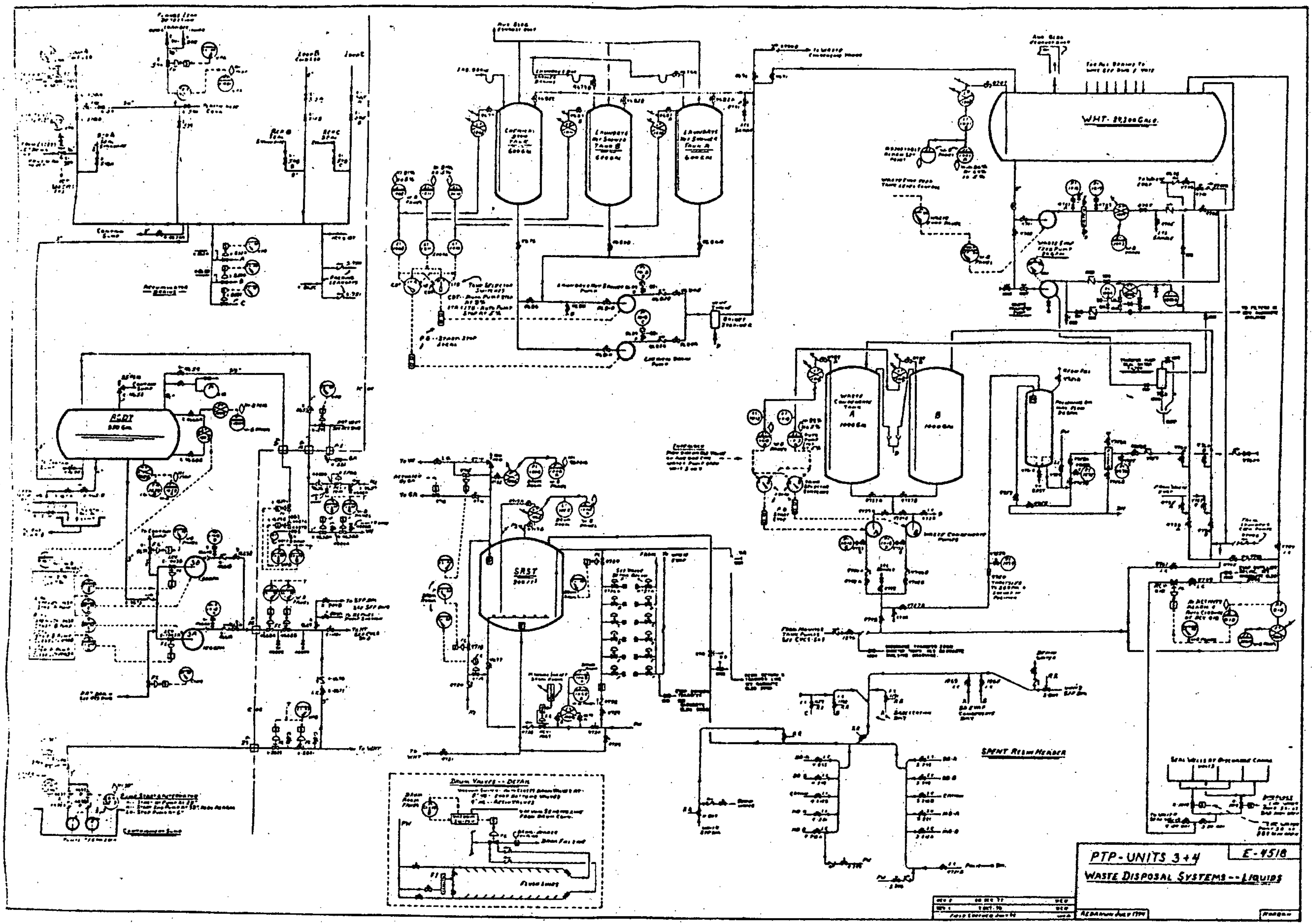


Figure B.12

Waste Disposal Systems P&ID - Liquids

