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Rockwell Hanford Operations Effluents and Solid Waste Burials During Calendar Year 1986

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# Rockwell Hanford Operations Effluents and Solid Waste Burials During Calendar Year 1986

Duncan B. Howe
Robert C. Aldrich
Richard S. Shay
Leotta J. Voigt

Prepared for the U.S. Department of Energy
under Contract DE-AC06-77RL01030

Rockwell International
Rockwell Hanford Operations
Richland, Washington

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# Rockwell Hanford Operations Effluents and Solid Waste Burials During Calendar Year 1986

Date Published: July 1987

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Robert C. Aldrich
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Rockwell Hanford Operations

Prepared for the U.S. Department of Energy
under Contract DE-AC06-77RL01030

## EXECUTIVE SUMMARY

Rockwell Hanford Operations (Rockwell) operates facilities at the Hanford Site under contract to the U.S. Department of Energy (DOE). The facilities generate radioactive and nonradioactive solid, liquid, and airborne wastes that must be disposed of, stored, or discharged to the environment. No radioactive liquid or solid wastes are discharged or disposed of offsite. The quantities of solid, liquid, or gaseous wastes buried or discharged during calendar year (CY) 1986 (table 1) are monitored and reported in this document in compliance with DOE Order 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements in order to determine compliance with Rockwell, DOE, and other applicable Federal, State and local effluent limits and to evaluate the effectiveness of effluent treatment and control programs at Rockwell. Information has also been provided to Pacific Northwest Laboratory, which is responsible for assessing the radiological impact from all Hanford Site operations as well as the issuance of the CY 1986 Hanford Site Environmental Monitoring Report required by DOE Order 5484.1.

Effluents are regulated by RHO-MA-139, Environmental Protection Manual, and RHO-MA-222, REV 4, Hanford Radioactive Solid Waste Packaging, Storage, and Disposal Requirements. The requirements of these manuals are consistent with and at least as restrictive as the requirements of DOE Order 5480.1B, Environment, Safety, and Health Program for DOE Operations, as amended, and DOE Order 5820.2, Radioactive Waste Management. The requirements of RHO-MA-139 are referred to in this report as the Rockwell administrative controls or control values. Nonradiological airborne effluents are regulated by the Benton-Franklin-Walla Walla County Air Pollution Control Authority and a Prevention of Significant Deterioration Permit issued by the U.S. Environmental Protection Agency.

All radioactive liquid and gaseous discharges were in compliance with DOE Order 5480.1B, as amended. Discharge concentrations were also compared to more restrictive Rockwell administrative control values (ACV) for compliance. Two gaseous streams exceeded Rockwell ACV. The Plutonium-Uranium Extraction (PUREX) Facility ammonia scrubber discharge stack (296-A-24) emitted $^{106}$Ru at an annual average concentration that was 1.13 times the Rockwell ACV. The 241-AW Tank Farm stack (296-A-27) emitted $^{129}$I at an annual average concentration that was 1.82 times the Rockwell ACV. Two liquid streams exceeded Rockwell ACV. The PUREX process condensate stream emitted $^{239,240}$Pu at an annual average concentration that was 1.87 times the Rockwell ACV. The PUREX ammonia scrubber stream emitted $^{106}$Ru at an annual average concentration that was 1.002 times the Rockwell ACV.

The 200 Area power plants operated in compliance with the requirements of the Benton-Franklin-Walla Walla County Air Pollution Control Authority. There were no opacity violations; all deviations from opacity guidelines were promptly reported. Seven deviations were reported in CY 1986.

Oxides of nitrogen ($NO_x$) emissions from PUREX and the $UO_3$ Plant were below annual limits for CY 1986.

Table 1. Total Rockwell Waste Discharged or Buried. (sheet 1 of 2)

| Waste type | Quantity | |
|---|---|---|
| | Calendar year 1985 | Calendar year 1986 |
| **Airborne** | | |
| **Radioactive** | | |
| $^{3}H$ | 200 Ci | 60 Ci |
| $^{14}C$ | 4 Ci | 1 Ci |
| $^{85}Kr$ | 700,000 Ci | 500,000 Ci |
| $^{89,90}Sr$ | 0.008 Ci | 0.0007 Ci |
| $^{103}Ru$ | 0.5 Ci | 0.02 Ci |
| $^{106}Ru$ | 0.6 Ci | 0.4 Ci |
| $^{113}Sn$ | 0.4 Ci | 0.2 Ci |
| $^{129}I$ | 0.3 Ci | 0.5 Ci |
| $^{131}I$ | 0.2 Ci | <0.2 Ci |
| $^{147}Pm$ | 0.07 Ci | 0.01 Ci |
| $^{220}Rn$ + daughters | 4 Ci | 4 Ci |
| $^{239,240}Pu$ | 0.01 Ci | 0.003 Ci |
| $^{241}Pu$ | 0.1 Ci | 0.01 Ci |
| Other | 0.2 Ci | 0.02 Ci |
| **Nonradioactive** | | |
| Particulates | 390,000 kg | 318,000 kg |
| Sulfur oxides ($SO_x$) | 1,500,000 kg | 1,186,000 kg |
| Nitrogen oxides ($NO_x$) | 1,000,000 kg | 820,000 kg |
| Carbon monoxide (CO) | 110,000 kg | 89,000 kg |
| Hydrocarbons | 54,000 kg | 45,000 kg |
| **Liquid** | | |
| **Radioactive[a]** | | |
| $^{3}H$ | 11,000 Ci | 7,000 Ci |
| $^{89,90}Sr$ | 5 Ci | <3 Ci |
| $^{103}Ru$ | 4 Ci | 2 Ci |
| $^{106}Ru$ | 28 Ci | 24 Ci |
| $^{113}Sn$ | 2 Ci | 2 Ci |
| $^{239,240}Pu$ | 2 Ci | 1 Ci |
| $^{241}Pu$ | 36 Ci | 8 Ci |
| Other | 11 Ci | <5 Ci |
| **Nonradioactive** | | |
| Nitrate | 357,000 kg | 106,000 kg |
| Total organic carbon | 16,000 kg | 15,000 kg |

Table 1. Total Rockwell Waste Discharged or Buried. (sheet 2 of 2)

| Waste type | Quantity | |
|---|---|---|
| | Calendar year 1985 | Calendar year 1986 |
| **Solid** | | |
| Radioactive[a] | | |
| Industrial waste (LLW)[b] | 4,300 $m^3$ | 8,600 $m^3$ |
| Nontransuranic[c] | 13,000 $m^3$ | 12,300 $m^3$ |
| Transuranic | 1,000 $m^3$ | 200 $m^3$ |
| Nonradioactive | | |
| Nonhazardous trash | 33,000 $m^3$ | 43,200 $m^3$ |
| Asbestos | 500 $m^3$ | 1,000 $m^3$ |
| Waste chemicals | 3 $m^3$ | 0 $m^3$ |

[a]No radioactive liquid or solid waste is discharged offsite.

[b]LLW = low-level waste.

[c]Now categorized as LLW.

NOTE: Significant differences in 1985 and 1986 discharges occurred because of the following:

- Due to installation of the fourth filter at PUREX in October 1985, the annual average total alpha concentration in the main stack of PUREX decreased by 99%.
- The nitrate content in liquid effluents decreased by 70% due to a 99% reduction in unplanned releases of nitrate to the PUREX chemical sewer.
- The volume of industrial waste (LLW) burials in 1986 was twice the volume in 1985. The increase was due primarily to increases in the volume of offsite waste received at Rockwell.
- Permanent burial of nonradioactive dangerous or extremely hazardous waste chemicals was discontinued in 1986. Instead, 549,000 kg of nonradioactive waste chemicals were sent offsite for recycle or disposal.

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# 1.0 INTRODUCTION

Rockwell Hanford Operations (Rockwell) is responsible for waste surveillance and management in the 200 Areas (fig. 1-1) and the central landfill of the Hanford Site, as specified in contract DE-AC06-77RL01030 with the U.S. Department of Energy-Richland Operations Office (DOE-RL). Appendix A contains a description of 200 Area facilities and the effluent points that service each facility.

## 1.1 PURPOSE AND SCOPE

This document describes the types and quantities of effluents Rockwell has discharged to the environment and the solid wastes which have been buried in Rockwell-operated areas during calendar year (CY) 1986. The discharges are compared with local, State, and Federal guidelines and Rockwell administrative control values (ACV) to determine compliance. Where appropriate, comparisons are made to past operations at the Hanford Site.

## 1.2 EFFLUENT LIMITS AND GUIDES

Through most of 1986, the concentrations of radioactive materials in airborne and liquid discharges from Rockwell-operated facilities were regulated in accordance with DOE Order 5480.1A, Environmental Protection, Safety, and Health Protection Program, as amended (Vaughan 1985), and 40 CFR 61, Subpart H (EPA 1986b). In September 1986, DOE Order 5480.1A was replaced by DOE Order 5480.1B, Environment, Safety, and Health Program (DOE 1986) and the Vaughan memo (1985) remained in effect. The effective dose equivalent received by any member of the public from all effluents emitted during routine operations at the Hanford Site is not to exceed 100 mrem/yr for continuous exposure over a prolonged period (5 yr) and 500 mrem/yr for noncontinuous exposure. From the air pathway only, the whole body dose equivalent to any member of the public is not to exceed 25 mrem/yr and the dose equivalent to any organ is not to exceed 75 mrem/yr. In addition, an administrative threshold of 25 mrem/yr effective dose equivalent from all pathways is established to prevent any individual in the general public from receiving more than 100 mrem/yr. Likewise, an anticipated or calculated dose equivalent from the air pathway greater than 12.5 mrem/yr must be reported.

Table 1-1 contains a summary of the DOE derived concentration guides (DCG) and Rockwell ACV for the most important of the radionuclides discussed in this document. The guides and controls listed in table 1-1 are based on annual averages. Each column of table 1-1 is discussed in the following paragraphs.

The DCG were developed to implement the dose standards in Vaughan (1985). The DCG in table 1-1 are taken from Delaney (1986) and are for interim application at the point of actual exposure to members of the public pending incorporation into DOE orders. To determine the effect of known

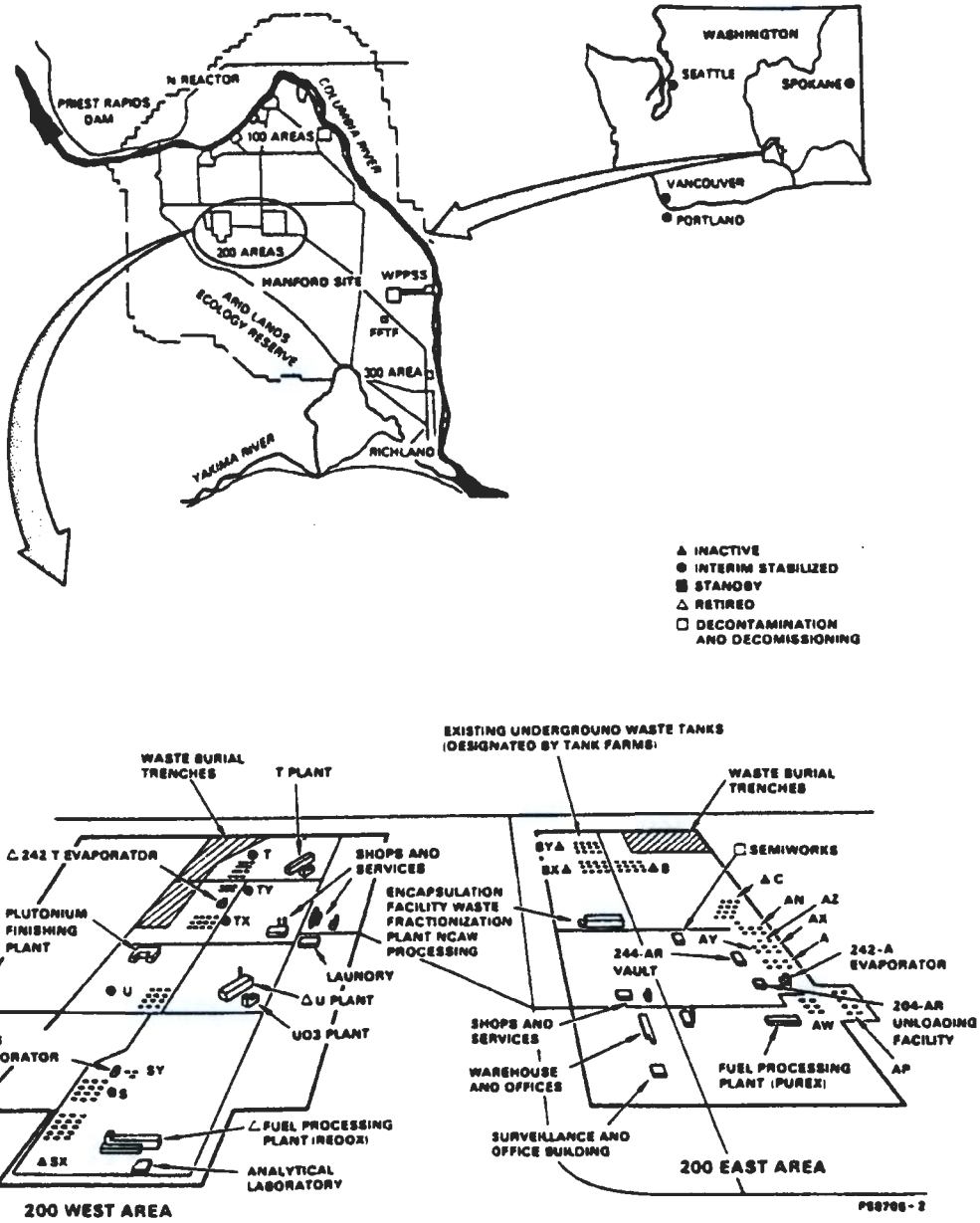


Figure 1-1. The 200 Areas.

Table 1-1. Effluent Concentration Guides and Control Values for Selected Radionuclides. (sheet 1 of 2)

| Radionuclide | DOE derived concentration guidelines[a] at the point of public exposure (µCi/mL)[b] | Concentration guides and control values at the point of release (µCi/mL)[c] | | |
|---|---|---|---|---|
| | | DOE | Rockwell ACV | |
| | | | Old facility[d] | New facility[d] |
| Airborne effluents | | | | |
| $^{3}H$ | 2 E-07[e] | ALARA | 5 E-06 | 2 E-07 |
| $^{14}C$ | 6 E-09 | ALARA | 4 E-06 | 1 E-07 |
| $^{85}Kr$ | No limit | ALARA | (4 E + 06 Ci/yr, sum of all effluents) | |
| $^{90}Sr$ | 9 E-12 | ALARA | 1 E-09 | 3 E-11 |
| $^{106}Ru$ | 3 E-11 | ALARA | 6 E-09 | 2 E-10 |
| $^{129}I$ | 7 E-11 | ALARA | 8 E-10 | 2 E-11 |
| $^{137}Cs$ | 4 E-10 | ALARA | 1 E-08 | 5 E-10 |
| $^{238}U$ | 1 E-13 | ALARA | 7 E-11 | 3 E-12 |
| $^{239}Pu$ | 2 E-14 | ALARA | 2 E-12 | 6 E-14 |
| $^{241}Pu$ | 1 E-12 | ALARA | 9 E-11 | 3 E-12 |
| $^{241}Am$ | 2 E-14 | ALARA | 6 E-12 | 2 E-13 |
| Liquid discharged to subsurface (cribs) | | | | |
| $^{3}H$ | 2 E-03 | ALARA/threshold | (2 E + 05 Ci/yr, sum of all discharges to cribs and ponds) | |
| $^{90}Sr$ | 1 E-06 | ALARA/threshold | 1 E-05 | 3 E-07 |
| $^{106}Ru$ | 6 E-06 | ALARA/threshold | 3 E-04 | 1 E-05 |
| $^{137}Cs$ | 3 E-06 | ALARA/threshold | 4 E-04 | 2 E-05 |
| $^{238}U$ | 6 E-07 | ALARA/threshold | 2 E-05 | 6 E-07 |
| $^{239}Pu$ | 3 E-07 | ALARA/threshold | 5 E-06 | 5 E-06 |
| $^{241}Am$ | 6 E-08 | ALARA/threshold | 4 E-06 | 4 E-06 |

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Table 1-1. Effluent Concentration Guides and Control Values for Selected Radionuclides. (sheet 2 of 2)

| Radionuclide | DOE derived concentration guidelines[a] at the point of public exposure (µCi/mL)[b] | Concentration guides and control values at the point of release (µCi/mL)[c] | | |
|---|---|---|---|---|
| | | DOE | Rockwell ACV | |
| | | | Old facility[d] | New facility[d] |
| Liquid discharged to surface (e.g., ponds) | | | | |
| $^{3}H$ | 2 E-03 | ALARA/threshold | (2 E + 05 Ci/yr, sum of all discharges to cribs and ponds) | |
| $^{90}Sr$ | 1 E-06 | ALARA/threshold | 3 E-07 | 3 E-07 |
| $^{106}Ru$ | 6 E-06 | ALARA/threshold | 1 E-05 | 1 E-05 |
| $^{137}Cs$ | 3 E-06 | ALARA/threshold | 2 E-05 | 2 E-05 |
| $^{238}U$ | 6 E-07 | ALARA/threshold | 6 E-07 | 6 E-07 |
| $^{239}Pu$ | 3 E-07 | ALARA/threshold | 5 E-06 | 5 E-06 |
| $^{241}Am$ | 6 E-08 | ALARA/threshold | 4 E-06 | 4 E-06 |

[a]These guides apply only at the point of actual public exposure.

[b]Although the becquerel (Bq) has replaced the curie (Ci) in standard international units, the use of µCi/mL is retained here since the guides and control values in DOE Orders and RHO-MA-139 are in terms of µCi/mL (1 Ci = $3.7 \times 10^{10}$ Bq).

[c]These values apply at the effluent release point (i.e., stack or pipe). The process condensate at B Plant has a special administrative control value (see section 1.2).

[d]Old facilities are those in operation before October 1977; new facilities are those started after that date. Rockwell internal ACV in 1986 were based on Table I and Table II Concentration Guides in DOE Order 5480.1A, Appendix XI-I.

[e]2 E-07 = $2 \times 10^{-7}$.

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mixtures of radionuclides, the sum of the ratios of the observed concentrations of each radionuclide to its corresponding DCG at the point of public exposure must be calculated.

The DOE guidelines for concentrations of radioactive materials at the point of release are not specific but consist of a requirement that contractors implement programs to ensure that exposures to members of the public, and thus effluent radionuclide concentrations, be maintained as-low-as-reasonably achievable (ALARA) (DOE 1986). Therefore, as shown in table 1-1, the DOE guidelines at the point of release are to maintain effluent concentrations ALARA.

The ALARA/threshold designation in table 1-1 refers to the DOE requirement that discharge of liquid low-level waste directly to the environment or on natural soil columns be replaced by alternative technologies (DOE 1984). To implement this requirement (DOE-RL 1985), disposal alternatives are currently being evaluated which will meet or approach U.S. Environmental Protection Agency (EPA) drinking water standards (EPA 1986c) for any wastes discharged to the soil.

In CY 1986, Rockwell regulated the concentrations of radioactive materials in airborne and liquid discharges in accordance with ACV given in RHO-MA-139, Environmental Protection Manual (Rockwell 1985). The Table I and Table II concentration guides of DOE Order 5480.1A, Attachment XI-1 (DOE 1981a) were used as the basis for these ACV. While Rockwell continued to use Table I and Table II guides as the basis for ACV in 1986, a revision to RHO-MA-139 was initiated in 1986 which will change the basis for ACV to multiples or fractions of the DCG (Delaney 1986). Use of the ACV based on the DCG will take place in CY 1987 in accordance with the provisions of the revised version of RHO-MA-139 (Rockwell 1987).

Although Table I and Table II concentration guides have been eliminated as guidelines for offsite personnel protection by Vaughan (1985) and replaced by the DCG provided in Delaney (1986), Rockwell's interim use of Table I and Table II guides in 1986 provided at least the same or greater protection to the public as the DCG. The reason for this is that Rockwell applies the Table I and Table II guides at the point of release and not at the point of public exposure as is the case with the DCG.

For those Rockwell facilities that were in operation prior to October 1977, the discharges were generally regulated to Table I values at the point of release in 1986. All liquid discharges to the surface and transuranics in liquid discharges to both the surface and cribs were regulated to Table II. For those facilities constructed after October 1977, the discharges were regulated to Table II values at the point of release. Effluent concentrations may briefly exceed the values listed in table 1-1, if the concentrations remain below the values on an annual basis.

In addition to the controls and guides listed in table 1-1, Rockwell has set temporary administrative controls on two effluents. For the main stack at the Plutonium-Uranium Extraction (PUREX) Facility (291-A-1), the sum of long-lived, alpha-emitting radionuclides (e.g., uranium, plutonium)

shall not exceed $3 \times 10^{-10}$ μCi/mL and the sum of long-lived beta-emitting radionuclides (e.g., strontium, cesium, ruthenium) shall not exceed $5 \times 10^{-8}$ μCi/mL. The limit on the B Plant process condensate liquid discharge for $^{90}Sr$ is $2.6 \times 10^{-3}$ μCi/mL, and the limit for $^{137}Cs$ is $1.1 \times 10^{-2}$ μCi/mL. These special, less-restrictive controls are contingent upon satisfactory progress toward required improvements in effluent treatment and monitoring systems. The temporary deviation at PUREX is conditional upon installation and use of the PUREX Moving Filter Radioactive Aerosol Monitor (MFRAM), which will provide the required sensitivity for $^{239}Pu$ monitoring. At B Plant, an improved condensate deentrainment system is being designed. Compliance with internal ACV will occur when operational testing of the MFRAM is completed in early 1988 and installation of the deentrainer at B Plant is completed in the second half of 1987.