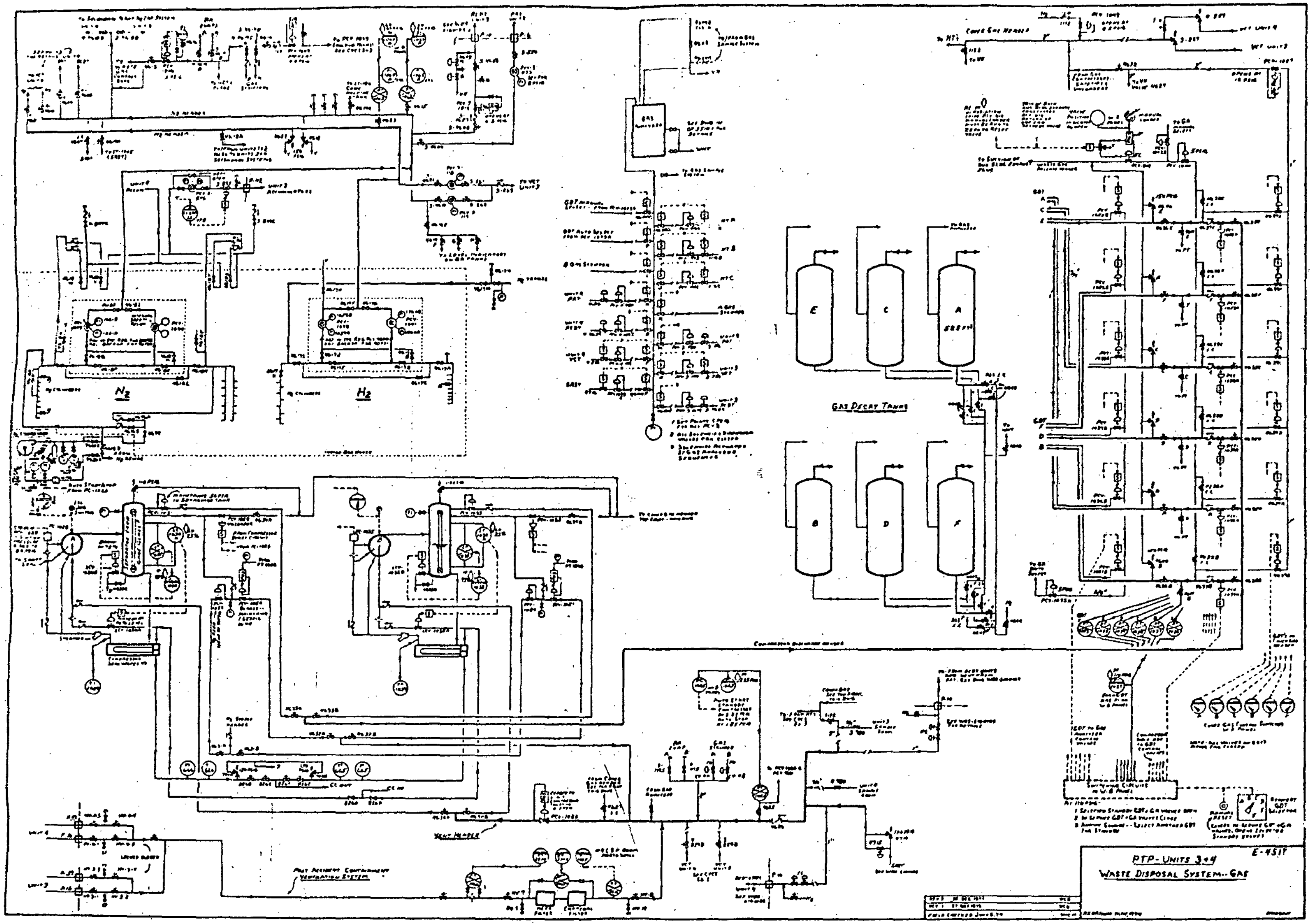


Figure B.13

Waste Disposal System P&ID - Gas

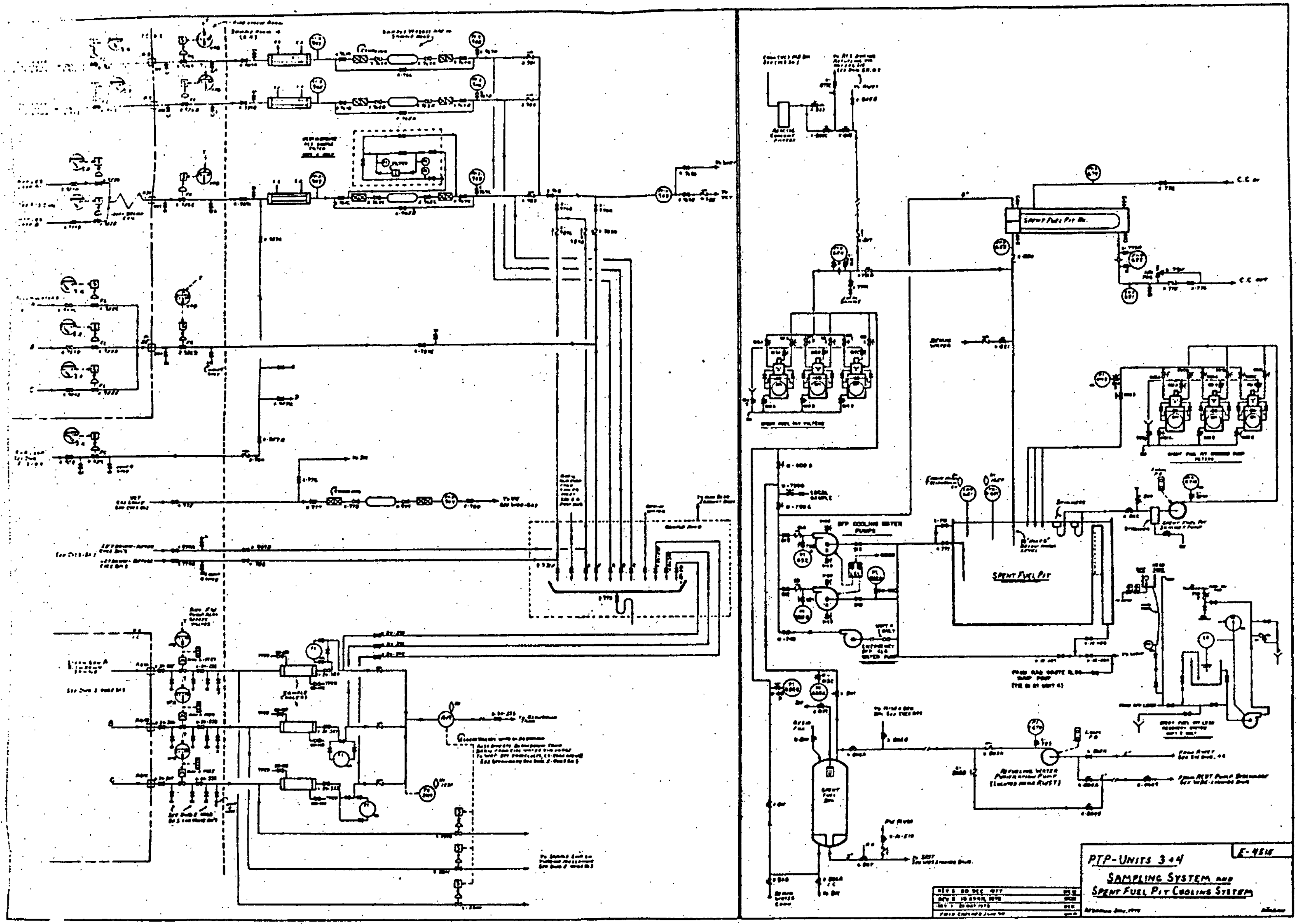


Figure B.14

Sampling System and Spent Fuel Pit Cooling System P&ID

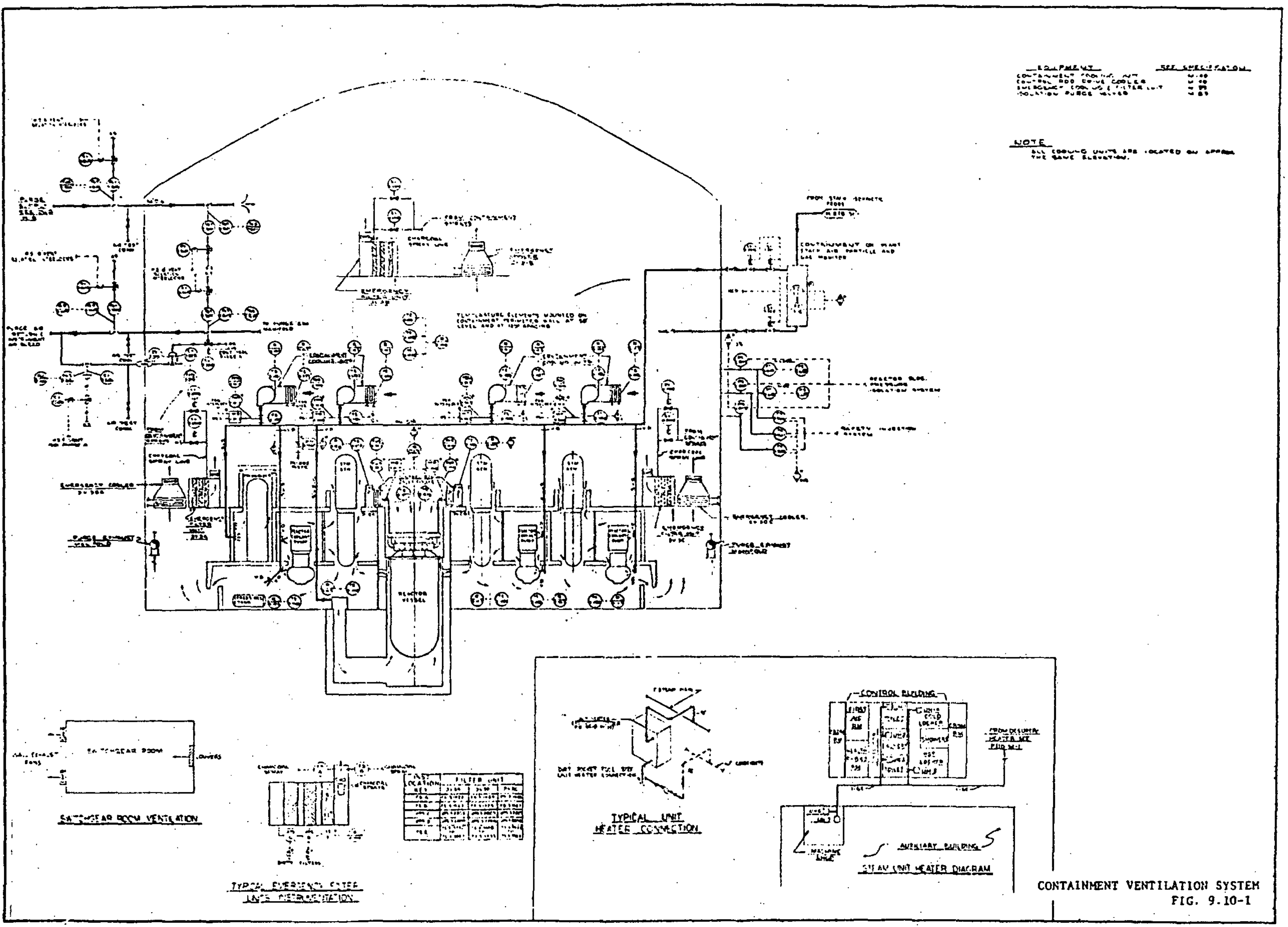