Because the ACV are applied at the point of release rather than at the point of actual public exposure, compliance with the Rockwell ACV will ensure that the effective dose equivalent received by any member of the public from Rockwell operations will be well below the limits given in Vaughan (1985). Pacific Northwest Laboratory's (PNL) Annual Environmental Monitoring Report for 1986 (PNL 1987) assesses the radiological impact of all Hanford Site operations on the public and thus determines the degree of compliance of Hanford Site operations with DOE Order 5480.1A, as amended (Vaughan 1985). The PNL assessment is used in this document to verify that Rockwell, as one fraction of all Hanford Site operations, is in compliance with DOE standards given in Vaughan (1985).

Nonradiological, regulated pollutants in airborne effluents are regulated according to the guidelines given in the Washington Administrative Code (WAC), chapter 173-400 (WAC 1983), the Benton-Franklin-Walla Walla Counties Air Pollution Control Authority (BFWW), General Regulation 80-7 (BFWW 1980), and the Clean Air Act provisions of 40 CFR 61 (EPA 1986b). Guidelines for sulfur oxides ($SO_X$) and particulates are given in WAC (1983) and BFWW (1980). Nitrogen oxides ($NO_X$) emitted from the PUREX and $UO_3$ Plants are regulated in accordance with limits defined in PSD-X80-14, Prevention of Significant Deterioration (PSD) Permit, issued by the EPA. No $NO_X$ limit is established for steam boilers equivalent in size to those in the 200 Areas Powerhouses.

Specific nonradiological parameters in liquid effluents from Rockwell operating facilities are routinely sampled and analyzed. Nitrate ($NO_3$) and total organic carbon (TOC) are not presently regulated but are compared to the standards given in 40 CFR 261 (EPA 1985b) and WAC 173-303 (WAC 1984). The pH of all streams, except the PUREX and $UO_3$ Plant process condensates, was regulated in 1986 to the range of 2 to 12.5 pH specified in WAC (1984) and Rockwell (1985). The PUREX and $UO_3$ Plant process condensate streams were exempted in 1986 under the byproduct rule of the Resource Conservation and Recovery Act (RCRA). Although these streams were designated as byproduct, Rockwell's intention has been to manage these waste streams in accordance with State and Federal Regulations. Monitoring and neutralization capabilities for these two streams will be completed in 1987.

Rockwell solid waste effluents are controlled in accordance with RHO-MA-222, Hanford Radioactive Solid Waste Packaging, Storage, and Disposal Requirements (Rockwell 1987). This manual provides guidelines for management of solid waste in compliance with applicable Federal and State requirements. In addition, in 1986 Rockwell operated in accordance with an implementation plan (DOE-RL 1985) for achieving compliance with DOE Order 5820.2.

## 1.3 EFFLUENT MONITORING PROGRAM

The Rockwell effluent monitoring program is composed of several activities designed to obtain and report high-quality data on effluents and determine compliance with administrative control values.

### 1.3.1 Facilities Audit Program

Rockwell's Radiological and Environmental Safety department maintains an audit program to appraise facilities' effluent treatment, sampling, and monitoring systems. Audits are conducted jointly with other Safety and Quality Assurance (S&QA) function participants and are designed to identify and report deficiencies to Rockwell management, who will then develop a compliance plan to correct any deficiencies.

### 1.3.2 Air Sample Collection and Analyses

A representative sample of the effluent discharges during the collection period is obtained by extracting the sample at a velocity that is as close as practicable to the stack airflow velocity, and by holding the ratio of sample volume to total stack discharge volume constant within $\pm 20\%$.

Rockwell generally uses two methods to obtain effluent air samples:

- Record Samplers

  A record sampler collects effluent particulates on a filter which is exchanged and evaluated at least weekly for gross alpha and gross beta activity by laboratory analyses. Record samplers provide information on amounts and concentrations of radioactive particulates being discharged. They do not have detectors, strip chart records, or alarms associated with them.

- Continuous Air Monitors

  The continuous air monitors (CAMs) serve as warning devices to alert personnel to releases that exceed normal operating parameters. A CAM collects particulates on a filter which is continuously monitored by a radiation detector. The CAM filter can also be used as a backup for the record sample if needed.

Some PUREX and tank farm stacks also emit radioactive gases and/or volatiles that are not collectible on the particulate filters. These gases and/or volatiles are sampled as follows:

- Iodines and volatile forms of antimony, ruthenium, and tin are collected on silver zeolite cartridges that are used to sample two PUREX stacks, two tank farm stacks, and one evaporator stack
- $^{3}H$ is collected on silica gel columns that are used to sample the PUREX main stack
- $^{14}C$ is sampled with a sodium hydroxide bubbler that is used to sample the PUREX main stack
- $^{85}Kr$ is calculated in the PUREX main stack effluent by assuming that all of the inventory in the plant has been released
- $^{241}Pu$ released in the PUREX and Z Plant main stacks is calculated from the plant inventories
- Thoron ($^{220}Rn$) and its daughters released in the PUREX main stack are calculated from $^{212}Pb$ measurements.

Record sampler filters are generally collected weekly. Sample flow is measured by a gas flow meter or rotameter. The stack flow rates are measured quarterly or monitored by facility equipment. The record air filter samples are allowed to radioactively decay for one week to eliminate interference from short-lived radon ($^{222}Rn$) or thoron ($^{220}Rn$) daughters. The samples are then analyzed for gross alpha and gross beta activity. For stacks with a flow rate greater than 10,000 $ft^3$/min, record samples for stacks with a 1985 or expected 1986 gross alpha concentration greater than $6 \times 10^{-15}$ µCi/mL or gross beta concentration greater than $3 \times 10^{-12}$ µCi/mL were composited by stack and analyzed quarterly for appropriate specific radionuclides. For stacks with a flow rate less than 10,000 $ft^3$/min, appropriate specific radionuclide analyses were performed on those record samples with a 1985 or expected 1986 gross alpha concentration greater than $3 \times 10^{-14}$ µCi/mL or gross beta concentration greater than $1.5 \times 10^{-11}$ µCi/mL. Stacks that required specific radionuclide analyses are labeled "significant stacks" in this report.

The volume of air sampled is designed to provide sufficient activity to detect $6 \times 10^{-15}$ µCi/mL of alpha-emitting radionuclides and $3 \times 10^{-12}$ µCi/mL of beta-emitting radionuclides with an analytical precision of $\pm$100% at the 95% confidence level.

### 1.3.3 Liquid Sample Collection and Analysis

Sample collection schemes are designed to provide a sample representative of the effluent. Volume proportionality and extraction from a well-mixed stream are accomplished where practicable. Liquid effluent streams

are sampled using weekly grab sampling, batch sampling from a retention area, incremental time-proportional sampling, incremental flow-proportional sampling, and continuous flow-proportional sampling.

Samples of the liquid effluents are collected for one month, composited, then analyzed for gross alpha and gross beta radioactivity, as well as for specific nonradioactive parameters. Specific radionuclide analyses are also performed on monthly composites that contain gross alpha or gross beta concentrations greater than predetermined limits.

The volume of sample collected over a one-month period is designed to provide enough material to allow detection of $5 \times 10^{-7}$ μCi/mL of alpha-emitting radionuclides and $3 \times 10^{-8}$ μCi/mL of beta-emitting radionuclides with an analytical precision of ±100% at the 95% confidence level.

Rockwell has characterized all currently used liquid samplers, monitors, and flow measurement equipment. An ongoing program is in place to upgrade all equipment and to provide accurate evaluations of liquid discharges. Changes that have been made in the liquid sampling systems of those streams during CY 1986 are described in section 5.0.

### 1.3.4 Data Handling

Radioactive airborne and liquid effluent data are received from four sources:

- Stack record air sampler flow rates, total flow volume, and sample times
- Stack flow rates from the ventilation balance unit or from facility stack flow meters
- Liquid discharge volumes from facilities operations
- Sample analysis data from the 222-S Analytical Laboratory.

These data are continuously merged and reviewed for consistency and errors. Effluent concentration values are calculated weekly, monthly, and quarterly and compared with past and present facility operations and with effluent release guides. All anomalies are investigated to detect and correct errors and to ensure data accuracy.

The following are additional sources of data:

- $NO_x$ data supplied by the PUREX Operations department
- Nonradiological airborne effluent quantities supplied by the Rockwell Utilities and Telecommunications function
- Nonradiological solid waste volumes supplied by the Rockwell Maintenance and Transportation function

- Radiological solid waste volumes supplied by the Rockwell Research and Engineering function.

According to the following formula, any data value that indicates a concentration less than the value determined to be the lowest concentration detectable is replaced in Rockwell records with the calculated detection limit value and is designated and handled as a "less than" (<) value. The graphs and tables in appendixes B and C indicate whether or not an average monthly radionuclide concentration was below the lower limit of detection (LLD).

$$LLD = \frac{(4.6 \times Sb) + (2.72/T)}{E \times V \times 2.22 \times 10^6 \times Y \times e^{(-\lambda\Delta\tau)}}$$

where

LLD = the lower limit of detection (microcuries per unit mass or volume)

Sb = the standard deviation of the background counting rate (counts per minute)

T = the counting time (minutes)

E = the counting efficiency (counts per disintegration)

V = the sample size (mass or volume)

$2.22 \times 10^6$ = the number of disintegrations per minute per microcurie

Y = the fractional radiochemical yield when applicable

e = the base of natural logs (i.e., 2.718 ...)

$\lambda$ = the radioactive decay constant for the particular radionuclide (minutes)

$\Delta\tau$ = the elapsed time between sample collection (or end of the sample collection period) and time of counting (minutes).

Generally, gross beta and gross alpha analyses results do not accurately reflect specific radionuclide emissions. However, if gross alpha results indicate a release concentration much less than the most restrictive limit for specific alpha-emitting radionuclides, the discharge is assumed to be within release limits for all alpha emitters. The same assumption can be made about gross beta results that are less than the most restrictive limit for beta emitters. There are exceptions to these assumptions: gross beta analyses for liquids do not include $^3H$; radioactive gases and volatile radionuclides are not included in gross analyses of air samples. Separate analyses are performed for $^3H$, gases, and volatiles where appropriate.

# 2.0 AIRBORNE EFFLUENTS

## 2.1 RADIOLOGICAL AIRBORNE EFFLUENTS

### 2.1.1 Stacks

In the 200 Areas, radiological airborne effluents generally discharge from stacks. Sizes, shapes, and discharge paths of stacks vary depending upon facility requirements at the time of construction. Stack heights range from a few meters to 61 m (200 ft), and stack flow rates range from less than 3,000 L/min (100 $ft^3$/min) to more than 6 million L/min (200,000 $ft^3$/min). Stacks also vary from horizontal to vertical, rectangular to cylindrical, and permanent to portable. Most of these variables affect dispersion and local environmental impact.

During 1986, 74 stacks discharged air that was normally or potentially contaminated with radioactive material (Aldrich and Voigt 1987).

### 2.1.2 Filtration

Various methods are used in the 200 Areas to remove radiological contaminants from contaminated or potentially contaminated exhausts:

- Water scrubbers
- Fiberglass prefilters
- Silver reactors (for iodine removal)
- Sand filters
- Deep-bed fiberglass filters
- High-efficiency particulate air (HEPA) filters.

At least one stage, and in many cases several stages of HEPA filtration is generally used as the final particulate removal method before air is released to the atmosphere. Two streams use sand filters (291-U-1 and 291-S-1), and one stream (291-A-1) uses deep-bed fiberglass filters as prefilters prior to final treatment by two stages of HEPA filters. All final filters are required to have an efficiency of 99.97% in the removal of airborne particulates of greater than 0.3 micron in size. The efficiency of a filter is confirmed by routine testing.

Three minor exhausts are unfiltered (296-W-1, 296-S-6, and 296-U-4); however, past effluent data have shown that radionuclide concentrations in these streams are negligible. The PUREX pipe and operating gallery exhausts (296-A-33 through -38) are also unfiltered, but are automatically shut down when contamination is detected in the gallery.

The PUREX and related tank farm and evaporator facilities release volatile forms of radionuclides, specifically $^{3}H$, $^{14}C$, $^{103}Ru$, $^{106}Ru$, $^{125}Sb$, $^{113}Sn$, and iodine ($^{129}I$, $^{131}I$); PUREX also releases $^{85}Kr$ gas. Iodine is the only volatile radionuclide removed with any significant efficiency by the effluent treatment system at PUREX.

### 2.1.3 Effluent Data

Data on concentrations and total activities for specific radionuclides emitted in the PUREX main stack (291-A-1) have been compiled in table 2-1. Table 2-2 gives similar information for other significant stacks. Graphs of monthly average gross alpha and gross beta concentrations in emissions from all active stacks are provided in appendix B. Annual average gross alpha and gross beta concentrations and concentrations of specific radionuclides, where appropriate, are also given in appendix B.

Concentrations of radioactive materials in gaseous effluents from Rockwell-operated facilities were well below the DOE 25 mrem/yr dose equivalent standard (Vaughan 1985). This conclusion is based on the results published in PNL (1987); PNL calculated that the 50-yr effective dose equivalent for the hypothetically maximally exposed individual from all Hanford Site gaseous and liquid effluents was 0.09 mrem in 1986.

To further demonstrate compliance with DOE orders, the annual average concentrations of all measured radionuclide airborne effluents were projected from their points of release to the site boundary (Aldrich and Voigt 1987). A dilution factor for concentrations at the site boundary was derived using time-integrated concentration values (X/Q) given in tables 13 and 14 of PNL (1984). The sum of the ratios of the projected concentrations to the corresponding DCG was calculated to be $3 \times 10^{-4}$, well below unity. If an individual were continuously breathing an atmosphere in which the sum of the ratios of radionuclide concentrations to their respective DCGs was unity, that individual would receive an effective dose equivalent of 100 mrem in 1 yr.

In addition, all stack emissions, with the exception of the PUREX ammonia scrubber (296-A-24) and 241-AW Tank Farm (296-A-27) discharges were below Rockwell ACV. The PUREX ammonia scrubber discharge exceeded the Rockwell ACV for $^{106}Ru$ by 13%. The AW Tank Farm stack exceeded the Rockwell ACV for $^{129}I$ by 82%. Corrective actions are currently under way to bring $^{106}Ru$ and $^{129}I$ releases below the respective ACV. The radiological impact of these releases is well below DOE guidelines.

Discharge measurements showed that over 98% of the total alpha activity was discharged by the 291-Z-1 (96.3%) and 291-A-1 (2.5%) stacks. Due to the installation of the fourth filter at PUREX in October 1985, the 291-A-1 annual average gross alpha concentration in 1986 was less than 1% of the 1985 concentration. In addition, 99% of all gross particulate beta activity was discharged by the 291-A-1 (97.3%) and 291-B-1 (1.7%) stacks.

Table 2-1. Radionuclide Releases from the PUREX Main Stack (291-A-1) in 1986.

| Radionuclide | Annual average concentration (μCi/mL) | Total Activity (Ci) |
|---|---|---|
| $^{3}H$ | 5 E-08 | 9 E+01 |
| $^{14}C$ | 7 E-10 | 1 E+00 |
| $^{85}Kr$[a] | 3 E-04 | 5 E+05 |
| $^{89,90}Sr$[b] | 1 E-13 | 2 E-04 |
| $^{95}Nb$ | 2 E-12 | 4 E-03 |
| $^{95}Zr$ | 1 E-12 | 2 E-03 |
| $^{103}Ru$ | 5 E-12 | 1 E-02 |
| $^{106}Ru$[b] | 2 E-10 | 3 E-01 |
| $^{113}Sn$ | 1 E-10 | 2 E-01 |
| $^{125}Sb$ | <3 E-12 | <5 E-03 |
| $^{129}I$ | 4 E-10 | 7 E-01 |
| $^{131}I$ | <2 E-10 | <3 E-01 |
| $^{134}Cs$ | ND[d] | ND |
| $^{137}Cs$[b] | 3 E-13 | 5 E-04 |
| $^{144}Ce$[b] | ND | ND |
| $^{147}Pm$ | 7 E-12 | 1 E-02 |
| $^{220}Rn$[c] | 9 E-10 | 2 |
| $^{238}Pu$ | 3 E-15 | 5 E-06 |
| $^{239,240}Pu$ | 3 E-14 | 5 E-05 |
| $^{241}Pu$[a] | 3 E-13 | 6 E-04 |
| Uranium (gross) | 2 E-15 | 3 E-06 |

[a]Calculated from plant inventory.
[b]Assumes equilibrium with daughter product.
[c]Based on $^{212}Pb$ measurements. Other members of the decay chain are present in the following multiples of $^{220}Rn$: $^{216}Po$ (1.0), $^{212}Pb$ (0.1), $^{212}Bi$ (0.07), $^{212}Po$ (0.04), and $^{208}Tl$ (0.02).
[d]ND - not detected.

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## Table 2-2. Radionuclide Releases from Other Significant Stacks in 1986.

| Stack[a] | Radionuclide concentration (µCi/mL) and total release (Ci) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $^{89,90}Sr$[b] | $^{137}Cs$[b] | $^{239,240}Pu$ | $^{103}Ru$ | $^{106}Ru$[b] | $^{113}Sn$ | $^{125}Sb$ | $^{129}I$ | $^{241}Pu$[e] | Uranium |
| 296-A-1 | c | c | 2 E-14 | c | c | c | c | c | c | c |
| 296-A-17 | 2 E-13 | 3 E-12 | c | d | 3 E-12 | d | d | d | c | c |
| 296-A-22 | <2 E-15 | <1 E-14 | c | d | d | d | 1 E-11 | d | c | c |
| 296-A-24 | 1 E-14 | <7 E-14 | c | 1 E-09 | 7 E-09 | 3 E-10 | <2 E-10 | d | c | c |
| 296-A-27 | <9 E-15 | <9 E-15 | c | 8 E-12 | 1 E-10 | 3 E-11 | <5 E-12 | 4 E-11 | c | c |
| 296-A-29 | <3 E-15 | <2 E-14 | c | c | c | c | c | c | c | c |
| 291-B-1 | 1 E-13 | 1 E-11 | c | c | c | c | c | c | c | 5 E-16 |
| 291-C-1 | 4 E-12 | <1 E-14 | c | c | c | c | c | c | c | c |
| 296-S-7W | c | c | 2 E-14 | c | c | c | c | c | c | c |
| 291-T-1 | 3 E-14 | 3 E-14 | 2 E-14 | c | c | c | c | c | c | c |
| 296-U-2 | c | c | 7 E-15 | c | c | c | c | c | c | 2 E-14 |
| 296-U-4 | 8 E-15 | 3 E-14 | <8 E-16 | <2 E-14 | 9 E-13 | c | c | c | c | 2 E-13 |
| 296-U-13 | c | c | 1 E-15 | c | c | c | c | c | c | <1 E-14 |
| 291-Z-1 | c | c | 9 E-13 | c | c | c | c | c | 4 E-12 | c |
| 296-Z-3 | c | c | 4 E-14 | c | c | c | c | c | c | c |
| Total (Ci) | 5 E-04 | 8 E-03 | 3 E-03 | 1 E-02 | 1 E-01 | 6 E-03 | <3 E-03 | 6 E-04 | 1 E-02 | <9 E-06 |

NOTE: Significant stacks are defined in section 1.3 2 of this report.

[a]Refer to appendix A for locations and descriptions of stacks

[b]Assumes equilibrium with daughter product

[c]Analysis not required (as determined from inventory, effluent history and/or gross beta/alpha analyses).

[d]Less than detectable (e.g., all quarterly composites were less than 10% of ACV). Specific detection limits are given as less than numbers in appendix B data.

[e]Calculated from plant inventory.

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In 1986, three gaseous effluent release points were deactivated. The PUREX east storage gallery exhaust (296-A-31) was diverted through the railroad tunnel and the PUREX vacuum pump exhaust (296-A-32) was diverted to the west sample gallery and R cell exhauster (296-A-7). In addition, the 242-S evaporator/crystallizer cell and vessel ventilation system (296-S-19) was shut down. In 1986, two new exhaust points were activated. The 241-AP Tank Farm began operations in October 1986, and the primary (296-A-40) and annular (296-A-41) exhausters were started up.

The following is a listing of the major radionuclide emissions from the PUREX main stack (291-A-1) and the relationship to the Rockwell ACV:

- $^{129}I$ emissions were 38% of the ACV
- $^{85}Kr$ emissions were 13% of the ACV
- $^{239,240}Pu$ emissions were 0.01% of the ACV for long-lived alpha emitters
- The sum of releases of all particulate, long-lived beta emitters was 0.4% of the ACV.

The Plutonium Finishing Plant (PFP) main stack (291-Z-1) emission of $^{239,240}Pu$ was 45% of its ACV. The 241-AW Tank Farm stack (296-A-27) emission of $^{106}Ru$ was 50% of its ACV. Stack emissions that were not discussed in this section were well below the ACV.

## 2.2 NONRADIOLOGICAL AIRBORNE EFFLUENTS

Nonradiological regulated pollutants were emitted from seven facilities (table 2-3). The emissions from the powerhouses were calculated from 1982 compliance testing data and formulas established by the EPA (EPA 1986a). The emissions from the 1100 Area were calculated from EPA formulas (EPA 1986a), and the $NO_x$ emissions from PUREX and $UO_3$ Plant were continuously measured by effluent monitors. Emissions of carbon tetrachloride ($CCL_4$) from the PFP in 1986 are also reported in this section.

### 2.2.1 Powerhouses

Particulates, and to a small degree $SO_x$, are removed from the 200 East and West Area powerhouse stacks by passing the air through baghouses. Compliance testing in 1982 demonstrated that emissions were in compliance with State of Washington regulations when the baghouses were in operation. The baghouses at both powerhouses were generally in continuous operation during 1986. In 1986, the baghouses at the 284-E and 284-W Powerhouses were bypassed seven times for a total of 53 h for purposes other than routine cleaning. The bypasses occurred during unavoidable replacement, repair, and maintenance of equipment. In addition, the bypasses were reported

immediately to Federal, State, and local authorities and were not the result of a recurring problem. Therefore, these bypasses are not considered violations of the requirements of BFWW (1980) and resulted in minimal impact to the environment.

### 2.2.2 1100 Area

Number 2 fuel oil is burned in the heating plants in the 1166, 1170, and 1171 Buildings and for the backup boiler at the 284-E Powerhouse. The emissions listed in table 2-3 have been calculated from fuel content and consumption (EPA 1986a) and are minor in comparison to emissions from other facilities.

Table 2-3. Nonradiological Emissions from Rockwell Facilities in Calendar Year 1986.

| Source | Fuel consumption | Pollutants (kg) | | | | |
|---|---|---|---|---|---|---|
| | | Particulates | $SO_x$ | $NO_x$ | CO | Hydrocarbons |
| 284-W powerhouse stacks | 26,500,000 kg (coal) | 94,800[a] | 353,000 | 199,000 | 26,500 | 13,300 |
| 284-E powerhouse stacks | 62,500,000 kg (coal) | 223,000[a] | 831,000 | 468,000 | 62,500 | 31,200 |
| 1100 Area and 284-E | 700 $m^3$ (No. 2 fuel oil) | 1,300 | 4,200 | 6,700 | 400 | 80 |
| PUREX main stack (291-A-1) | b | b | b | 134,000 | b | b |
| $UO_3$ Plant stack (296-U-4) | b | b | b | 15,900 | b | b |

[a]Assumes particulate emission control is 95% efficient during time of operation based on compliance testing.
[b]Analysis not applicable or not required.

### 2.2.3 PUREX and $UO_3$

Oxides of nitrogen are released as part of the processes at the PUREX and $UO_3$ Plants; PUREX reduces its $NO_x$ emissions by passing the $NO_x$-bearing air through a hydrogen peroxide scrubbing system. Discharge limits (table 2-4) are established by a PSD Permit (PSD-X80-14) issued by the EPA.

Table 2-4. Oxides of Nitrogen ($NO_x$) Emission Limits.

| Source | Instantaneous concentration (vol%) | Daily mass (kg/d) | Annual mass (kg/yr) |
|---|---|---|---|
| PUREX $NO_x$ absorber exit | 2.0 | 1,160 | NA |
| Main stack | NA | 2,250 | 424,000 |
| $UO_3$ | 4.0 | 858 | 50,000 |

NA - not applicable.

The PUREX Plant exceeded the instantaneous concentration limits at the dissolver offgas acid absorber exit three times for very short durations (15 min or less) in 1986. In all cases, appropriate corrective actions were taken. The daily and annual limits at the absorber exit and main-stack monitor were not exceeded. The $UO_3$ Plant did not exceed the instantaneous, daily, or annual limits for $NO_x$ emissions in 1986.

### 2.2.4 Plutonium Finishing Plant

The quantities of $CCl_4$ emitted from the 291-Z-1 stack for the past 3 yr were derived from material balance calculations and are given in table 2-5. The $CCl_4$ in gaseous effluents represents more than 95% of all PFP $CCl_4$ purchases and was the result of normal evaporation from process solutions. Emissions of $CCl_4$ from PFP in 1986 were well below the permit condition of 40 tons/yr for volatile organic compounds (EPA 1985a). In addition, the concentration of $CCl_4$ at the point of release was below the Rockwell occupational threshold limit value of 5 ppm for occupational exposure (Rockwell 1986).

Table 2-5. Carbon Tetrachloride Emissions from the Plutonium Finishing Plant Main Stack (291-Z-1).

| Quantity/Concentration | Year | | |
|---|---|---|---|
| | 1984 | 1985 | 1986 |
| Quantity (tons) | 21.7 | 11.2 | 7.4 |
| Concentration (ppm) | 0.9 | 0.5 | 0.3 |

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# 3.0 LIQUID EFFLUENTS

## 3.1 RADIOLOGICAL LIQUID EFFLUENTS

### 3.1.1 Liquid Discharge Points

During 1986, 21 liquid streams that were potentially or normally contaminated with radioactive materials were discharged to ponds or cribs (Aldrich 1987). Potentially radioactive liquid discharges include process and steam condensates, cooling waters, and other waste waters from facilities containing radioactive materials. Discharges to French drains and the reverse well at 201-C (216-L-2) are not included because of their very low volumes and overall insignificant input of radioactive materials to the soil.

### 3.1.2 Effluent Data

Data on concentrations of important radionuclides for all 21 streams have been compiled in table 3-1, and inventories of radionuclide discharges in those streams have been compiled in table 3-2. Graphs of monthly average gross alpha, gross beta, and, where appropriate, $^{3}H$ concentrations, are provided in appendix C. Appendix C also provides information on annual average concentrations and total activity for gross alpha, gross beta, and, where appropriate, specific radionuclide constituents of liquid effluent streams. Total discharges of radionuclides in liquids were 7,000 Ci of $^{3}H$, 3 Ci of $^{90}Sr$, 2 Ci of $^{103}Ru$, 24 Ci of $^{106}Ru$, 2 Ci of $^{113}Sn$, <0.1 Ci of $^{129}I$, <2 Ci of $^{137}Cs$, 2 Ci of $^{147}Pm$, 0.1 Ci of $^{238}Pu$, 1 Ci of $^{239}Pu$, 8 Ci of $^{241}Pu$, and lesser amounts of other radionuclides. The total liquid released to ponds and cribs was $2.5 \times 10^{10}$ L.

The largest source of $^{3}H$ was the PUREX process condensate, which accounted for 86% of the total emission. The B Plant process condensate accounted for 67% of the $^{90}Sr$ releases; the PUREX ammonia scrubber and steam condensate accounted for 20% of the $^{90}Sr$ releases. The PUREX ammonia scrubber discharge accounted for 96% of the $^{106}Ru$ releases; the remaining 4% appeared in the PUREX process condensate. The principal sources of $^{239,240}Pu$ were PUREX process condensate and Z Plant waste water, which accounted for 84% and 16% of the total discharge, respectively.*

*Percentages were calculated from analytical data and may vary from percentages calculated from rounded data in table 3-2.

Table 3-1. Average Concentrations of Radioactive Liquid Discharges in 1986.

| Effluent | Radionuclide concentration (µCi mL)[a] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $^{3}H$ | Beta | $^{89,90}Sr$[b] | $^{137}Cs$[b] | $^{103}Ru$ | $^{106}Ru$[b] | $^{113}Sn$ | $^{129}I$ | $^{147}Pm$ | Alpha | $^{238}Pu$ | $^{239,240}Pu$ | $^{241}Pu$ | Uranium |
| PUREX process condensate | 8 E-02 | 2 E-05 | <6 E-08 | <7 E-08 | 4 E-07 | 1 E-05 | d | 2 E-07 | 1 E-06 | 1 E-05 | 8 E-07 | 9 E-06 | 1 E-04 | 5 E-08 |
| PUREX ammonia scrubber | 2 E-03 | 8 E-04 | 4 E-06 | 6 E-06 | 4 E-05 | 4 E-04 | 3 E-05 | <4 E-08 | 4 E-05 | <4 E-07 | c | 4 E-08 | 4 E-07 | c |
| PUREX steam condensate | 8 E-06 | 6 E-06 | 6 E-07 | 3 E 07 | c | c | c | c | c | <5 E-08 | c | c | c | c |
| PUREX cooling water | 2 E-05 | 1 E-07 | <3 E-08 | <6 E-08 | d | d | c | c | d | <9 E-09 | c | c | c | c |
| PUREX chemical sewer | 5 E-06 | 2 E-07 | <3 E-08 | <5 E-08 | d | c | c | c | d | <2 E-08 | c | c | c | c |
| B Plant process condensate | c | 2 E-03 | 5 E-04 | 9 E-05 | c | c | c | c | c | <8 E-07 | c | c | c | c |
| B Plant steam condensate | c | 5 E-07 | c | c | c | c | c | c | c | 2 E-07 | c | c | c | c |
| B Plant cooling water | c | <4 E-08 | c | c | c | c | c | c | c | <7 E-09 | c | c | c | c |
| B Plant chemical sewer | c | <2 E-07 | d | d | c | c | c | c | c | <7 E-09 | c | c | c | c |
| 242-A process condensate | 1 E-02 | 5 E-06 | 4 E-07 | 6 E 07 | c | c | c | <2 E-08 | 1 E-06 | <3 E-08 | c | c | c | <2 E-09 |
| 242-A steam condensate | 3 E-05 | <9 E-08 | c | c | c | c | c | c | c | <5 E-09 | c | c | c | c |
| 242-A cooling water | 1 E-05 | <1 E-07 | c | c | c | c | c | c | c | <6 E-09 | c | c | c | c |
| 244-AR Vault cooling water | c | <3 E-08 | d | d | c | c | c | c | c | <8 E-09 | c | c | c | c |
| A Tank Farm cooling water | c | <4 E-08 | c | c | c | c | c | c | c | <1 E-08 | c | c | c | c |
| PFP, 231-Z waste water | c | 9 E-08 | c | c | c | c | c | c | c | 7 E-07 | c | 4 E-07 | 1 E-06 | c |
| $UO_3$ process condensate | c | 4 E-06 | c | c | c | c | c | c | c | 3 E-06 | c | c | c | 4 E-06 |
| $UO_3$ waste water | c | < 7 E-08 | d | d | c | c | c | c | c | <2 E-08 | c | c | c | 2 E-08 |
| 222-S Lab waste water | c | <2 E-08 | c | c | c | c | c | c | c | 7 E-09 | c | c | c | c |
| Laundry waste water | c | 8 E-07 | 8 E-08 | <2 E-07 | c | c | c | c | c | <3 E-08 | c | c | c | c |
| 242-S steam condensate | c | <6 E-08 | c | c | c | c | c | c | c | <9 E-09 | c | c | c | c |
| REDOX chemical sewer | c | <3 E-08 | c | c | c | c | c | c | c | <5 E-09 | c | c | c | c |

[a]A less-than value (<) indicates that monthly less than results contributed at least 10% of the annual total.
[b]Equilibrium with daughter product is assumed.
[c]Analysis not necessary (as determined from inventory, effluent history, and or gross beta alpha analyses).
[d]Below lower limit of detection (LLD). LLD is less than 1% of ACV of referenced radionuclide.

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Table 3-2. Total Activity of Radioactive Liquid Discharges in 1986.

| Effluent | Radionuclide activity (Ci)[a] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $^{3}H$ | Beta | $^{89,90}Sr$[b] | $^{137}Cs$[b] | $^{103}Ru$ | $^{106}Ru$[b] | $^{113}Sn$ | $^{129}I$ | $^{147}Pm$ | Alpha | $^{238}Pu$ | $^{239,240}Pu$ | $^{241}Pu$ | Uranium |
| PUREX process condensate | 6,040 | 1 | <5 E-03 | <5 E 03 | 3 E 02 | 1 | d | 2 E-02 | 1 E-01 | 7 E-01 | 6 E 02 | 7 E-01 | 7 | 3 E-03 |
| PUREX ammonia scrubber | 137 | 48 | 2 E-01 | 3 E-01 | 2 | 23 | 2 | <3 E-03 | 2 | <3 E-02 | c | 2 E-03 | 2 E-02 | c |
| PUREX steam condensate | 6 | 5 | 4 E-01 | 2 E-01 | c | c | c | c | c | <5 E-02 | c | c | c | 1 E-02 |
| PUREX cooling water | 252 | 1 | <3 E-01 | <6 E-01 | d | d | c | c | d | <9 E-02 | c | c | c | c |
| PUREX chemical sewer | 8 | 4 E-01 | <5 E-02 | <9 E-02 | d | c | c | c | d | <3 E-02 | c | c | c | c |
| B Plant process condensate | c | 8 | 2 | 3 E 01 | c | c | c | c | c | <4 E-03 | c | c | c | c |
| B Plant steam condensate | c | 2 E-03 | c | c | c | c | c | c | c | 9 E-04 | c | c | c | c |
| B Plant cooling water | c | <2 E-01 | c | c | c | c | c | c | c | <3 E-02 | c | c | c | c |
| B Plant chemical sewer | c | <7 E-02 | d | d | c | c | c | c | c | <4 E-03 | c | c | c | c |
| 242-A process condensate | 560 | 3 E-01 | 2 E-02 | 3 E-02 | c | c | c | <1 E-03 | 6 E-02 | <2 E-03 | c | c | c | <7 E-05 |
| 242-A steam condensate | 2 | <6 E-03 | c | c | c | c | c | c | c | <4 E-04 | c | c | c | c |
| 242-A cooling water | 40 | <4 E-01 | c | c | c | c | c | c | c | <3 E-02 | c | c | c | c |
| 244-AR Vault cooling water | c | <4 E-03 | d | d | c | c | c | c | c | <1 E-03 | c | c | c | c |
| A Tank Farm cooling water | c | <3 E-02 | c | c | c | c | c | c | c | <7 E-03 | c | c | c | c |
| PFP, 231-Z waste water | c | 3 E-02 | c | c | c | c | c | c | c | 2 E-01 | c | 1 E-01 | 4 E-01 | c |
| $UO_3$ process condensate | c | 1 E-02 | c | c | c | c | c | c | c | 1 E-02 | c | c | c | 2 E-02 |
| $UO_3$ waste water | c | <4 E-02 | d | d | c | c | c | c | c | <8 E-03 | c | c | c | 1 E-02 |
| 222-S Lab waste water | c | <7 E-04 | c | c | c | c | c | c | c | 3 E-04 | c | c | c | c |
| Laundry waste water | c | 3 E-02 | 4 E-03 | <5 E 03 | c | c | c | c | c | <2 E-03 | c | c | c | c |
| 242-S steam condensate | c | <9 E-04 | c | c | c | c | c | c | c | <2 E-04 | c | c | c | c |
| REDOX chemical sewer | c | <5 E-03 | c | c | c | c | c | c | c | <9 E-04 | c | c | c | c |
| Total[e] | 7,040 | 65 | <3 | <1 7 | 2 4 | 24 | 1 6 | <.02 | 2.2 | 1.2 | .06 | .8 | 7.6 | .04 |

[a]A less-than value (<) indicates that monthly less than results contributed at least 10% of the annual total.
[b]Equilibrium with daughter product is assumed.
[c]Analysis not necessary (as determined from inventory, effluent history, and or gross beta alpha analyses).
[d]Below lower limit of detection (LLD). LLD is less than 1% of ACV of referenced radionuclide.
[e]Due to rounding, in body of table totals may not equal sum of column.

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The assessment of the radiological impacts of radioactive liquid discharges from Rockwell operations on any member of the public is not as clearly defined as the assessment provided in section 2.1.3 for radioactive airborne effluents. The reason is that the effects of radioactive liquid discharges may not appear at points of public exposure for decades. The transport rate of a radionuclide in the soil and groundwater is dependent on its mobility in the soil and groundwater, its dilution and dispersion resulting from current and future patterns of groundwater plume movement, and its radioactive decay. All of these factors function to delay or prevent the appearance of radionuclides at points of public exposure.

In addition, atmospheric dispersion models currently provide acceptable estimates of airborne effluent concentrations and subsequent dose to the public. On the other hand, characterization of the movement of radionuclides in the soil column is a continuing process and is dependent on future activities which are difficult to anticipate. Therefore, transport models for liquid discharges are not as useful as those for airborne releases for predictions of eventual concentrations of radionuclides at points of public exposure.

The best available data for the assessment of the radiological impact of radioactive liquid discharge from all Hanford Site operations on the public is given in PNL (1987). As noted in section 2.1.3, PNL calculated the 50-yr effective dose equivalent to the hypothetical maximally exposed member of the public from all gaseous and liquid effluents to be 0.09 mrem in CY 1986. This is well below the DOE guidelines of 25 mrem/yr given in Vaughan (1985).

Due to the extended transport time of radionuclides in the soil column, the component of the 1986 PNL dose estimate due to 200 Areas liquid discharges actually reflects the effects of past 200 Areas operations. In addition, many of the radionuclides from past discharges remain bound to the soil, and the rest will require additional years to appear at points of public exposure if they do not first decay to negligible activities.

Figures 3-1 and 3-2 illustrate the history of gross beta and gross alpha discharges in liquid effluents for the 200 Areas since 1956. Figure 3-1 shows a significant decrease in radionuclide discharges since 1956. Figure 3-2 summarizes this decrease and indicates that the average annual quantities of gross beta and gross alpha curies discharged to the soil between 1984 and 1986 were, respectively, 0.1 and 1.0% of the average annual amounts discharged between 1956 and 1972. Thus, the radiological impact from current operations will be far less than the impact from operations in the past four decades.

The reason for this decline is that radioactive discharges have been administratively controlled at the point of discharge to those concentrations in the DOE order (DOE 1981a) that were intended for application at points of worker exposure at ground level within the site boundary and at points of exposure to members of the public at the site boundary. Further declines in radioactive liquid discharges will occur in the future as plans to discontinue disposal of contaminated liquids into the soil column are

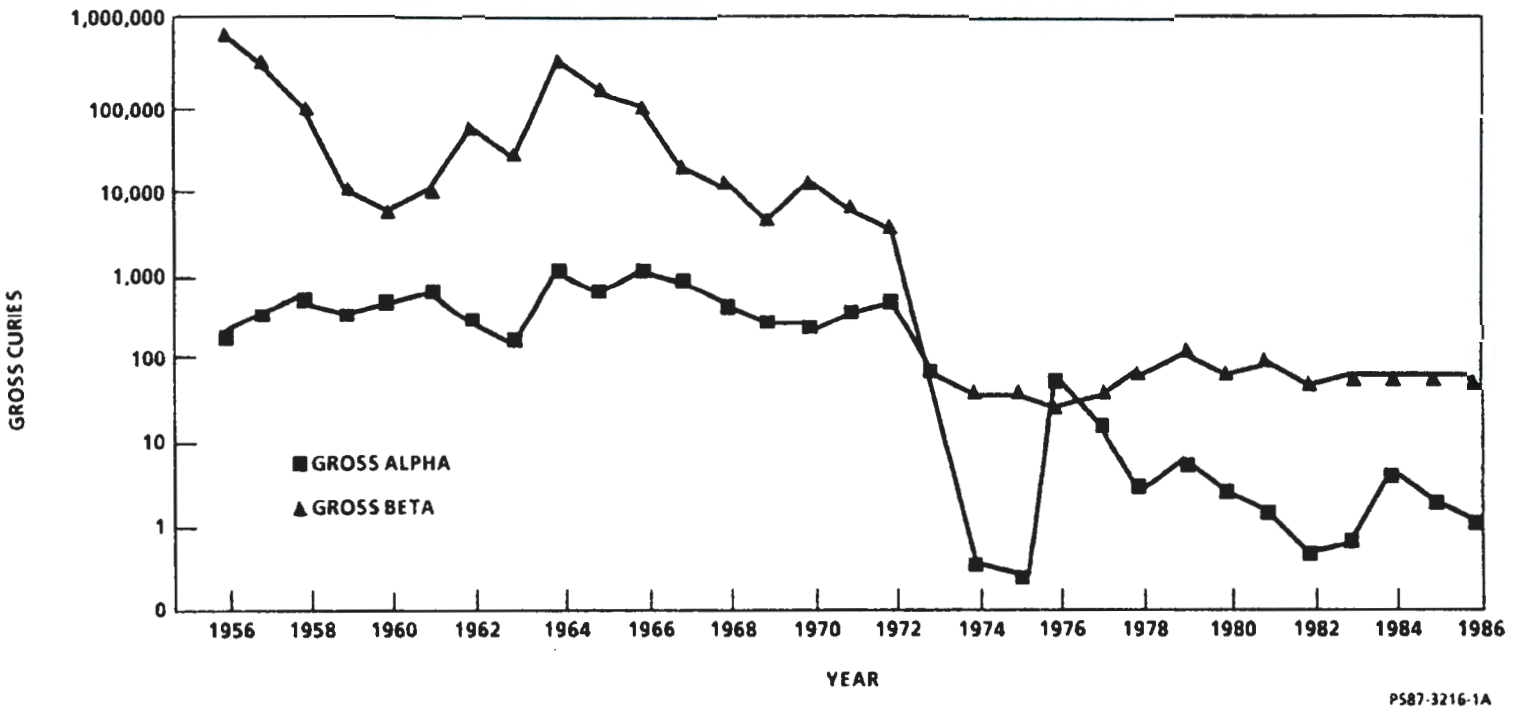


Figure 3-1. 200 Areas Liquid Discharges, 1956 to 1986.

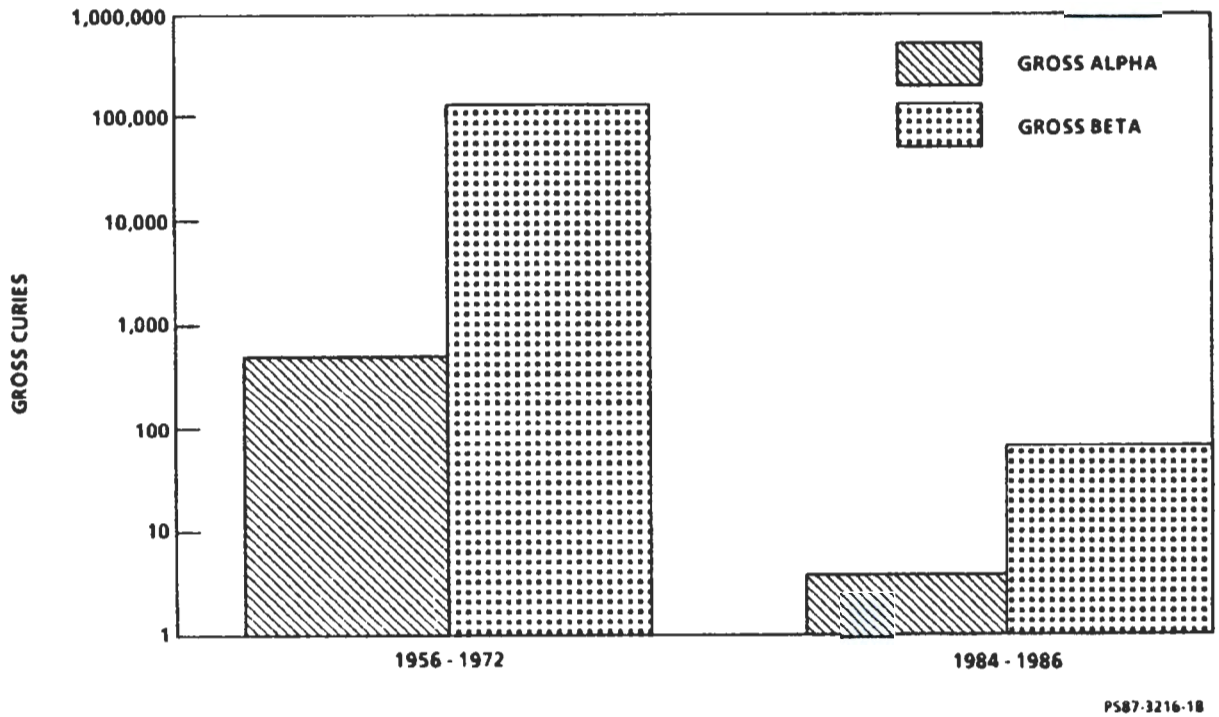


Figure 3-2. 200 Areas Annual Average Liquid Discharges from 1956 to 1972 and from 1984 to 1986.

completed. The plans and schedules for these alternatives to discharge were submitted to Congress in March 1987 (DOE-RL 1987). In the interim, the ACV for radioactive liquid discharges have been revised in RHO-MA-139 (Rockwell 1987) to more restrictive levels. These ACV are designed to ensure that the groundwater below those areas of the Hanford Site which may be released from institutional control in the future will not exceed the maximum contaminant levels in 40 CFR 141 (EPA 1986c).