Figure B.15

Containment Ventilation System P&ID

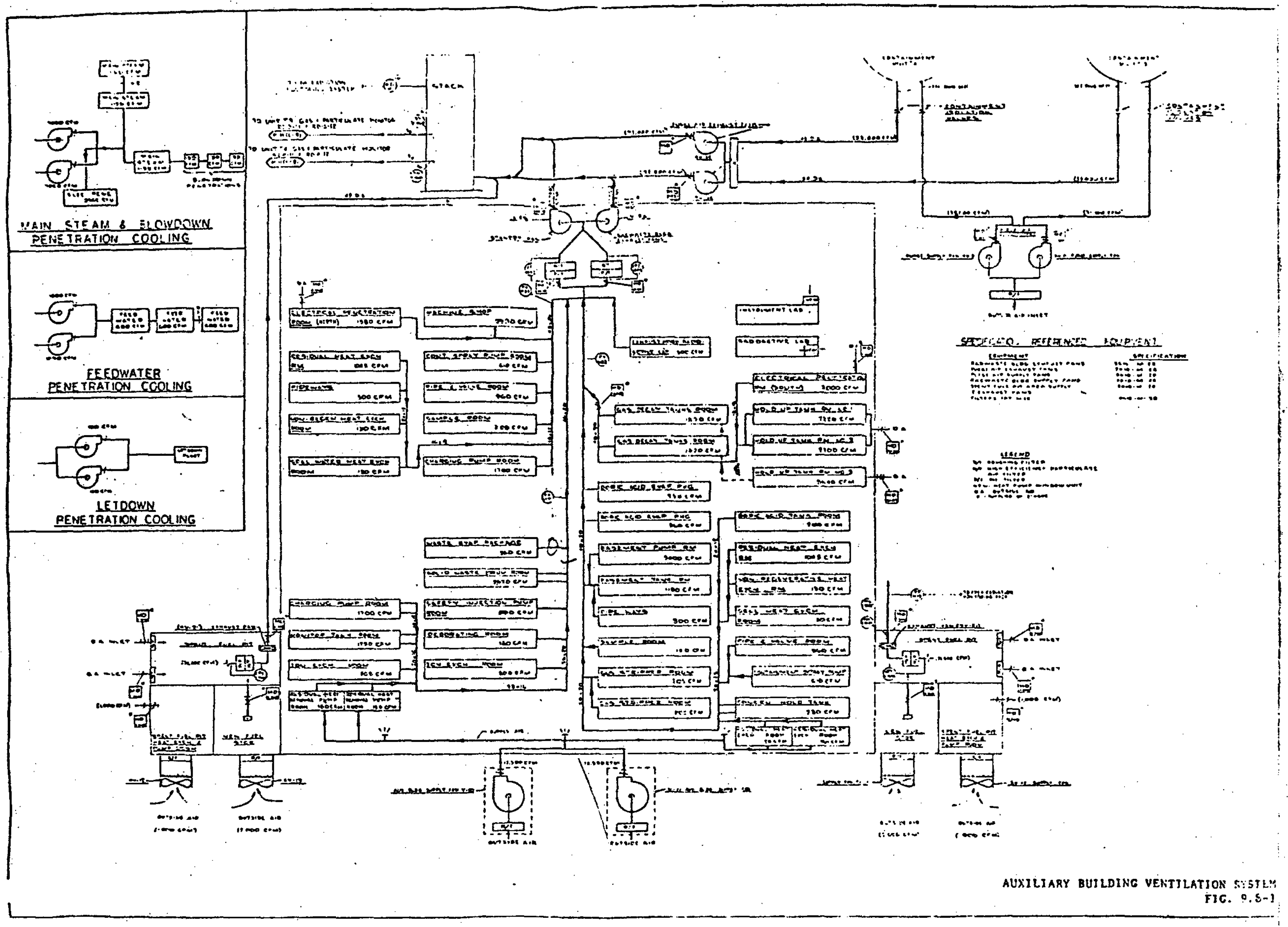


Figure B.16

Auxiliary Building Ventilation System P&ID

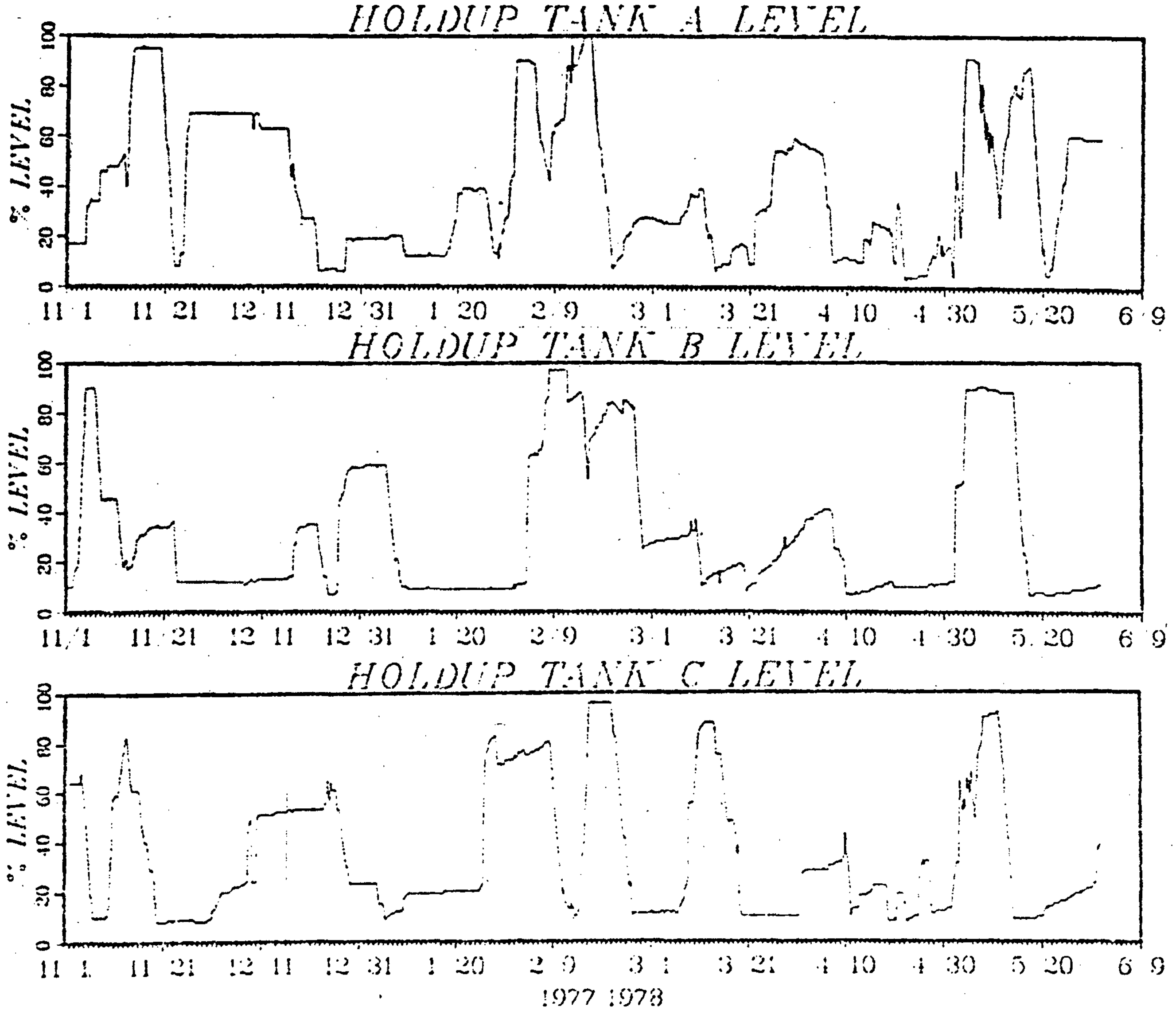


Figure B.17