Continued monitoring is required to determine the movement of radionuclides discharged to the soil column below the 200 Areas. However, the environmental sampling results to date, the accompanying dose estimates (PNL 1987), and the current downward trend in radionuclide discharges indicate that Rockwell liquid discharges in 1986 are in compliance with current DOE guidelines (Vaughan 1985).

Two liquid streams exceeded the Rockwell ACV, the PUREX process condensate (for $^{239,240}Pu$) and the PUREX ammonia scrubber (for $^{106}Ru$) (table 3-3).

Table 3-3. Comparison of Major Discharge Streams to Rockwell Administrative Controls.

| Stream | Radionuclide | Ratio to Rockwell ACV |
|---|---|---|
| B Plant process condensate | $^{89,90}Sr$ | 0.20[a] |
| | $^{137}Cs$ | 0.01 |
| PUREX process condensate | $^{239,240}Pu$ | 1.87 |
| | $^{241}Pu$ | 0.48 |
| | $^{238}Pu$ | 0.17 |
| | $^{129}I$ | 0.05 |
| | $^{3}H$ | 0.04 |
| PUREX ammonia scrubber | $^{106}Ru$ | 1.00 |
| | $^{89,90}Sr$ | 0.37 |
| $UO_3$ Process Condensate | Uranium (gross) | 0.21 |
| Laundry liquid waste | $^{89,90}Sr$ | 0.28 |
| PFP waste water | $^{239,240}Pu$ | 0.09 |

[a]The ACV for $^{89,90}Sr$ and $^{137}Cs$ in the B Plant condensate are $2.6 \times 10^{-3}$ and $1.1 \times 10^{-2}$ μCi/mL, respectively, while upgrades to the treatment system are being made.

Several factors caused the plutonium concentration in the PUREX process condensate to exceed the Rockwell ACV. When solution was routed between H and J cell concentrators for additional concentration, backflow into the PDD header occasionally occurred. In addition, offgas from a vessel vent system in L Cell was mixing with offgas from a condenser that feeds the PDD stream. Both of these designs are being upgraded to prevent recurrence. A third possible source, the plutonium stripper sampling system, is being investigated.

The PUREX ammonia scrubber stream exceeded the Rockwell ACV for $^{106}Ru$ due to volatilization of ruthenium in the F11 bottoms. In 1987, a study will be made to determine a more-suitable chemical environment for suppression of ruthenium volatility.

In 1986, two liquid effluent streams were not used which were used in 1985. The 242-S process condensate stream (RC3) had been deactivated because the 242-S evaporator is in a standby mode, and an auxiliary use for removal of uranium from groundwater was completed at the end of 1985. The use of the 241-AY, -AZ Tank Farm steam coil condensate stream (A8) was discontinued in 1986, during which time corrective actions were developed to isolate monitoring and sampling systems from a contaminated weir pit.

At the end of 1986, the B Plant process condensate stream was diverted to underground storage tanks in the tank farms. Work is ongoing to replace a deentrainer on the E-23-3 concentrator. Flow to the 216-B-62 crib will resume when the upgrade has proven to be effective in reducing radionuclide concentrations below limits that are consistent with the usual guidelines in RHO-MA-139 (Rockwell 1987).

## 3.2 NONRADIOLOGICAL LIQUID EFFLUENTS

During 1986, 20 of the normally or potentially contaminated liquid discharge streams were also sampled and analyzed for certain chemical parameters: pH and nitrate ($NO_3$) and total organic carbon (TOC) concentrations. Nonradiological samples were split from the radiological samples obtained with the well-established, radiological liquid-sampling network. These samples were used to create a monthly composite for analysis. From this sampling program, the average annual concentrations of $NO_3$ and TOC and the range of pH occurring in each stream during the year were identified (table 3-4).

With the exception of two streams (PUREX and $UO_3$ Plant process condensates), all liquid discharges to the environment are considered nonhazardous according to WAC (1984). The PUREX and $UO_3$ Plant process condensates exceeded WAC (1984) and Rockwell (1985) standards for pH, but were excluded from regulation because of their byproduct classification in 1986. Rockwell is currently installing pH monitoring and neutralization systems to make these byproduct streams nonhazardous.

The quantity of $NO_3$ released from Rockwell facilities in 1986 was 30% of the quantity released in 1985. This was primarily due to a 99% reduction in unplanned $NO_3$ releases to the PUREX chemical sewer.

Table 3-4. Major Nonradiological Indicators in Major Streams.

| | Volume (L) | pH range | Nitrate[a] (mg/L) | Total organic[b] (mg/L) | Total quantity released | |
|---|---|---|---|---|---|---|
| | | | | | Nitrate[a] (kg) | Total organic[b] (kg) |
| PUREX ammonia scrubber (ASD) | 5 66 E +07 | 9 5-10 1 | c | 30 | c | 1,600 |
| PUREX chemical sewer (CSL) | 1 69 E +09 | 6 7-9 5 | 2 | 4 | 2,790 | 7,000 |
| PUREX cooling water (CWL) | 1 09 E +10 | 7 3-8 9 | c | c | c | c |
| PUREX process condensate (PDD) | 7 37 E +07 | 1 6-13.4 | 1,100 | 40 | 81,160 | 3,110 |
| PUREX steam condensate (SCD) | 7 65 E +08 | 2.7-8 8 | c | c | c | c |
| B Plant chemical sewer (BCE) | 5.14 E +08 | 7.0-10 4 | 1 | 3 | 760 | 1,470 |
| B Plant process condensate (BCP) | 3.89 E +06 | 6.6-10 4 | 1 | 3 | 6 | 10 |
| B Plant steam condensate (BCS) | 4.23 E +06 | 6 7-9 0 | c | c | c | c |
| B Plant cooling water (CBC) | 3 58 E +09 | 7.1-9 1 | c | c | c | c |
| 244-AR Vault cooling water (CAR) | 1.22 E +08 | 7.2-9.2 | c | c | c | c |
| Tank Farm surface condenser cooling water (CA8) | 7 07 E +08 | 7 1-8 3 | c | c | c | c |
| 242-A evaporator cooling water (ACW) | 3 65 E +09 | 7 8-9 4 | c | c | c | c |
| 242-A after-filter process condensate (AFPC) | 5 04 E +07 | 7 7-10 3 | 3 | 20 | 140 | 800 |
| 242-A steam condensate (ASC) | 6.79 E +07 | 7.1-9 0 | c | c | c | c |
| $UO_3$ Plant process condensate (U-12) | 3.92 E +06 | 1 0-2 6 | 3,760 | 6 | 14,740 | 30 |
| $UO_3$ steam condensate and cooling water (207-U) | 5.27 E +08 | 6 9-9 0 | c | c | c | c |
| Plutonium Finishing Plant liquid waste (2904-ZA) | 2.97 E +08 | 4 7-9 1 | 22 | 2 | 6,510 | 570 |
| 2724-W Laundry waste water (LWC) | 4.43 E +07 | 6.3-7 8 | c | 6 | c | 270 |
| 242-S steam condensate (RC1) | 1 50 E +07 | 7.1-10 0 | c | c | c | c |
| 222-S cooling water (207-SL) | 4 12 E +07 | 7 2-9 6 | 1 | 10 | 50 | 450 |
| Totals[d] | 2.31 E +10 | e | e | e | 106,200 | 15,300 |

[a]Reported as $NO_3$

[b]Reported as total organic carbon (TOC).

[c]Analysis not necessary as determined from expected inventory during operations

[d]Total listed may not equal the total for the column due to rounding

[e]Not applicable

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# 4.0 SOLID WASTES

## 4.1 RADIOLOGICAL SOLID WASTES

Radiological solid waste generated at the Hanford Site (and some from offsite) is stored or disposed in the 200 Areas shallow land burial sites. The wastes are segregated into three categories: high-level waste (HLW), TRU, and low-level waste (LLW), and are disposed of or stored in separate trenches. The LLW includes that waste which was formerly categorized as industrial and nontransuranic (non-TRU).

High-level waste in the form of spent fuel was received in limited quantities in 1986 and was placed in interim storage pending identification of a retrievable storage site in the future.

All solid wastes containing or suspected of containing TRU materials have been placed in specific retrievable storage sites since May 1970. Containers in these sites are designed to maintain their integrity for ultimate retrieval and reprocessing of the stored wastes for up to 20 yr.

The LLW includes contaminated, obsolete, and failed equipment, and miscellaneous waste that is placed in large burial boxes. The LLW is sometimes referred to as mixed-fission (low-level) product waste, although it does contain radionuclides other than mixed-fission products. The LLW contains waste from radiation zones within the facilities, which includes paper, rags, protective clothing, and tape, and is usually buried in plastic-lined cardboard boxes. This waste is not intended to be retrieved.

In 1986, a small percent of LLW (less than 1%) was stored on asphalt pads in the burial grounds for eventual retrieval. This LLW consists of liquid organics and banned waste. The organics are not disposed to soil because their chelating characteristics could enhance the transport rate of contaminants in the soil. This waste consists of radioactive extremely hazardous waste, dangerous waste, and nonhazardous waste. Banned waste is also prohibited from land disposal.

The radioactive mixed waste (RMW) is defined as waste having both radioactive and hazardous contamination. Limited segregation of RMW and storage for eventual retrieval began in the latter half of 1986. Routine manifesting of RMW will begin in the first quarter of 1987.

Approximately 21,100 $m^3$ of radiological solid waste were buried or stored in 1986 (table 4-1). This represents a 17% increase from 1985, which was due, in large part, to a 300% increase in the receipt of offsite waste. Rockwell generated the most waste volume of Hanford contractors (47% of the total); UNC Nuclear Industries (24%), Westinghouse Hanford Company (6%), and PNL (5%) were also significant contributors. Shipments of radiological solid waste from offsite government contractors constituted 15% of the waste volume in 1986.

Table 4-1. Source Comparison of Total Radioactive Solid Waste Volume Buried in the 200 Areas (1983 through 1986).

| Source | Volume ($m^3$) | | | |
|---|---|---|---|---|
| | 1983 | 1984 | 1985 | 1986 |
| Rockwell | | | | |
| PUREX | 630 | 870 | 2,100 | 2,000 |
| B Plant | 820 | 720 | 900 | 1,950 |
| S Plant (except 222-S Laboratory) | 1,700 | 240 | 2 | 3 |
| 222-S Laboratory | 330 | 380 | 350 | 370 |
| T Plant | 710 | 310 | 690 | 410 |
| $UO_3$ Plant | 14 | 16 | 7 | 140 |
| PFP | 190 | 640 | 1,100 | 520 |
| 200 West Area Tank Farms | 1,700 | 1,200 | 1,000 | 950 |
| 200 East Area Tank Farms | 940 | 1,100 | 2,100 | 1,460 |
| Semiworks | 0 | 350 | 180 | 260 |
| 1100 Area | 1,000 | 8 | 0 | 460 |
| 200 West Area shops | 14 | 330 | 32 | 0 |
| 2724-W Laundry | 380 | 540 | 620 | 560 |
| Other[a] | 0 | 0 | 0 | 930 |
| Subtotal[b] | 8,400 | 6,700 | 9,100 | 10,000 |
| Non-Rockwell | | | | |
| J. A. Jones Construction | 4,000 | 5,900 | 1,000 | 640 |
| Pacific Northwest Laboratories | 570 | 930 | 800 | 960 |
| UNC Nuclear Industries | 2,500 | 4,300 | 5,700 | 5,040 |
| Westinghouse Hanford Company | 420 | 370 | 300 | 1,200 |
| Offsite Contractors | 2,500 | 1,250 | 1,100 | 3,250 |
| Subtotal[b] | 10,000 | 12,700 | 8,900 | 11,100 |
| Total[b] | 18,400 | 19,400 | 18,000 | 21,100 |

[a]Includes 870 $m^3$ of waste buried under the Radiation Area Reduction program.
[b]Total listed may not equal the total for the column due to rounding.

More detail about the volume of Rockwell-generated wastes, segregated by category, is presented in table 4-2. Similarly, table 4-3 identifies non-Rockwell-generated wastes, segregated by category.

## 4.2 NONRADIOLOGICAL SOLID WASTES

Nonradiological solid wastes from the Hanford Site are disposed in the 600 Area central landfill, with the exception of coal wastes and waste chemicals. Coal wastes are disposed near the powerhouses (table 4-4). Disposal records for asbestos, waste chemicals, and trash, plus weekly inspections of the central landfill provide volume data for those wastes (table 4-5).

As noted in table 4-5, disposal of waste chemicals at the central landfill was eliminated in 1986. This reduction was due to the closure of the Central Landfill to waste chemical disposal in May 1985. Waste chemicals are currently being stored and then shipped offsite for disposal, destruction, or recycle.

Extremely hazardous waste (as defined by the WAC 173-303, "Dangerous Waste Regulations") and bulk liquid organics can no longer be disposed of in landfills in Washington State. Such wastes generated at the Hanford Site are sent to a recycler of dangerous waste.

In CY 1986, 2,700 empty 55-gal drums were sent offsite for recycling to prevent future liability and to promote metal reclamation. In addition, 445,000 kg of dangerous waste and 104,000 kg of extremely hazardous waste were sent offsite for disposal or recycle. These containers varied in size from paint cans to 55-gal drums to 5,000-gal tank trucks.

Table 4-2. Burial of Rockwell-Generated Radioactive Waste in the 200 Areas by Category (1983 through 1986).

| Source | Waste type | Volume ($m^3$) | | | |
|---|---|---|---|---|---|
| | | 1983 | 1984 | 1985 | 1986 |
| PUREX | Industrial (LLW)[a] | 150 | 110 | 290 | 460 |
| | Non-TRU[b] | 480 | 740 | 1,800 | 1,530 |
| | TRU | 0 | 12 | 50 | 16 |
| B Plant | Industrial (LLW) | 240 | 200 | 130 | 250 |
| | Non-TRU[b] | 580 | 520 | 780 | 1,700 |
| S Plant (except 222-S Laboratory) | Industrial (LLW) | 0 | 18 | 0 | 0 |
| | Non-TRU[b] | 1,700 | 240 | 2 | 3 |
| | TRU | 0 | 0 | 0 | 0 |
| 222-S Laboratory | Industrial (LLW) | 0 | 18 | 0 | 0 |
| | Non-TRU[b] | 330 | 360 | 350 | 370 |
| | TRU | 0 | 0 | 1 | 0 |
| T Plant | Industrial (LLW) | 360 | 130 | 180 | 210 |
| | Non-TRU[b] | 340 | 180 | 510 | 200 |
| $UO_3$ Plant | Industrial (LLW) | 0 | 0 | 0 | 2 |
| | Non-TRU[b] | 14 | 16 | 7 | 140 |
| PFP | Industrial (LLW) | 0 | 30 | 45 | 4 |
| | Non-TRU[b] | 94 | 180 | 360 | 370 |
| | TRU | 100 | 430 | 720 | 144 |
| 200 West Area Tank Farm | Industrial (LLW) | 0 | 4 | 0 | 0 |
| | Non-TRU[b] | 1,700 | 1,200 | 1,000 | 950 |
| 200 East Area Tank Farm | Industrial (LLW) | 38 | 0 | 0 | 0 |
| | Non-TRU[b] | 910 | 1,100 | 2,100 | 1,460 |
| Semiworks | Non-TRU[b] | 0 | 350 | 180 | 260 |
| 1100 Area | Industrial (LLW) | 980 | 0 | 0 | 460 |
| | Non-TRU[b] | 40 | 8 | 0 | 0 |
| 200 West Area shops | Non-TRU[b] | 14 | 330 | 32 | 0 |
| 2724-W Laundry | Non-TRU[b] | 380 | 540 | 600 | 560 |
| Other[c] | Non-TRU[b] | | | | 930 |
| Total[d] | | 8,400 | 6,700 | 9,100 | 10,000 |

[a]LLW - low-level waste.
[b]Now categorized as LLW.
[c]Includes 870 $m^3$ of waste buried under the Radiation Area Reduction program.
[d]Totals listed may not be equal to the total for the column due to rounding.

Table 4-3. Burial of Non-Rockwell-Generated Radioactive Solid Waste in the 200 Areas by Category (1983 through 1986).

| Source | Waste type | Volume ($m^3$) | | | |
|---|---|---|---|---|---|
| | | 1983 | 1984 | 1985 | 1986 |
| J. A. Jones Construction | Industrial (LLW)[a] | 86 | 60 | 0 | 0 |
| | Non-TRU[b] | 3,900 | 5,800 | 1,000 | 640 |
| | TRU | 0 | 0 | 0 | 0 |
| Pacific Northwest Laboratories | Industrial (LLW) | 38 | 150 | 260 | 140 |
| | Non-TRU[b] | 520 | 770 | 550 | 820 |
| | TRU | 11 | 7 | 8 | 2 |
| UNC Nuclear Industries | Industrial (LLW) | 680 | 1,900 | 2,600 | 3,260 |
| | Non-TRU[b] | 1,800 | 2,400 | 3,100 | 1,780 |
| | TRU | 1 | 0 | 0 | 0 |
| Westinghouse Hanford Company | Industrial (LLW) | 120 | 90 | 49 | 810 |
| | Non-TRU[b] | 250 | 260 | 230 | 390 |
| | TRU | 41 | 23 | 12 | 7 |
| Offsite Hanford | Industrial (LLW) | 1,700 | 870 | 770 | 2,960 |
| | Non-TRU[b] | 400 | 130 | 96 | 240 |
| | TRU | 350 | 250 | 200 | 50 |
| Total[c] | | 10,000 | 12,700 | 8,900 | 11,100 |

[a]LLW - low-level waste.
[b]Now categorized as LLW.
[c]Totals listed may not be equal to the total for the column due to rounding.

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Table 4-4. Nonradioactive Solid Waste Burial Locations in Calendar Year 1986.

| Waste type | Site location |
|---|---|
| Office waste | Central Landfill--trash trench |
| Demolition/construction waste | Central Landfill--trash trench |
| Asbestos | Central Landfill--asbestos trench |
| Waste chemicals | Shipped offsite for disposal or recycle |
| Fly ash/boiler clinkers | Mound east of 284-E powerhouse and pit southeast of 284-W powerhouse |

Table 4-5. Nonradioactive Solid Waste Buried at the Central Landfill by Category (1983 through 1986).

| Waste type | Volume ($m^3$) | | |
|---|---|---|---|
| | 1984 | 1985 | 1986 |
| Nonhazardous (trash trench) | | | |
| Trash | 31,000 | 33,000 | 43,200 |
| Hazardous[a] (asbestos trench) | | | |
| Asbestos | 560 | 510 | 970 |
| Waste chemicals | 300 | 3 | 0 |

[a]Does not include extremely hazardous waste (EHW) and receipt of dangerous waste (DW) was discontinued in 1985; EHW and DW are defined in WAC 173-303.

## 5.0 EFFLUENT SYSTEM IMPROVEMENT PROJECTS

During CY 1986, Rockwell continued to support improvements in the effluent program, including improved filtration, sampling, monitoring, and laboratory analyses.

The main-stack monitoring building at PUREX, 292-AB, was completed to house all of the 291-A-1 sampling and monitoring systems. The MFRAM was installed in 292-AB to provide greater monitoring sensitivity for $^{239}Pu$ and $^{90}Sr$ emissions from the main stack. Operational testing of the MFRAM began in 1986 and continued into 1987. When testing is complete, the system will operate in tandem for a trial period with the current particulate-iodine-noble gas (PING) system to monitor for $^{131}I$, $^{85}Kr$, $^{239}Pu$, and particulate beta (including $^{90}Sr$ and $^{106}Ru$ emissions). Installation was begun on a system for mixing dissolver offgas and canyon exhaust at the base of the main stack to ensure more representative samples of gaseous effluents from 291-A-1.

Actions designed to reduce the $^{239}Pu$ content of the PUREX process condensate stream (PDD) at PUREX were initiated. Condensate flow from the H4 concentrator is being eliminated and the L Cell vessel vent offgas system is being rerouted. An interim neutralization system for the PDD was installed that allows caustic addition when pH readings are low. In addition, Tank A-5 was filled with $CaCO_3$ to provide final neutralization for the PDD stream before discharge.

An extensive containment project in the PUREX aqueous makeup facility was initiated in 1986 to prevent overflows and misroutings of hazardous materials into the chemical sewer. Liquid-level probes, which alarm at both warning and high-liquid levels, were installed in 57 chemical makeup tanks. When the high-liquid-level monitor alarms, the incoming chemical stream is designed to shutoff automatically. Troubleshooting and calibration of the system is ongoing in 1987. In addition, installation of a catch tank system to contain overflows and spills was begun in 1986. Diking was installed around the storage tanks in the 211 Area to prevent potential tank overflows or leaks from entering the chemical sewer. A number of potential inputs to the chemical sewer were administratively locked out including wastes from the 203-A recovered acid storage and uranyl nitrate hexahydrate loadout facility.