Levels for Holdup Tanks A, B, and C

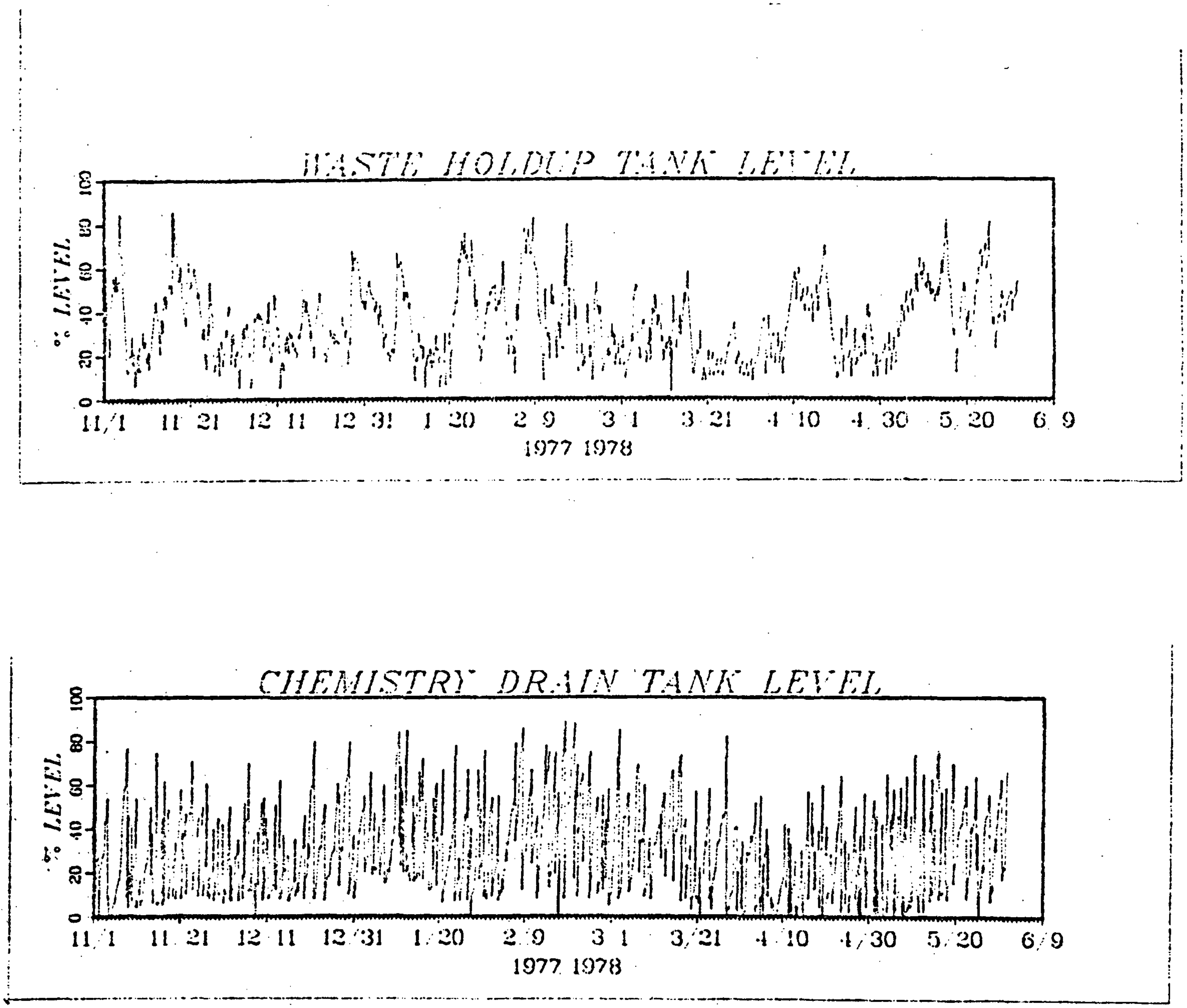
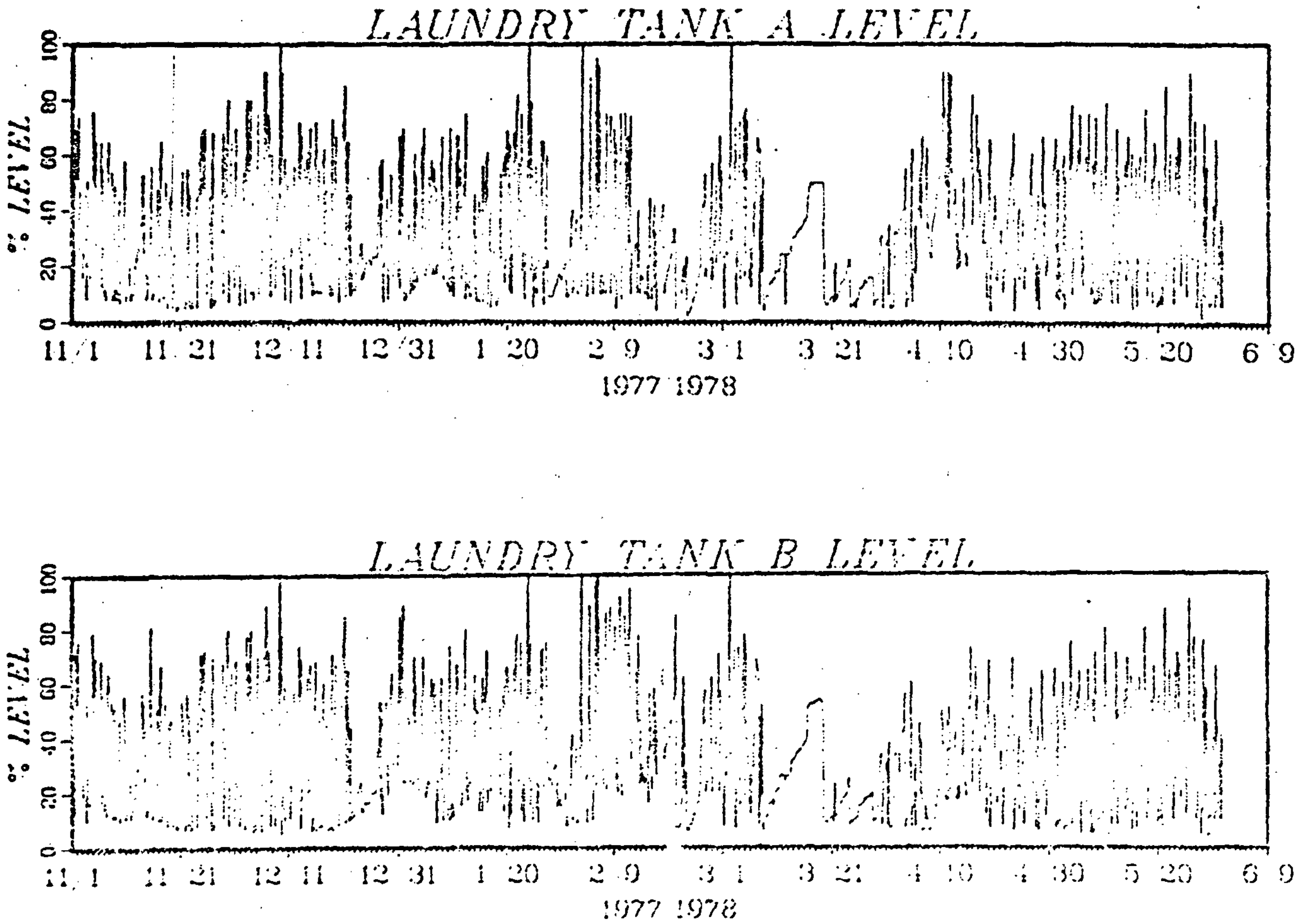


Figure B.18

Levels for Waste Holdup Tank #1 and Chemistry Drain Tank


LAUNDRY TANK A LEVEL

LAUNDRY TANK B LEVEL

Figure B.19

Levels for Laundry Drain Tanks A and B

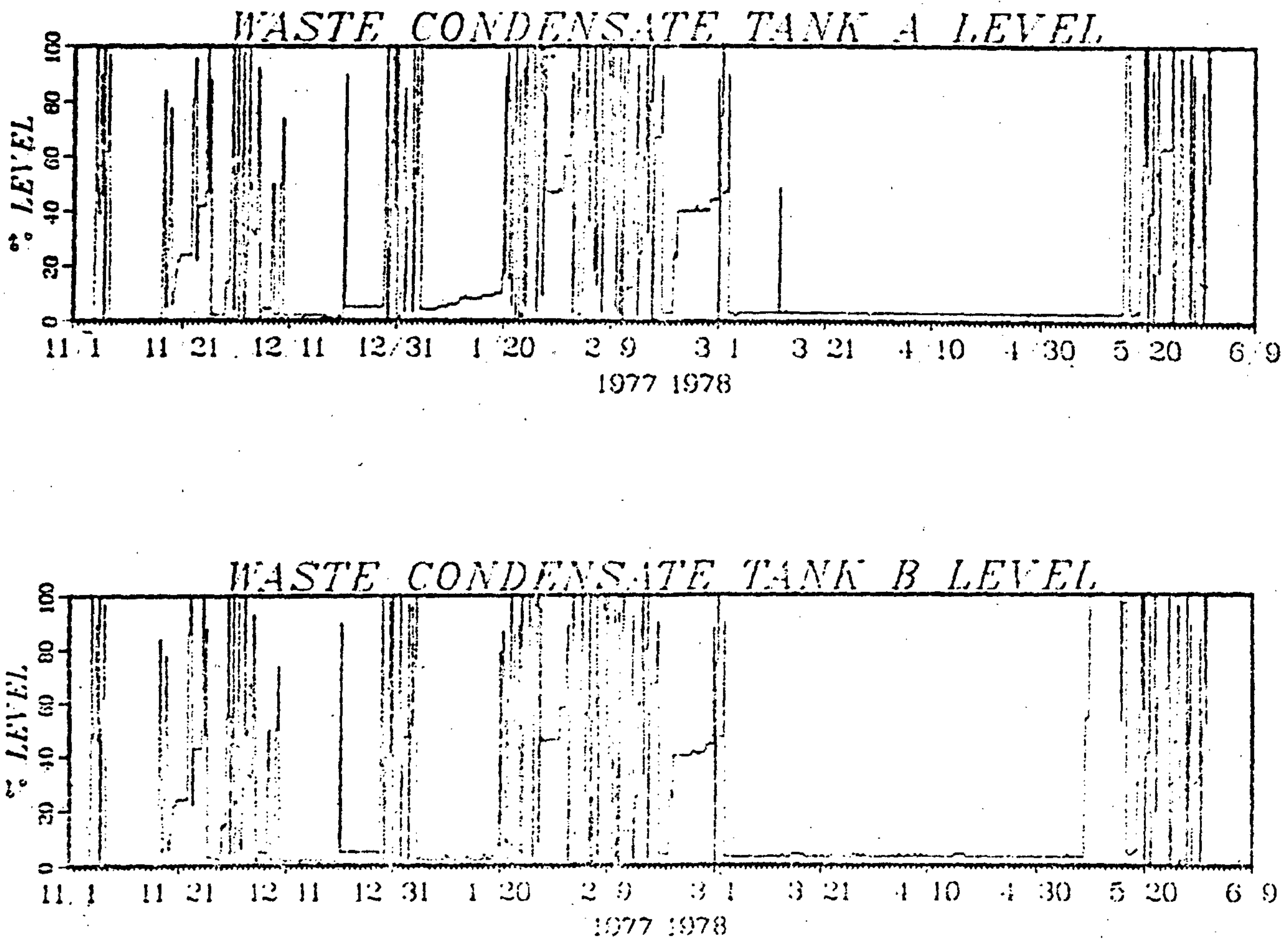
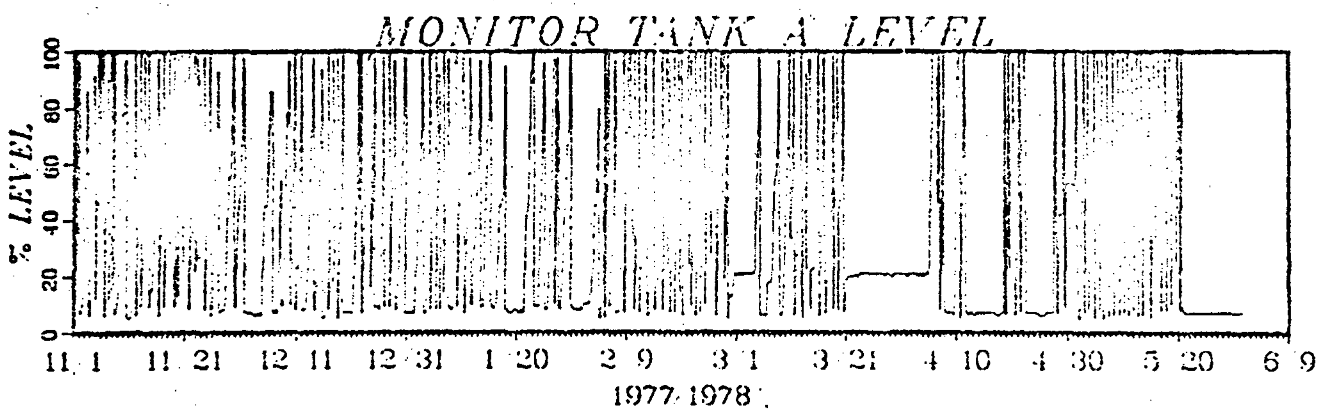