At $UO_3$ Plant, the drain line from the nitric acid loading station was rerouted to a catch tank to prevent potential spills from entering the chemical sewer. An automatic, incremental, flow-proportional sampler was installed on the combination cooling water, chemical sewer, and steam condensate discharge stream to the 216-U-14 ditch.

At B Plant, a neutralization system was installed for the demineralizer regeneration discharge and an online, time-proportional pH monitor was installed on the chemical sewer upstream of the discharge point. Online

beta monitors and upgraded incremental, flow-proportional samplers were installed in the chemical sewer and steam condensate discharge streams. The grab sampling system was upgraded on the process condensate batch release stream. Operational testing on the flow-proportional samples and grab sampling system will be completed in 1987.

At Z Plant, a major contributor to contamination in the waste stream to the 216-Z-20 crib was removed. The primary cooling loop and water seal system for the 26-in. vacuum pump was replaced with a closed-loop cooling system which no longer discharges to the environment. Operational testing of the system was completed in early 1987. A pH monitoring/sampling system was installed which initiates a grab sample whenever a low or high pH occurs and alarms in the shift support manager's office and the 236-Z control room. A remote alarm for the alpha monitor was installed in the 236-Z control room.

Since 1980, Rockwell has conducted a program to upgrade sampling and monitoring systems on the liquid and airborne effluents. The program not only replaces old equipment with state-of-the-art equipment, but also provides a degree of uniformity in the hardware at all sites for ease of maintenance and operation. The stack sampling and monitoring program was completed in 1986; all major and most minor stacks have been upgraded. In 1986, 6 stack sampling and monitoring system upgrades were completed. Upgraded sampling and monitoring systems were installed in three B Plant liquid effluent streams and operational testing will be completed in 1987.

In the analytical laboratory, an improved method for uranium analysis using laser-induced fluorescence was implemented. As a result, the sensitivity of uranium analyses has been significantly improved.

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# APPENDIX A

## POTENTIALLY AND NORMALLY CONTAMINATED AIR AND LIQUID EFFLUENT POINTS IN THE 200 AREAS

## 200 EAST AREA FACILITIES

### A PLANT--PLUTONIUM-URANIUM EXTRACTION AND ASSOCIATED FACILITIES

#### Description

The Plutonium-Uranium Extraction (PUREX) Plant is a fuel processing plant that was constructed in 1956 and operated until 1972. The facility was then placed on standby status. Upgrade modifications were completed and PUREX resumed processing a backlog of fuel from N Reactor in November 1983.

#### Airborne Effluents

- 291-A-1* PUREX Process and Canyon Exhaust

  This stack exhausts filtered air from canyon ventilation, vessel and condenser vents, and treated dissolver offgas. The sampling system is composed of two separate units, including separate probes and transport lines. One unit consists of a record sampler and a silver zeolite cartridge for gases and volatiles. The other unit has $^{3}H$ and $^{14}C$ samplers, an oxide-of-nitrogen ($NO_x$) monitor, and a particulate-iodine-noble-gas (PING) monitor.

- 296-A-1 PUREX N Cell, Q Cell, and Product Removal Room Exhaust

  This stack exhausts filtered air from N and Q Cells, the product removal (PR) room, and gloveboxes in these rooms. The sampling system is composed of a record sampler and an alpha continuous air monitor (CAM) unit.

- 296-A-2 PUREX West Sample Gallery Hoods Exhaust

  This stack exhausts filtered air from the west sample gallery hoods. The sampling system is composed of a record sampler and alpha and beta-gamma CAM units.

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* Stack number designation; see page B-1.

- 296-A-3 <u>PUREX East Sample Gallery Hoods Exhaust</u>

  This stack exhausts filtered air from hoods in the PUREX east sample gallery. The sampling system is composed of a record sampler and a beta-gamma CAM.

- 296-A-5a,b <u>PUREX Lab Hoods Dual Exhaust</u>

  These stacks operate on an alternating basis and exhaust filtered air from 202-A Laboratory hoods. The sampling and monitoring system for each stack is composed of a generic system containing a record sampler and alpha and beta-gamma CAM units.

- 296-A-6 <u>PUREX East Sample Gallery and U Cell Exhaust</u>

  This stack exhausts filtered room air from PUREX east sample gallery and U Cell. The sampling system is composed of a record sampler.

- 296-A-7 <u>PUREX West Sample Gallery and R Cell Exhaust</u>

  This stack exhausts filtered room air from PUREX west sample gallery and R Cell. The sampling system is composed of a record sampler.

- 296-A-8 <u>PUREX Pipe and Operating Gallery and White Room Exhaust</u>

  This stack exhausts filtered air from the PUREX pipe and operating (P&O) gallery and the white room. The sampling system consists of a record sampler.

- 296-A-10 <u>PUREX Burial Tunnel No. 2 Exhaust</u>

  This stack exhausts filtered air from PUREX burial tunnel no. 2. The sampling system consists of a record sampler.

- 296-A-14 <u>293-A Building (Nitric Acid Recovery) Exhaust</u>

  This stack exhausts filtered air from the 293-A Offgas Treatment and Recovery Building. The sampling system consists of a record sampler.

- 296-A-24 <u>PUREX Ammonia Scrubber Waste Concentrator Exhaust</u>

  This stack exhausts filtered air from E and F Cells to reduce the ammonium nitrate loading on the 291-A-1 filters. The sampling and monitoring system is composed of a record sampler, two silver zeolite cartidge samplers for volatile radionuclides, and alpha and beta-gamma CAM units.

- 296-A-32 — PUREX Vacuum Pump Exhaust

  An ambient air record sampler, which is located beneath the PUREX vacuum pump exhaust port, samples unfiltered air from radiological sampling systems. This sampler was taken off line in February 1986 and this location is now exhausted through the 296-A-7 stack.

- 296-A-33, -34, -35 -36, -37, and -38 — PUREX Wall Exhausters EF-3-5, -6, -7, -8, and -9

  These exhaust sites are spaced along the PUREX P&O gallery. Unfiltered air from the gallery is sampled by beta-gamma CAM units. An electrical intertie system will, upon activation of any two CAM units, shut down the wall exhausters and direct the airflow to the 296-A-8 filtered exhaust.

Liquid Effluents

- PDD — PUREX Process Condensate to 216-A-10 Crib

  The condensate from the first uranium cycle concentrator, the final uranium cycle concentrator, and the backcycle waste concentrator feed this waste stream. Weekly samples are collected from an incremental, flow-proportional sampler. The stream is monitored by a gamma monitor and a pH monitor. The 216-A-10 Crib was deactivated and replaced with the 216-A-45 Crib in March 1987.

- CSL — PUREX Chemical Sewer to 216-B-3 Pond via 216-A-29 Ditch

  The chemical sewer receives aqueous makeup (AMU) wastes, liquids from the P&O gallery floor drains, fractionator steam condensate, vacuum pump seal water, and water demineralizer regeneration wastes. Weekly samples are collected from an incremental, flow-proportional sampler. The stream is monitored by a gamma monitor and a pH monitor. Automatic diversion to the 216-A-42 basin occurs if gamma or pH monitors alarm.

- CWL — PUREX Cooling Water to 216-B-3 Pond

  Cooling water wastes from low-risk cooling coils and tube bundles and water from the railroad tunnel door drain feed this waste stream. Weekly samples are collected from an incremental, flow-proportional sampler. The stream has both alpha and gamma monitors. Automatic diversion to the 216-A-42 basin occurs if the monitors alarm.

- SCD — PUREX Steam Condensate to 216-A-30 (67%) and 216-A-37-2 Cribs (33%)

  Steam condensate from concentrator tube bundles, cooling water from high-risk vessel coils, and the slug storage overflow and jet-out feed this stream. Weekly samples are collected from an incremental, flow-proportional sampler. The stream has both alpha and gamma monitors. Automatic diversion to the 216-A-42 basin occurs if the monitors alarm.

- ASD — PUREX Ammonia Scrubber Discharge to 216-A-36B Crib

  Ammonia scrubber wastes from the dissolver cells and E Cell are routed to the EF-11 condenser, then discharged to this stream. Weekly samples are collected from an incremental, flow-proportional sampler. The stream has a gamma monitor.

## B PLANT AND WASTE ENCAPSULATION STORAGE FACILITY

### Description

In the past, B Plant has been used as a waste fractionization facility removing $^{137}Cs$ and $^{90}Sr$ from high-level liquid waste. The mission of the Waste Encapsulation Storage Facility (WESF) has been to convert $^{137}Cs$ and $^{90}Sr$ to solid strontium fluoride and cesium chloride, which were then doubly encapsulated and placed in water-filled storage basins. Currently, WESF is no longer converting $^{137}Cs$ and $^{90}Sr$. The inventory of capsules is being stored or shipped to qualified customers. B Plant activities in 1986 were primarily directed towards preparing the facility for processing neutralized current acid waste (NCAW) prior to transfer to the proposed Transportable Grout and Waste Vitrification Plants.

## Airborne Effluents

- 291-B-1 B Plant Process and Canyon Exhaust

  The main stack at B Plant exhausts filtered air from the B Plant canyon, the process vessel ventilation system number 1, and the 212-B and 224-B Buildings. The sampling and monitoring system consists of a record sampler, a backup record sampler, and a beta-gamma CAM.

- 296-B-5 221-BB Building (Process Condensate Retention) Exhaust

  This stack exhausts filtered air from 221-BB Building, which houses the BCP and BCS receiver tanks. The sampling and monitoring system consists of a record sampler that was upgraded in 1983 and a beta-gamma CAM.

- 296-B-10 225-B Building (WESF) Exhaust

  This stack exhausts filtered air from the 225-B Building (WESF). The sampling and monitoring system consists of a record sampler and a beta-gamma CAM.

- 296-B-13 221-BF Building (Process Condensate Retention Ventilation)

  This stack exhausts filtered air from the 221-BF Condensate Effluent Discharge Facility. The sampling and monitoring system was upgraded in 1984 and consists of a record sampler and a beta CAM.

- 296-B-14 B Plant Vessel Vent No. 2 Exhaust

  This stack exhausts filtered air from the 221-B Building and the vessel ventilation system number 2. The sampling system is composed of a record sampler.

Liquid Effluents

- BCS — B Plant Steam Condensate to 216-B-55 Crib

  The source of this waste stream is B Plant steam condensate from E-23-3, the number 1 and 2 vessel ventilation heaters, and water from tank coils discharging to the 114 header. Samples are collected each shift (three times daily). The stream has beta and gamma monitors.

- BCP — B Plant Process Condensate to 216-B-62 Crib

  The source of this waste stream is B Plant process condensate from the E-23-3 concentrator. Batch samples are withdrawn from collection tanks before each discharge. The discharge is monitored with beta and gamma monitors.

- BCE — B Plant Chemical Sewer to 216-B-63 Ditch

  The B Plant chemical sewer waste stream is fed by load-out drains (212-B); storage building drains (224-B); organic makeup drains (276-B); chemical storage tank drains; tank car load-out drains; chemical sewer and fan cooling water (225-B); AMU chemical drains (271-B); and floor, header, and overflow drains in pipe, electrical, and operating galleries (221-B). Weekly samples are collected from a flow-controlled incremental sampler. The stream has an in-line beta monitor, a gamma monitor (RE chamber) in the electrical gallery, and a pH monitor. The beta and pH monitors are undergoing operational testing.

- CBC — B Plant Cooling Water to 216-B-3 Ponds

  This stream collects cooling water waste from 221-B and 225-B Buildings. Two pipelines (CNP and CSP) combine to form the CBC, which discharges to the 207-B metering basins. Grab samples are collected near the inlet pipe to the basins prior to discharge of the basins. The two parent streams (CNP and CSP) are monitored with gamma (only) monitors.

## C PLANT--SEMIWORKS

### Description

The Semiworks is presently shut down, but contains residual radioactivity from prior operations. The facility was used as a pilot plant for the reduction-oxidation (REDOX) and PUREX processes. The plant was also used as a separations plant and a pilot plant for the B Plant fractionization process. Decontamination and decommissioning of this facility began in spring 1984 and is ongoing.

### Airborne Effluents

- 291-C-1 Semiworks Process and Cells Exhaust

  This stack exhausts filtered air from the process cells and vessels in the 201-C Building. The sampling and monitoring system consists of a record sampler and a beta-gamma CAM.

### Liquid Effluents

None.

## AR VAULTS (OR CR VAULTS)

### Description

The AR or CR vaults are retention and treatment facilities for high-level liquid wastes. Waste is transferred to and from PUREX, B Plant, and Tank Farms. The AR Vault is being upgraded to receive NCAW from PUREX prior to transfer to B Plant.

### Airborne Effluents

- 296-A-12 AR Vault Vessel Vent

  This stack exhausts filtered air from the 244-AR Vault vessel vent system. The sampling and monitoring system consists of an upgraded generic record sampler and beta-gamma CAM.

- 296-A-13 AR Vault Canyon and Cell Exhaust

  This stack exhausts filtered air from the 244-AR Vault canyon and cells. A modified stack-sampling and monitoring system consisting of a record sampler and a beta-gamma CAM is in operation.

- 296-C-5 CR Vault Cell and Vessel Ventilation

  This stack exhausts filtered air from the 244-CR Vault cell and process ventilation. The sampling and monitoring system consists of an upgraded generic record sampler and a beta-gamma CAM.

Liquid Effluents

- CAR AR Vault Cooling Water to 216-B-3 Ponds

  The source of this stream is the cooling water and/or steam condensate from process and vessel vent system condensates, seal loop water, and other miscellaneous sources. Daily samples are collected from a continuous, flow-proportional sampler. Loss-of-function alarms and gamma monitors are provided.

## 200 EAST AREA TANK FARMS (EXCLUDING EVAPORATOR)

Description

High-level wastes such as liquid sludges or saltcake are stored, solidified, and otherwise treated in tank farms. Decladding waste from PUREX is received in 214-AW Tank Farm prior to evaporation and fission product waste from PUREX is aged in the 241-AY and -AZ boiling waste tanks prior to evaporation.

Airborne Effluents

- 296-A-17 241-AY and -AZ Tank Exhaust

  This stack exhausts filtered, noncondensable vapors from waste storage tanks in 241-AY and -AZ Tank Farms. The sampling and monitoring system consists of a record sampler, two silver zeolite cartridge samplers for volatile radionuclides, and a beta-gamma CAM. A portable $^{14}C$-$^{3}H$ sampler is presently being upgraded for use.

- 296-A-18 <u>101-AY Tank Annulus Exhaust</u>

  This stack exhausts filtered air from the 241-AY-101 tank annulus. The sampling system consists of an upgraded record sampler.

- 296-A-19 <u>102-AY Tank Annulus Exhaust</u>

  This stack exhausts filtered air from the 241-AY-102 tank annulus. The sampling system consists of an upgraded record sampler.

- 296-A-20 <u>241-AZ Tank Annuli Exhaust</u>

  This stack exhausts filtered air from 241-AZ-101 and -102 tank annuli. The sampling system consists of an upgraded record sampler.

- 296-A-25 <u>244-A Lift Station Catch Tank</u>

  This stack exhausts filtered air from the catch tank at the 244-A lift station. The sampling and monitoring system was upgraded in 1986 and consists of a generic record sampler and beta-gamma CAM.

- 296-A-26 <u>204-AR Waste Unloading Facility</u>

  This stack exhausts filtered air from the waste unloading room and sump tank in 204-AR. The sampling and monitoring system consists of an upgraded generic record sampler and beta-gamma CAM.

- 296-A-27 <u>241-AW Tank Exhaust</u>

  This stack exhausts filtered air from all 241-AW waste storage tanks. The sampling and monitoring system consists of an upgraded generic record sampler, two silver zeolite cartridge samplers for volatile radionuclides, and a beta-gamma CAM.

- 296-A-28 <u>241-AW Tank Farm Annuli Exhaust</u>

  This stack exhausts filtered air from all 241-AW tank annuli. The sampling and monitoring system consists of an upgraded generic record sampler and a beta-gamma CAM.

- 296-A-29 <u>241-AN Tank Exhaust</u>

  This stack exhausts filtered air from all AN tank exhausts. The sampling and monitoring system consists of a modified record sampler and a beta-gamma CAM.

- 296-A-30 <u>241-AN Tank Farm Annuli Exhaust</u>

  This stack exhausts filtered air from all -AN annuli exhausts. The sampling and monitoring system consists of a modified record sampler and a beta-gamma CAM.

- 296-B-28 <u>244-BX Salt Well Receiver</u>

  This stack exhausts filtered air from the 244-BX tanks and annulus. The sampling and monitoring system consists of a record sampler, and two beta-gamma CAMs, one for the tank exhaust and one for the annulus exhaust.

- 296-P-16* <u>241-C-105 and -106 Tanks Exhaust</u>

  This stack exhausts filtered air from the 241-C-104, -105 and -106 tanks. The sampling and monitoring system consists of an upgraded generic record sampler and a beta-gamma CAM.

- 296-P-17 <u>241-A-105 Tank Exhaust</u>

  This portable exhauster exhausts filtered air from the 241-A-105 tank. The sampler and monitoring system has an upgraded generic record sampler and a beta-gamma CAM.

<u>Liquid Effluents</u>

- A8 <u>AY, AZ Tank Farm Steam Coil Condensate to A8 Crib</u>

  Steam coil condensate from the 241-AY, -AZ Tank Farms make up this intermittent waste stream. Weekly samples are collected from a continuous, flow-proportional sampler during stream operation. The stream is monitored by a gamma monitor. Automatic diversion capabilities are provided. This stream was not used in 1986.

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*"P" denotes a portable exhauster.

- CA8 — 241-A Tank Farm Surface Condenser Cooling Water to 216-B-3 Pond

  Cooling water from the surface condensers for 241-AY and -AZ Tank Farms is collected in this waste stream. Weekly samples are collected from a continuous, flow-proportional sampler. The stream is monitored by a gamma monitor.

## 200 EAST AREA EVAPORATOR

### Description

The evaporator is used to remove most of the water from nonboiling, high-level liquid waste. This process results in a slurry that is pumped back to the storage tanks to form a semisolid material known as saltcake, which is stored in the Tank Farms.

### Airborne Effluents

- 296-A-21 — 242-A Evaporator Exhaust

  This stack exhausts filtered air from the 242-A Evaporator-Crystallizer Building. The sampling and monitoring system consists of an upgraded generic record sampler and alpha and beta-gamma CAMs.

- 296-A-22 — 242-A Evaporator Exhaust

  This stack exhausts filtered air from the 242-A evaporator-crystallizer vessel vent system. The sampling and monitoring system consists of an upgraded generic record sampler, two silver zeolite cartidge samplers for volatile radionuclides, and alpha and beta-gamma CAMs.

### Liquid Effluents

These discharges are present only when the evaporator is operational.

- ACW — 242-A Cooling Water to 216-B-3 Pond

  This waste stream consists of cooling water from the primary, intermediate, and after condensers, E-C-1, -2, and -3. Daily samples are collected from an incremental, flow-proportional sampler. The stream is monitored by a gamma monitor.

- ASC — 242-A Steam Condensate to 216-B-3 Pond

  Steam condensate from the E-A-1 reboiler makes up this waste stream. Samples are collected from a continuous, flow-proportional sampler each time a retention basin fills (approximately daily). The stream is monitored by a gamma monitor. Automatic diversion capabilities are provided.

- AFPC — 242-A After Filter Process Condensate to 216-A-37 Crib

  This stream collects condensables from the E-C-1 and -3 condensers and the vessel vent seal pot. The stream passes through a filter and an ion exchange column before discharge to a retention basin. Samples are collected from a continuous, flow-proportional sampler each time a retention basin fills. The stream is monitored by a gamma monitor. Automatic and manual diversion capabilities are provided.

## 200 WEST AREA FACILITIES

### S PLANT--REDUCTION-OXIDATION (202-S)

#### Description

The REDOX Plant was operated as a fuel reprocessing facility until 1967, when it was shut down. The building is now a retired facility and scheduled for decontamination in the 1990s.

#### Airborne Effluents

- 291-S-1 — REDOX Process and Canyon Exhaust

  The REDOX main stack exhausts filtered air from the REDOX canyon and vessel ventilation and treated dissolver offgas system. The sampling and monitoring system was upgraded in 1986 and consists of a record sampler and a beta-gamma CAM.

- 296-S-2 <u>REDOX North Sample Gallery, Hoods Ventilation, and PR Cage</u>

  This stack exhausts filtered air from REDOX north and south sample galleries and hoods. The sampling system consists of a record sampler.

- 296-S-4 <u>REDOX Decontamination Room, Regulated Shop, Regulated Tool Room, Low-Level Decontamination Sink, and Special Work Permit Lobby Ventilation</u>

  This stack exhausts filtered air from the REDOX decontamination room and regulated shop. Also, unfiltered air from the regulated tool room, low-level decontamination sink, and Special Work Permit (SWP) lobby is exhausted through this stack. The sampling and monitoring system was upgraded in 1986 and consists of a record sampler and beta-gamma CAM.

- 296-S-6 <u>REDOX Silo Ventilation</u>

  This stack exhausts air from REDOX, the silo gallery, an organic feed tank, and a sample elevator. The sampling and monitoring system was upgraded in 1986 and consists of a record sampler and beta-gamma CAM.

- 296-S-7 E, W <u>REDOX Product Building (233-S) Ventilation, Dual Stacks</u>

  These stacks exhaust filtered air from the 233-S Building, the REDOX plutonium processing greenhouse, and process vessel ventilation and load-out area. Both stacks have identical sampling systems, which consist of a record sampler and a shared alpha CAM. Stack 296-S-7E did not operate in 1986.

<u>Liquid Effluents</u>

- S-10 <u>REDOX Chemical Sewer to the 216-S-10 Ditch</u>

  Compressor cooling water from REDOX and raw water overflow from the water tower are the major contributors to this waste stream. Weekly grab samples are collected from the 216-S-10 ditch outlet.

## T PLANT--DECONTAMINATION, STORAGE, AND ASSOCIATED FACILITIES

### Description

The T Plant is one of the original fuel reprocessing facilities. The last fuel was reprocessed there in 1956. The 221-T Building is now used for decontaminating and repairing equipment. The 224-T Building is used for storage and assay of drums of plutonium-contaminated waste.

### Airborne Effluents

- 291-T-1 T Plant Canyon Exhaust (Main)

  This stack exhausts filtered air from 221-T canyon and process ventilation. A new bank of high-efficiency particulate air (HEPA) filters was installed in 1983, and a new isokinetic probe and sampling system were installed in 1984. The sampling and monitoring system consists of a record sampler and beta-gamma and alpha CAMs.

- 296-T-11 224-T Building Exhaust, East Stack

  This stack exhausts filtered air from the 224-T Building ventilation through the east part of the plenum. The sampling system consists of a record sampler.

- 296-T-12 224-T Building Exhaust, West Stack

  This stack exhausts filtered air from the 224-T Building ventilation through the west part of the plenum. The sampling system consists of a record sampler.

- 296-T-13 T Plant Canyon Exhaust (Roof)

  This stack exhausts filtered air from the 221-T Building and canyon ventilation. The sampling and monitoring system consists of an upgraded record sampler and a beta-gamma CAM.

### Liquid Effluents

None.

## U PLANT--URANIUM RECOVERY AND $UO_3$ PLANT

### Description

The U Plant was originally constructed as a fuel reprocessing plant but was never used for that purpose. The plant was used to recover uranium from bismuth-phosphate waste and high-level waste from Tank Farms. The U Plant is shut down and is considered a retired facility. However, it does house some offices and shops. The plant includes the adjacent $UO_3$ facility that produces uranium trioxide from PUREX solutions. The $UO_3$ Building was shut down in 1972 but has been refurbished to process UNH from PUREX. The $UO_3$ Plant restarted in March 1984.

### Airborne Effluents

- 291-U-1 U Plant Canyon Exhaust

  This stack exhausts filtered air from U Plant and 221-U canyon ventilation. The sampling and monitoring system was upgraded in 1986 and consists of a record sampler and a beta-gamma CAM.

- 296-U-2 $UO_3$ Powder-Handling Exhaust

  This stack exhausts filtered air from the powder-handling system in the 224-UA Building. The sampling system consists of a record sampler.

- 296-U-4 $UO_3$ Calciner Exhaust

  This stack exhausts unfiltered exhaust from the process offgas system (vessel vent, concentrator, and calciner) on the 224-U Building. The sampling and monitoring system consists of a record sampler and $NO_x$ monitor.

- 296-U-13 $UO_3$ Powder Load-out Hood Exhaust

  This is a new exhaust system, stack, and sampling system. It was installed prior to restart of the facility. The system exhausts filtered air from the powder load-out hood. The sampling and monitoring system consists of a record sampler and alpha and beta CAMs.

Liquid Effluents

- U-12 — UO, Plant Process Condensate to the U-12 Crib

  The stream is composed of condensate from concentrators, calciners, vessel vents, and steam jet exhaust. Process condensates are collected in tank C-5 and sampled prior to discharge. An automatic, incremental time-proportional sampler is activated when Tank C-5 is discharged.

- 207-U — UO, Plant Waste Water to the 216-U-14 Ditch

  Receives cooling water, steam condensate, and chemical sewer discharge from UO,, and sump water from 221-U, 271-U, and 222-U. Discharge is to the 216-U-14 ditch via the 207-U retention basin. Grab samples from the basin were collected weekly.

## PLUTONIUM FINISHING PLANT--PLUTONIUM EXTRACTION, RECOVERY, AND FABRICATION

Description

The Plutonium Finishing Plant (PFP) recovered plutonium in the form of plutonium nitrate by processing plutonium scrap. In addition, plutonium metal was produced from the recovered nitrate and plutonium nitrate that was received from PUREX.

Airborne Effluents

- 291-Z-1 — PFP Process and Building Ventilation

  This stack exhausts filtered air from the 234-5Z, 232-Z, 236-Z, and 242-Z Buildings, and process ventilation. The sampling and monitoring system consists of a record sampler and an alpha CAM.

- 296-Z-3 — 241-Z Vault Ventilation

  This stack exhausts filtered air from 241-Z vault sump and vessel ventilation. The sampling and monitoring system consists of a record sampler and an alpha CAM.

- 296-Z-5 — 2736-ZB Building Exhaust

  The system exhausts filtered air from the shipping and receiving building, 2736-ZB. The sampling and

monitoring system consists of a record sampler and an alpha CAM.

- 296-Z-6 Plutonium Storage Vault Exhaust

  This stack exhausts filtered air from the 2736-ZA Building and the plutonium storage vault ventilation system. The sampling and monitoring system consists of a record sampler and two alpha CAMs, one located on each duct that feeds into this stack.

- 296-Z-10 231-Z Building Ventilation

  This stack exhausts filtered air from the 231-Z Building. The sampling and monitoring system system consists of a record sampler and an alpha CAM.

- 296-Z-11 231-Z Building Change Room

  This stack exhausts filtered air from the 231-Z Building change room. The sampling and monitoring system system consists of a record sampler and an alpha CAM.

Liquid Effluents

- 2904-ZA PFP Liquid Waste to 216-Z-20 Crib

  The cooling water waste stream receives the following effluents: ventilation system drainage and cold chemical and floor drains from 232-Z; roof and cold chemical drains, D-1 drains (cooling water, safety showers), D-2 drains (cooling water, floor drains, ventilation condensates), and D-3 drains from 234-5Z; cold chemical drains, cooling water, steam condensate, and D-1 and D-3 waste from 236-Z; and seal and cooling water from 291-Z. Shift samples are collected from an incremental, flow-proportional sampler. In-line alpha and pH monitors are present.

- 231-Z 231-Z Building Waste to 216-Z-20 Crib

  Process and sanitary water from the 231-Z Building make up this stream. Weekly samples can be collected from a proportional sampler. This stream is nonradioactive and is mixed with the 2904-ZA stream before discharge to the 216-Z-20 crib.

## 200 WEST AREA TANK FARMS (EXCLUDING EVAPORATORS)

### Description

High-level waste in liquid, sludge, or saltcake form is stored, solidified, or otherwise treated in tank farms.

### Airborne Effluents

- 296-P-22 241-SY Tank Farm Annuli Exhaust

  This stack exhausts filtered air from the 241-SY-101, -102, and -103 tank annuli. The sampling and monitoring system consists of a record sampler and a beta-gamma CAM.

- 296-P-23 241-SY Tank Farm Vent

  This stack exhausts filtered air from the 241-SY-101, -102, and -103 tanks. The sampling and monitoring system consists of a combination record sampler and beta-gamma CAM.

- 296-S-15 241-SX Sludge Cooling Exhaust

  This stack exhausts filtered air from tanks 241-SX-107 through -112 and -114. The sampling and monitoring system consists of an upgraded generic record sampler and a beta-gamma CAM.

- 296-S-22 244-S Salt Well Receiver Tank and Annulus Exhaust

  This stack exhausts filtered air from the 244-S tank and annulus. This sampling and monitoring system consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

- 296-T-18 244-TX Salt Well Receiver Tank and Annulus Exhaust

  This stack exhausts filtered air from the 244-TX tank and annulus. The sampling and monitoring system system consists of a record sampler, an alpha CAM, and two beta-gamma CAMs for the tank and the annulus.

### Liquid Effluents

None.

## 200 WEST AREA EVAPORATORS

### Description

These evaporators were used to remove most of the water from nonboiling high-level liquid waste. This process left a semisolid material known as saltcake, which was stored in tank farms. The 242-T evaporator is now shut down. The 242-S evaporator is on standby and may be restarted to process waste from the 241-SY Tank Farm.

### Airborne Effluents

- 296-S-18 242-S Evaporator Exhaust

  This stack exhausts filtered air from the 242-S evaporator-crystallizer building. The sampling and monitoring system consists of an upgraded record sampler, an alpha CAM, and a beta-gamma CAM.

- 296-S-19 242-S Evaporator Exhaust

  This stack exhausts filtered air from the 242-S evaporator-crystallizer cell and vessel ventilation. The sampling and monitoring system includes an upgraded record sampler, an alpha CAM, and a beta-gamma CAM. This exhaust system was not used in 1986.

- 296-T-17 242-T Evaporator Exhaust

  This stack exhausts filtered air from the 242-T evaporator-crystallizer and cold cell ventilation. The sampling and monitoring system includes an upgraded generic record sampler, an alpha CAM, and a beta-gamma CAM.

### Liquid Effluents

The 242-S evaporator did not operate in 1986 as an evaporator. Only the RC1 liquid effluent stream was active in 1986.

- RC1 242-S Steam Condensate to 216-U-10 Pond

  During operation, steam condensate from the E-A-1 reboiler comprises this stream. In 1986, the RC1 stream consisted only of pump cooling water and raw water. Daily samples are collected from an upgraded continuous, flow-proportional sampler. A gamma monitor is provided. Automatic diversion capabilities are in place.

- RC2 — 242-S Cooling Water to 216-U-10 Pond

  During operation, cooling water from the primary, intermediate, and after condensers, E-C-1, -2, and -3, comprises this stream.

- RC3 — 242-S Process Condensate to 216-S-25 Crib

  During operation, this stream is composed of condensates from E-C-1, -2, and -3 condensers and the vessel vent seal pot water that pass through a filter and an ion exchange column. The RC3 was last used in 1985 to process groundwater from the U1 and U2 cribs. The water was passed through the 242-S ion exchange column prior to discharge.

## LAUNDRY--PROTECTIVE EQUIPMENT AND DECONTAMINATION FACILITY

### Description

This facility launders contaminated protective clothing and equipment for Hanford contractors.

### Airborne Effluents

- 296-W-1 — 2724-W Dryer/Rotoclone Exhaust

  This stack exhausts unfiltered air from clothes dryers and the washroom. The effluent is scrubbed with a water wash prior to exhaust from the Protective Equipment Decontamination Facility (2724-W Laundry). A record sampler samples the effluent from this stack.

### Liquid Effluents

- LWC — 2724-W Laundry Waste Water to 216-W-LWC Crib

  This stream is made up of waste waters from the laundering of contaminated clothing and equipment. A hydrosieve filters the larger particulates prior to discharge to the crib. Weekly samples are taken from an incremental time-proportional sampler.

## LABORATORIES--222-S BUILDING

### Description

The 222-S facility provides analytical support for Rockwell Hanford Operations. Support includes analyses of environmental and effluent samples, research and development, and control of waste management processes.

### Airborne Effluents

- 296-S-16 222-S Laboratory Waste Vault Ventilation

  This stack exhausts filtered air from the 219-S Building vault and waste tanks. The sampling system was upgraded in 1984 and includes a new isokinetic probe and record sampler.

- 296-S-21 222-S Laboratory Ventilation

  This stack exhausts filtered air from the 222-S laboratory hoods, gloveboxes, hot cells, and the room ventilation system. The sampling and monitoring system includes a record sampler, an alpha CAM, and a beta-gamma CAM.

### Liquid Effluents

- 207-SL 207-SL Discharge to 216-S-26 Crib

  The liquid waste being deposited in the 207-SL retention basin is made up of vacuum pump cooling water, cooling fan condenser water, and sink and nonradioactive hood drainage. Flow-proportional samples are collected from each half of the basin during each shift.

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# APPENDIX B

## RADIOACTIVE AIRBORNE DISCHARGE DATA FOR 1986

Airborne effluent points (stacks) are identified by height, facility, and specific stack within the facility (e.g., 291-A-1, etc.). A coded system is used for simplicity: a 291- prefix denotes a 61-m (200-ft) stack and a 296- prefix denotes a shorter height for all other stacks. The second term identifies the facility or complex the stack is associated with:

- A - Plutonium-Uranium Extraction (PUREX) Facility and PUREX support facilities
- B - B Plant
- C - Semiworks and CR Vault
- P - Portable exhausters, predominately associated with Tank Farms
- S - REDOX, Analytical Laboratory, S Tank Farms
- T - T Plant
- U - U Plant and $UO_3$
- W - Laundry
- Z - Z Plant.

The third term identifies the specific stack within the facility or complex.

Stack samplers are also identified by Electronic Data Processing (EDP) code. The EDP code is used for sample identification and tracking, and data processing purposes. It should be noted that there is no implied ranking of importance assigned either to the stack number or EDP code.

The facilities from which the stacks discharge are designated as old or new for regulatory purposes. Discharges are compared to Rockwell Hanford Operations (Rockwell) administrative control values (ACV). The ACV are listed in table 1-1 of this document. The ACV for gross alpha and gross beta are the same as the ACV for $^{239}Pu$ and $^{90}Sr$, respectively, and are given below as a reference when viewing the graphs and tables.

| | Old facility | New facility |
|---|---|---|
| Gross alpha ($\mu Ci/cm^3$) | 2 E-12 | 6 E-14 |
| Gross beta ($\mu Ci/cm^3$) | 1 E-09 | 3 E-11 |

When a monthly average concentration is less than (<) the lower limit of detection (LLD), the symbol on a graph is left open. When a monthly average concentration is greater than (>) the LLD, the symbol on a graph is filled. In the tables, an annual average concentration that is below the LLD is preceded by a less than symbol.

PUREX Process and Canyon Exhaust (291-A-1)

EDP Code: A552
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| $^{3}H$ | 4 E-08 | 6 E+01 |
| $^{14}C$ | 5 E-10 | 9 E-01 |
| $^{85}Kr$[a] | 3 E-04 | 5 E+05 |
| $^{89,90}Sr$[b] | 1 E-13 | 2 E-04 |
| $^{95}Nb$ | 2 E-12 | 4 E-03 |
| $^{95}Zr$ | 1 E-12 | 2 E-03 |
| $^{103}Ru$ | 5 E-12 | 1 E-02 |
| $^{106}Ru$[b] | 2 E-10 | 3 E-01 |
| $^{113}Sn$ | 1 E-10 | 2 E-01 |
| $^{125}Sb$ | <3 E-12 | <5 E-03 |
| $^{129}I$ | 3 E-10 | 5 E-01 |
| $^{131}I$ | <1 E-10 | <2 E-01 |
| $^{137}Cs$[b] | 3 E-13 | 5 E-04 |
| $^{147}Pm$ | 7 E-12 | 1 E-02 |
| $^{220}Rn$[c] | 9 E-10 | 2 E+00 |
| $^{238}Pu$ | 3 E-15 | 5 E-06 |
| $^{239,240}Pu$ | 3 E-14 | 5 E-05 |
| $^{241}Pu$[a] | 3 E-13 | 6 E-04 |
| $^{241}Am$ | <1 E-13 | <2 E-04 |
| U (gross) | 2 E-15 | 3 E-06 |

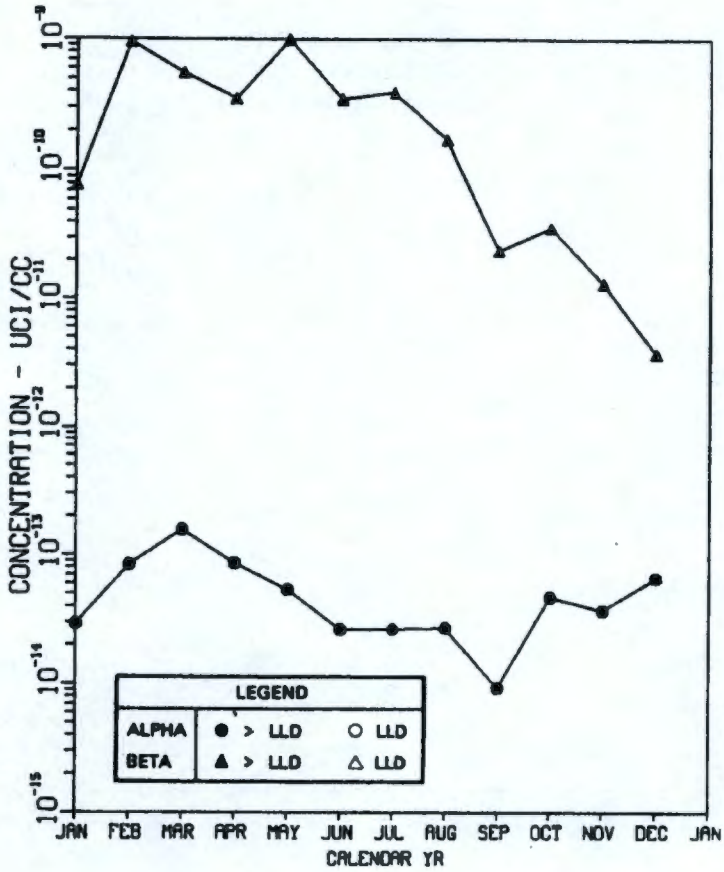
[a]Calculated from plant inventory. Not measured as an effluent.

[b]Assumes equilibrium with daughter product.

[c]Based on $^{212}Pb$ measurements. Other members of the decay chain are present in the following multiples of $^{220}Rn$: $^{216}Po$ (1.0), $^{212}Pb$ (0.1), $^{212}Bi$ (0.07), $^{212}Po$ (0.04), $^{208}Tl$ (0.02).

PUREX Process and Canyon
Exhaust (291-A-1)

EDP Code: A552
Old Facility

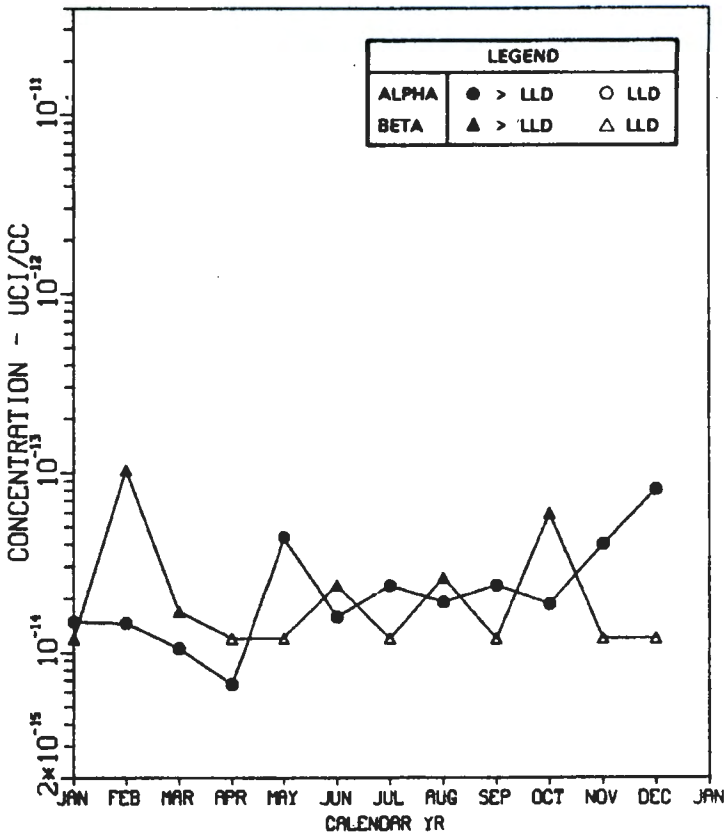



Comments: . Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV. The increase in gross beta activity at the beginning of the year was due to processing of shorter cooled fuel and problems with dissolver pressurization. Increased production rates were responsible for the increase in May. The decrease in gross beta activity during the last five months of the year coincided with the cessation of operations in August.

PUREX N Cell, Q Cell, and PR Room Exhaust (296-A-1)

EDP Code: A540
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross Beta | <3 E-14 | <2 E-06 |
| $^{239,240}Pu$ | 2 E-14 | 1 E-06 |

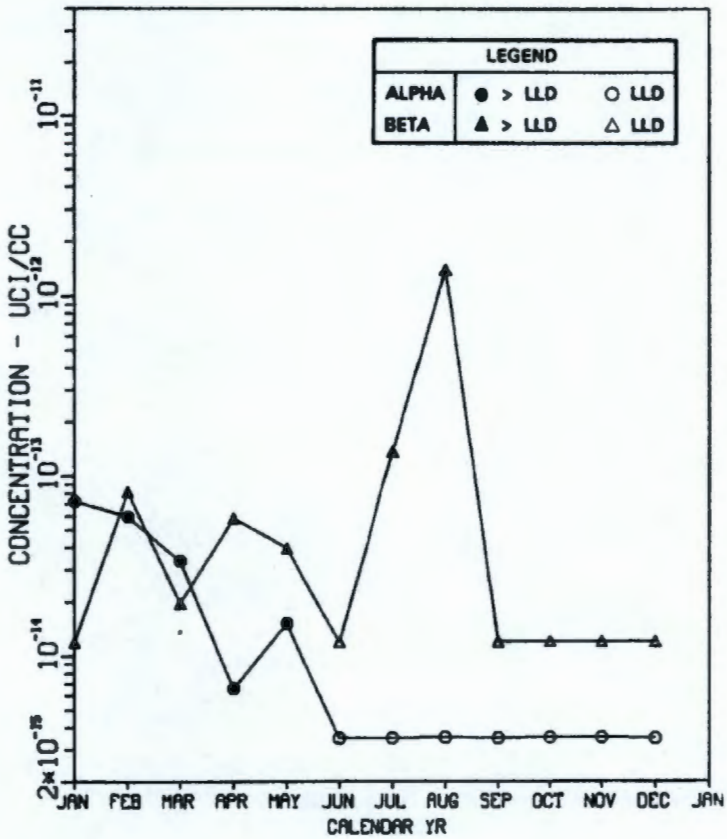



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

PUREX West Sample Gallery Hoods
Exhaust (296-A-2)

EDP Code: A542
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross beta | 2 E-13 | 9 E-06 |
| $^{239,240}Pu$ | 3 E-15 | 1 E-07 |

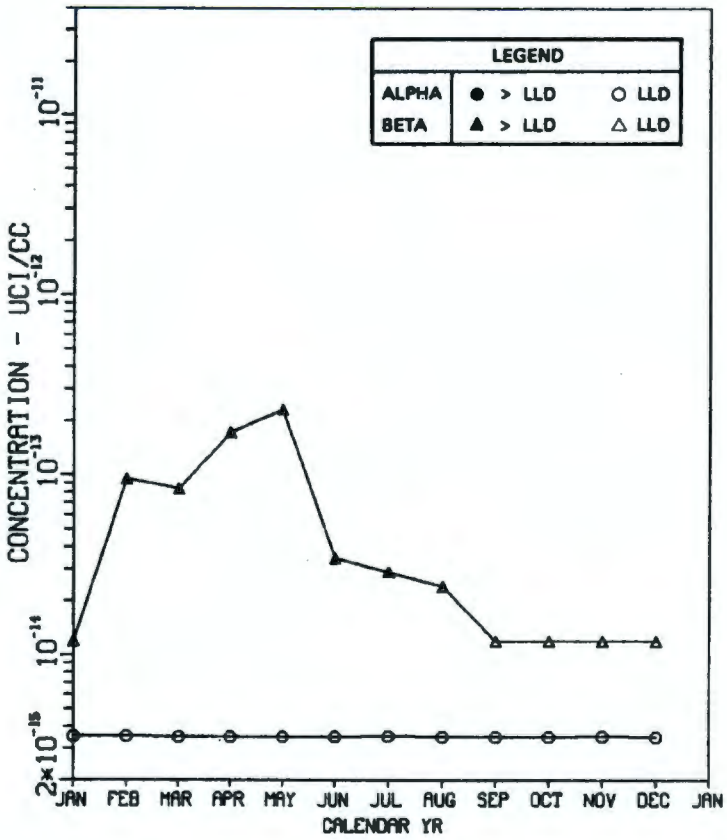



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV. The increase in gross beta activity in July and August may have been due to repair work on the 296-A-2 fan, which dislodged particles in adjacent ductwork.