Figure B.20

Levels for Waste Condensate Tanks A and B



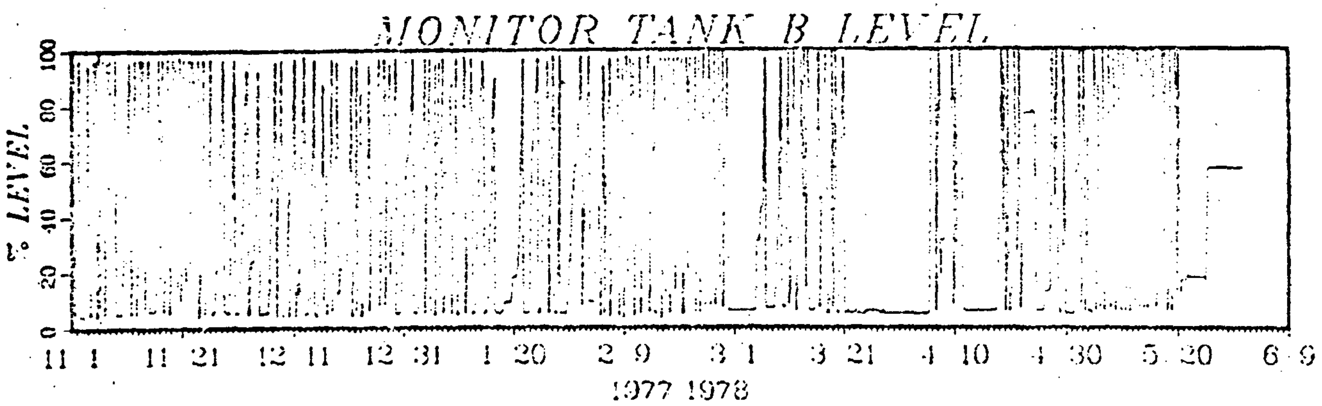


Figure B.21

Levels for Monitor Tanks A and B in Auxiliary Building

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16. ABSTRACT *(200 words or less)*

This report presents data obtained at Turkey Point Units #3 and #4 as a part of the in-plant source term measurement program in operating light water reactors (LWR's). The primary objective of this program is to provide the Nuclear Regulatory Commission (NRC) with operational data that can be used in evaluation of plant designs for liquid and gaseous waste treatment systems.

Data presented were obtained at the Turkey Point Power Station operated by Florida Power and Light. This plant is the third in a planned series of six operating LWR's to be studied. Data from all plants will be combined and interpreted to provide a data base for radioisotope inventory in plant systems, radioactive waste treatment system performance, and source terms for both liquid and gaseous systems.

One of the primary objectives in performing measurements at Turkey Point was to study primary-to-secondary leaks if they occurred and to determine partition factors in steam generators. The opportunity to study primary-to-secondary leaks occured twice during the in-plant measurement period. Results of these studies together with measurements performed on the liquid and gaseous systems at Turkey Point are presented.

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