PUREX East Sample Gallery Hoods
Exhaust (296-A-3)

EDP Code: A543
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-07 |
| Gross beta | 6 E-14 | 3 E-06 |

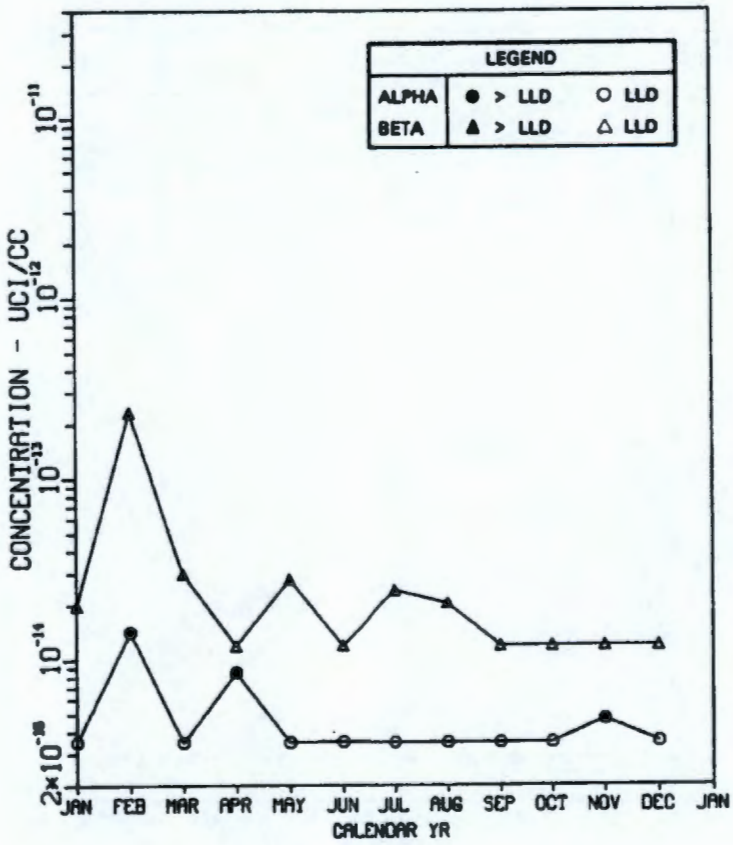



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Lab Hoods and Gloveboxes
West Exhaust (296-A-5a)

EDP Code: A545
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <7 E-07 |
| Gross beta | <4 E-14 | <6 E-06 |

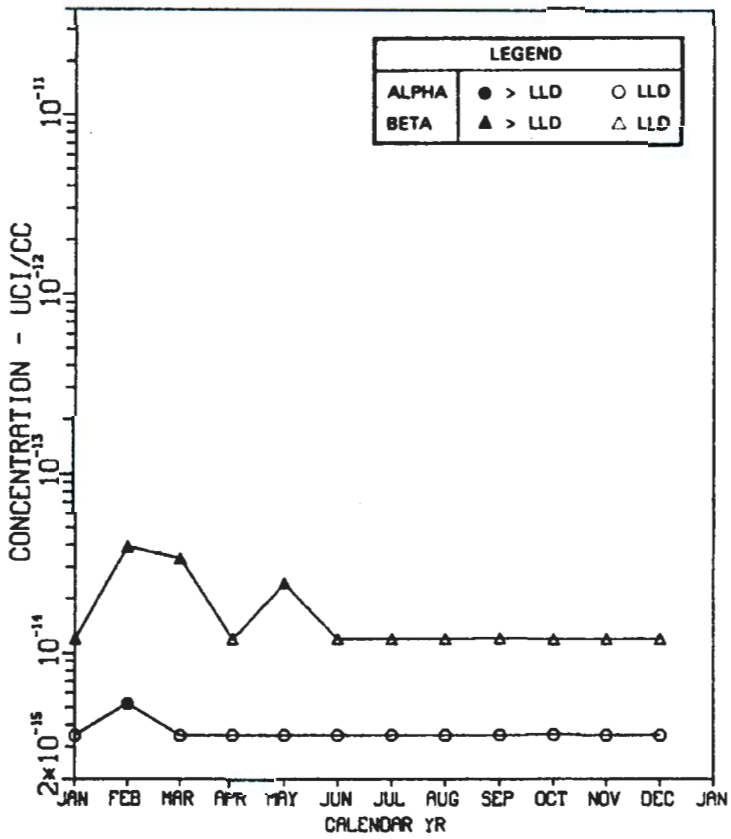



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Lab Hoods and Gloveboxes
East Exhaust (296-A-5b)

EDP Code: A546
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <5 E-07 |
| Gross beta | <2 E-14 | <3 E-06 |

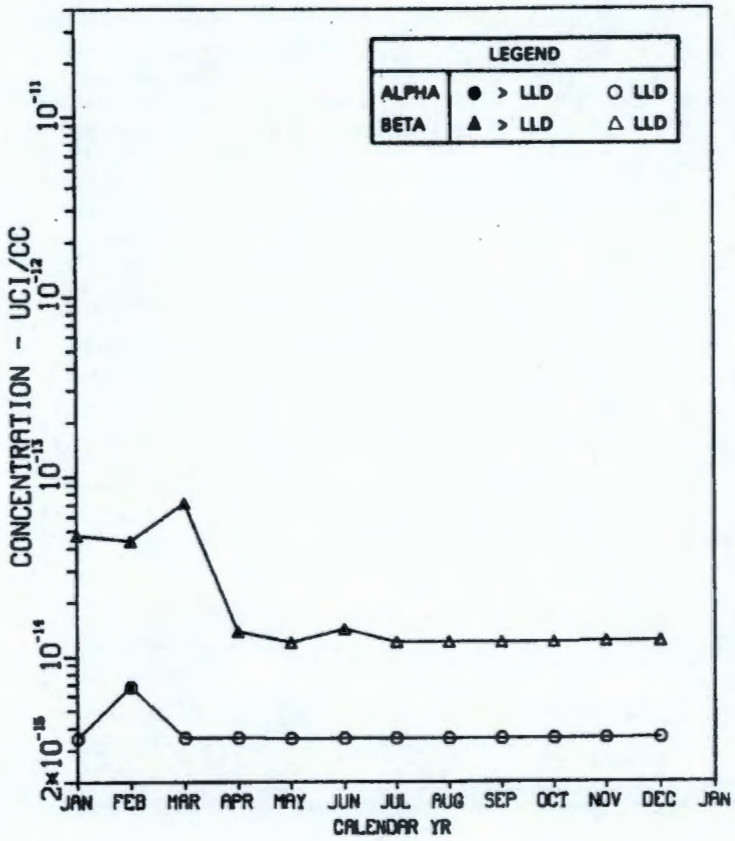



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX East Sample Gallery and
U Cell Exhaust (296-A-6)

EDP Code: A547
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <9 E-07 |
| Gross beta | <3 E-14 | <6 E-06 |

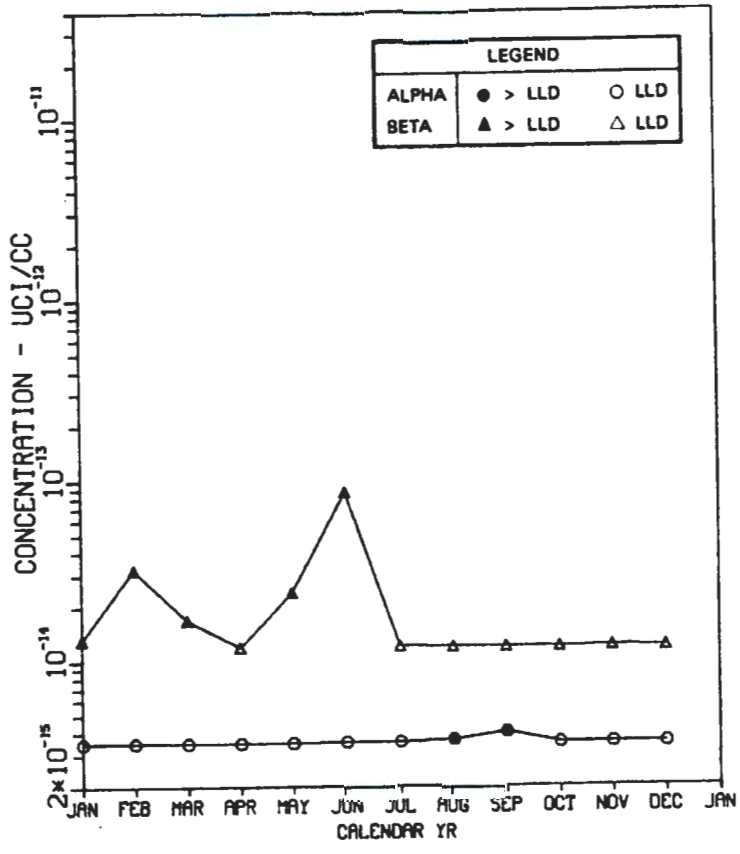



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX West Sample Gallery and
R Cell Exhaust (296-A-7)

EDP Code: A548
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <8 E-07 |
| Gross beta | <3 E-14 | <5 E-06 |

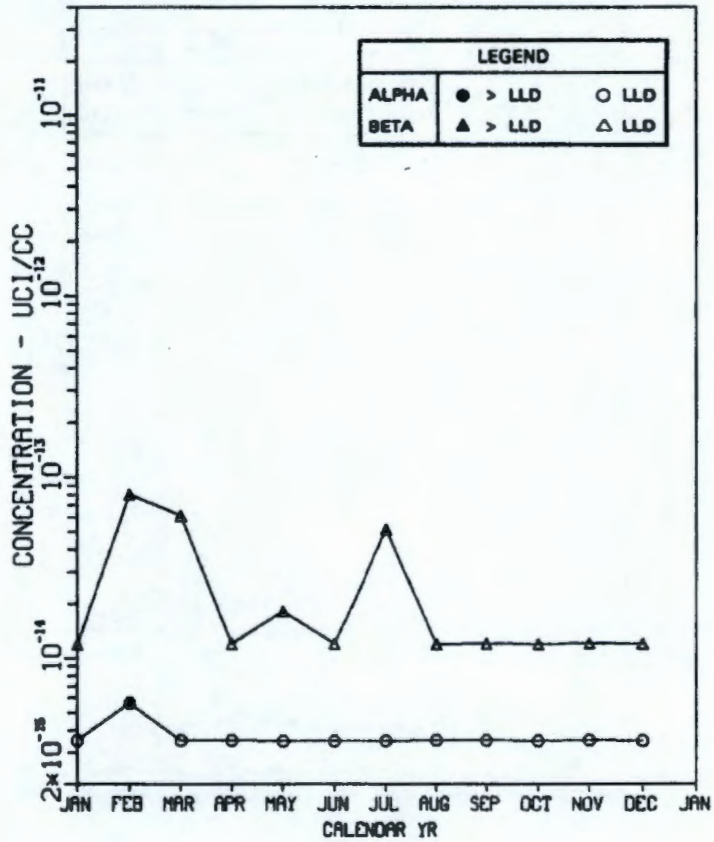



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX P&O Gallery (White Room)
Exhaust (296-A-8)

EDP Code: A549
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <8 E-07 |
| Gross beta | <3 E-14 | <6 E-06 |

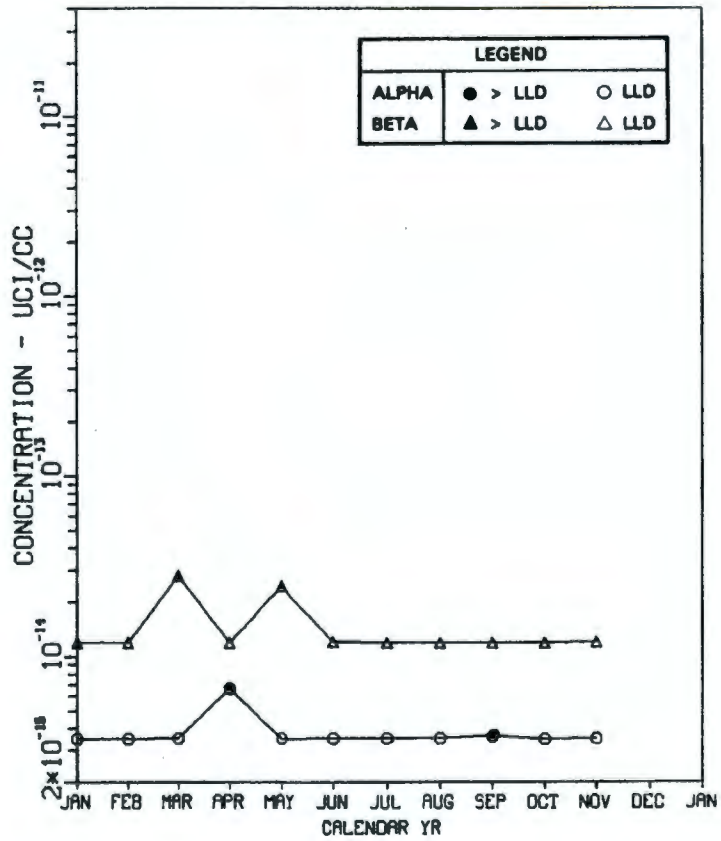



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Burial Tunnel No. 2
Exhaust (296-A-10)

EDP Code: A550
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-07 |
| Gross beta | <2 E-14 | <6 E-07 |

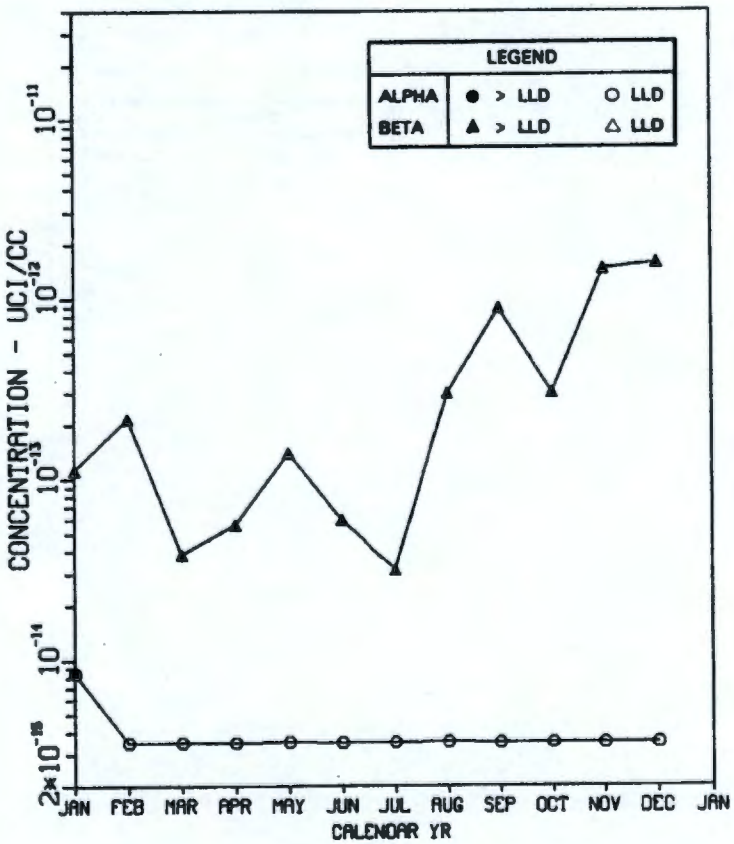



Comments: Annual average gross alpha and gross beta concentrations were below ACV. Shut down in November for repairs to electrical service.

AR Vault Vessel Vent
(296-A-12)

EDP Code: E058
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <3 E-08 |
| Gross beta | 4 E-13 | 3 E-06 |

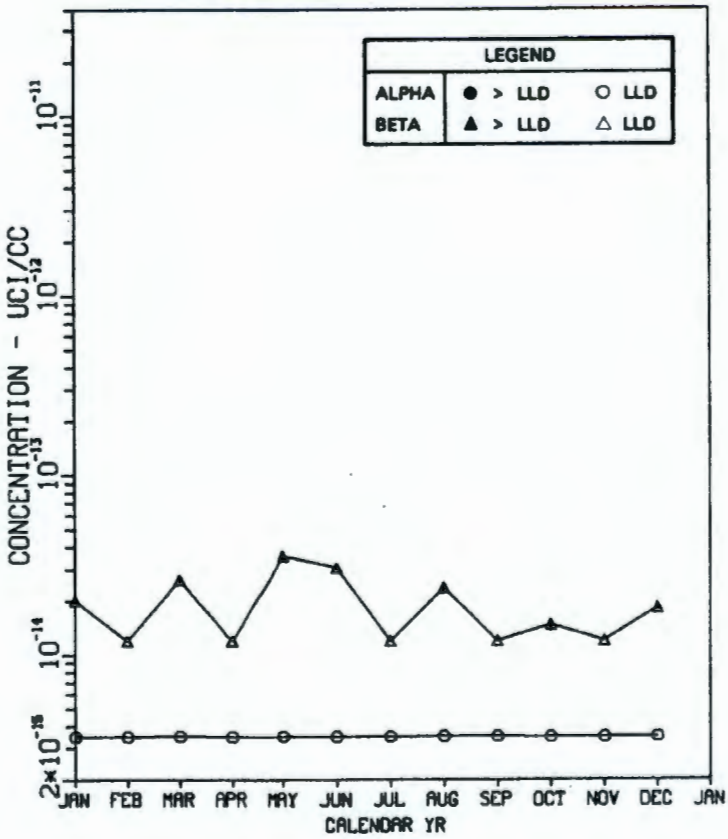



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

AR Vault Canyon and Cell
Exhaust (296-A-13)

EDP Code: E052
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <4 E-07 |
| Gross beta | <2 E-14 | <2 E-06 |

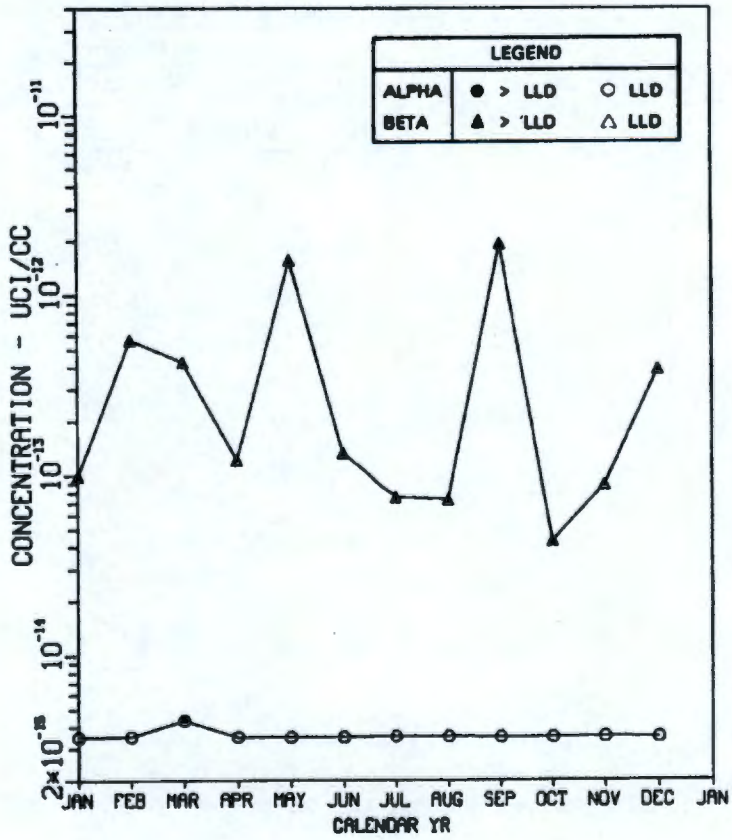



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

293-A Building (Nitric Acid Recovery) Exhaust (296-A-14)

EDP Code: A544
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-07 |
| Gross beta | 5 E-13 | 2 E-05 |

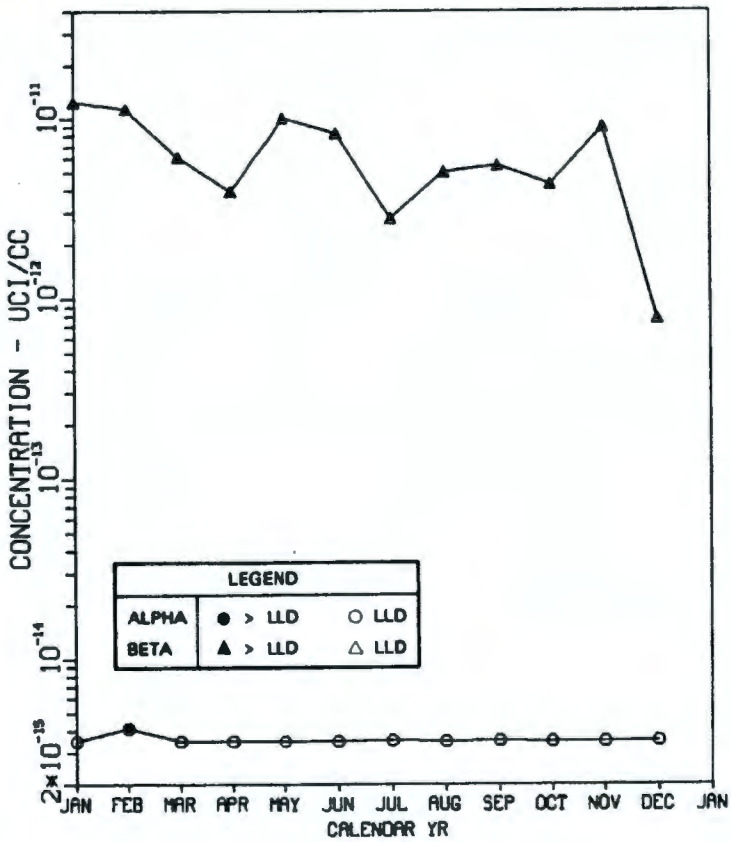



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

241-A, -AY, and -AZ Tank Exhaust (296-A-17)

EDP Code: E059
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-07 |
| $^{89,90}Sr$ | 2 E-13 | 1 E-05 |
| $^{137}Cs$ | 3 E-12 | 2 E-04 |
| $^{106}Ru$ | 3 E-12 | 2 E-04 |

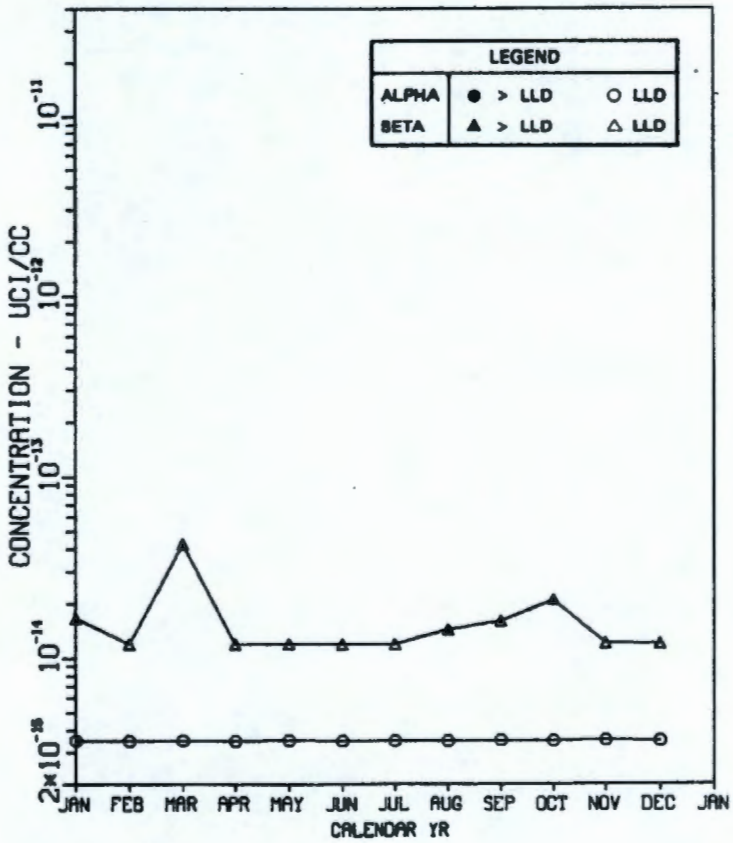



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

101-AY Tank Annuli Exhaust
(296-A-18)

EDP Code: E060
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <5 E-08 |
| Gross beta | <2 E-14 | <3 E-07 |

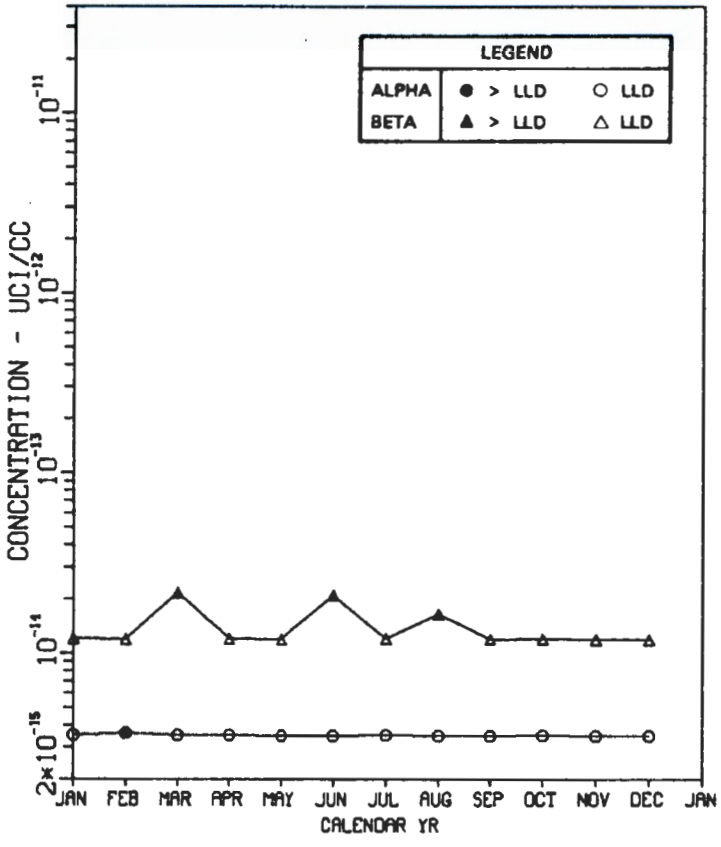



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

102-AY Tank Annuli Exhaust
(296-A-19)

EDP Code: E061
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <5 E-08 |
| Gross beta | <2 E-14 | <2 E-07 |

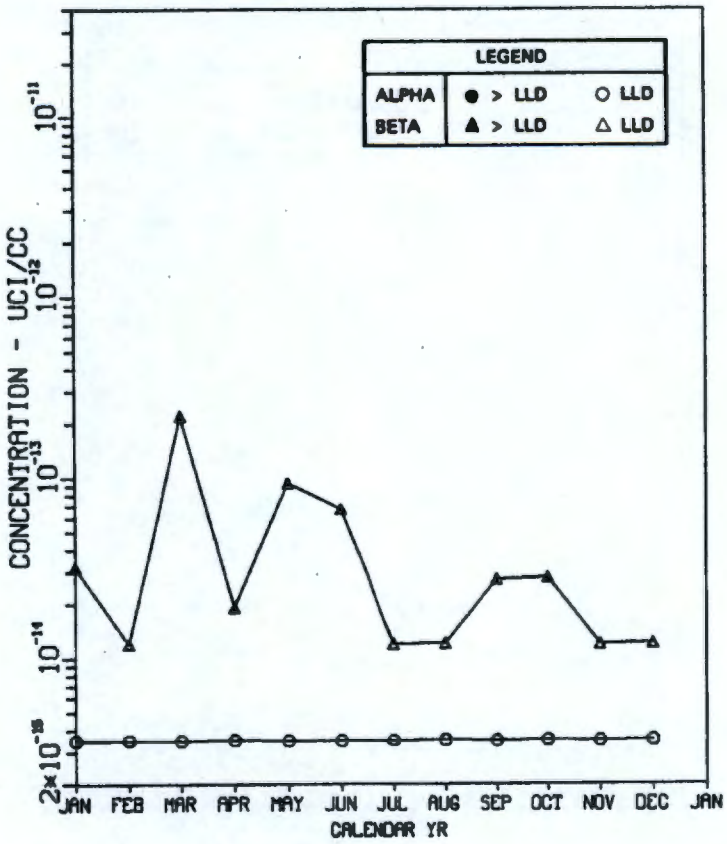



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

241-AZ Tank Annuli Exhaust
(296-A-20)

EDP Code: E197
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <7 E-08 |
| Gross beta | <5 E-14 | <1 E-06 |

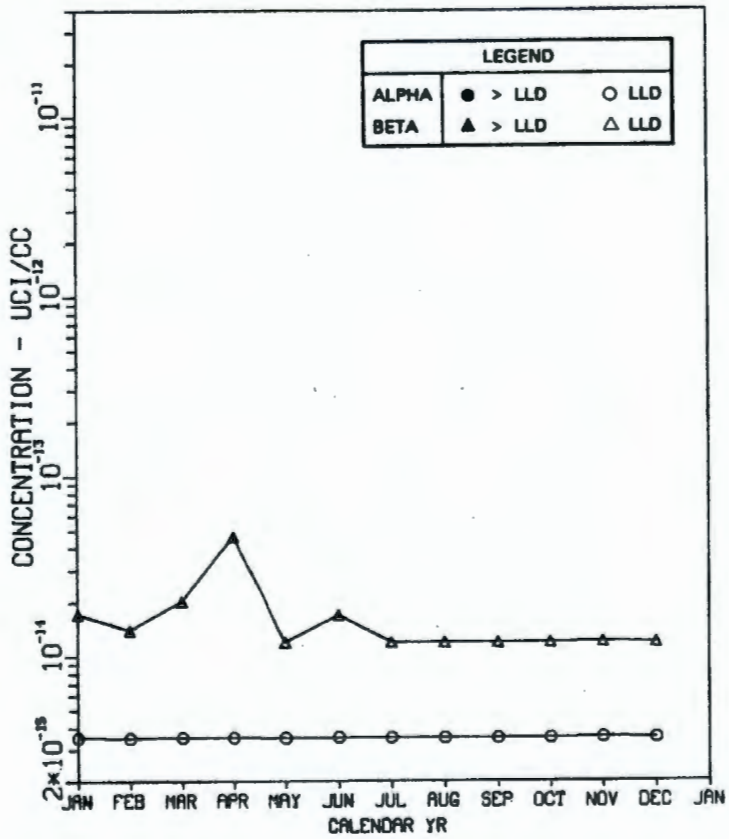



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

242-A Evaporator-Crystallizer Building
Exhaust (296-A-21)

EDP Code: E645
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <1 E-06 |
| Gross beta | <2 E-14 | <5 E-06 |

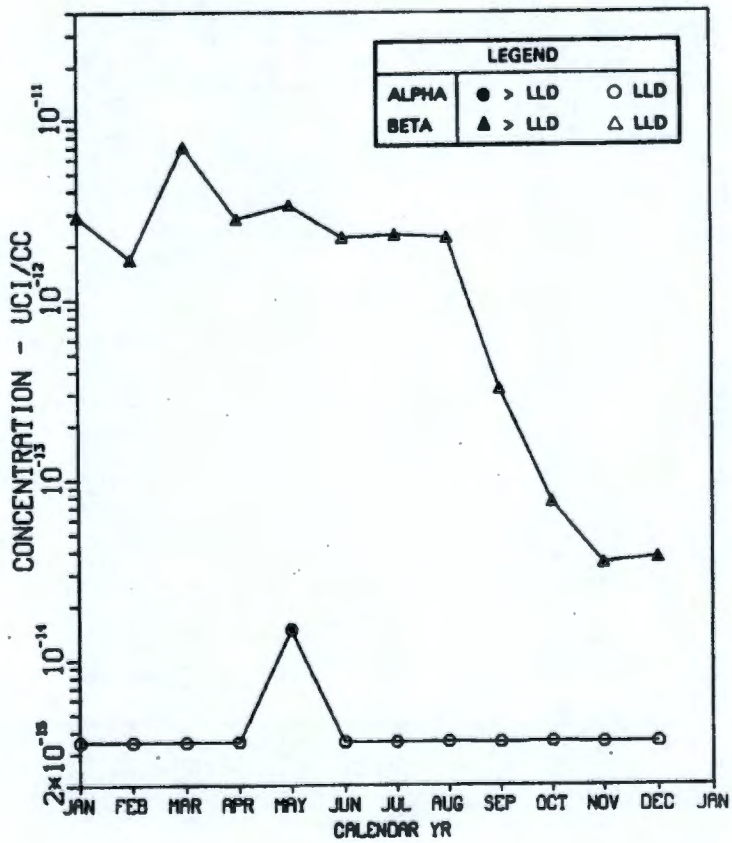



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

242-A Evaporator-Crystallizer Vessel Vent Exhaust (296-A-22)

EDP Code: E643
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <5 E-08 |
| $^{89,90}Sr$ | <2 E-15 | <2 E-08 |
| $^{137}Cs$ | <1 E-14 | <1 E-07 |
| $^{125}Sb$ | 1 E-11 | 1 E-04 |

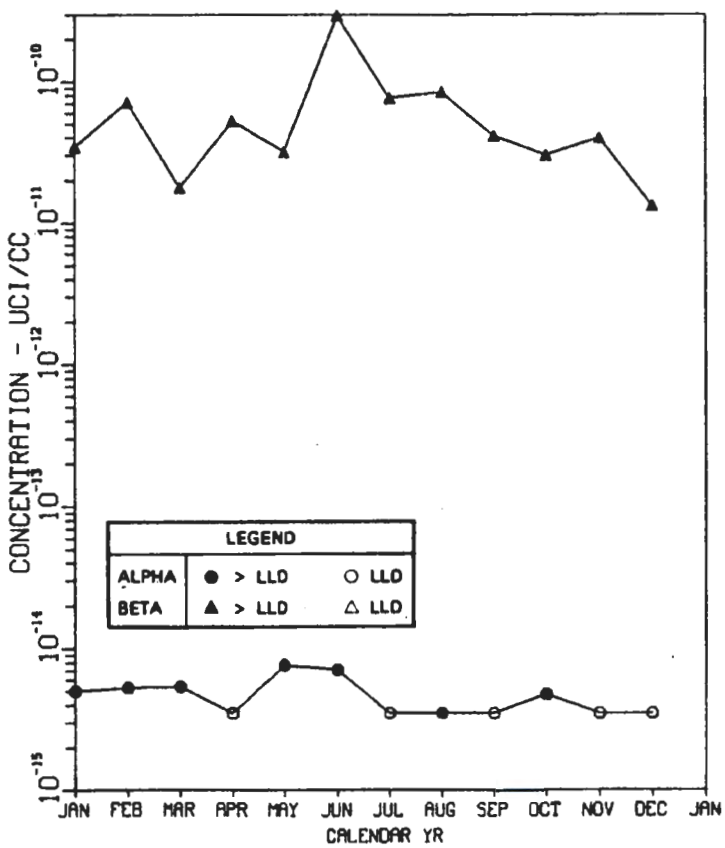



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV. The downward trend in gross beta activity in the last quarter resulted from shutdown of the 242-A Evaporator.

Ammonia Scrubber Waste Concentrator Exhaust (296-A-24)

EDP Code: A539
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <7 E-08 |
| $^{89,90}Sr$ | 1 E-14 | 2 E-07 |
| $^{103}Ru$ | 1 E-09 | 1 E-02 |
| $^{106}Ru$ | 7 E-09 | 1 E-01 |
| $^{113}Sn$ | 3 E-10 | 5 E-03 |
| $^{125}Sb$ | <2 E-10 | <3 E-03 |
| $^{137}Cs$ | <7 E-14 | <1 E-06 |

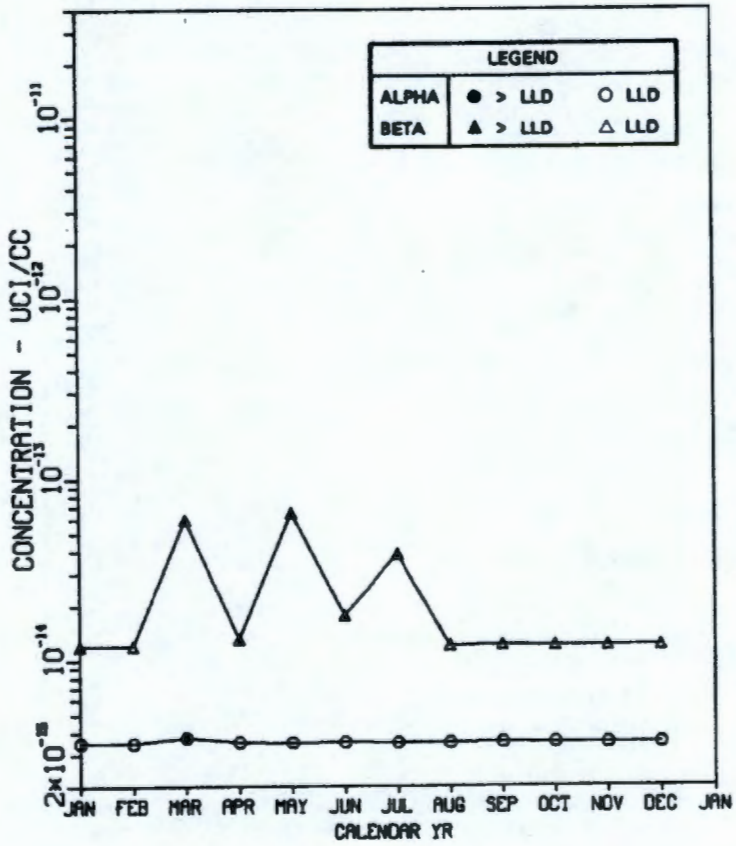



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV, with the exception of $^{106}Ru$. Corrective action for control of $^{106}Ru$ releases is ongoing. The annual averages and total activities for the volatile isotopes of ruthenium, tin, and antimony are greater than gross beta because the isotopes are volatile and pass through particulate filters from which gross beta is derived. Downward trend in gross beta activity from August to December reflects PUREX outage.

244-A Lift Station Catch Tank
(296-A-25)

EDP Code: E080
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <9 E-09 |
| Gross beta | <3 E-14 | <6 E-08 |

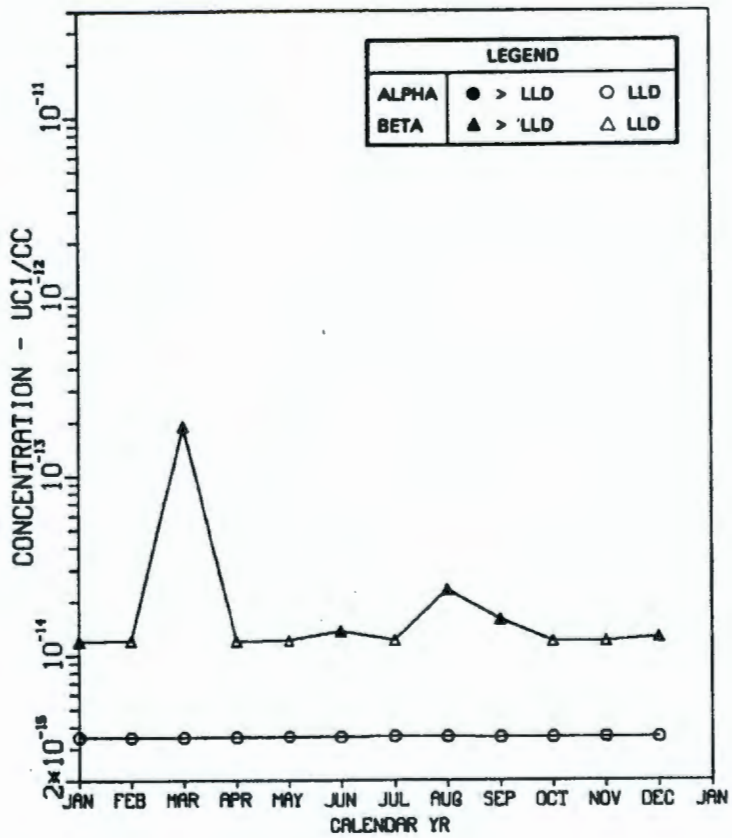



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

204-AR Waste Unloading Facility
(296-A-26)

EDP Code: E297
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <1 E-07 |
| Gross beta | <3 E-14 | <8 E-07 |

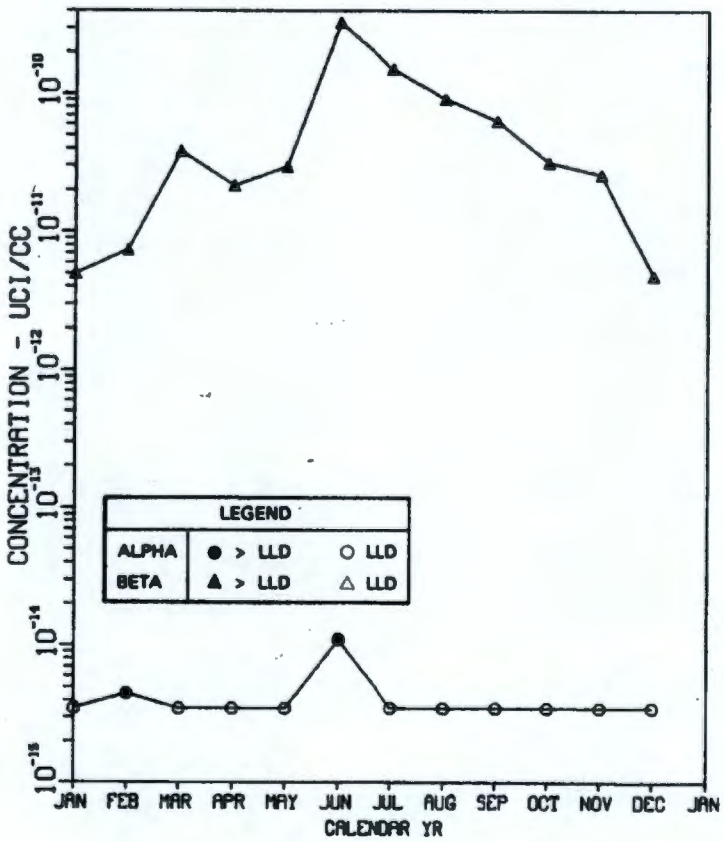



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

241-AW Tank Exhaust
(296-A-27)

EDP Code: E270
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <7 E-08 |
| $^{89,90}Sr$ | <9 E-15 | <1 E-07 |
| $^{103}Ru$ | 8 E-12 | 1 E-04 |
| $^{106}Ru$ | 1 E-10 | 2 E-03 |
| $^{113}Sn$ | 3 E-11 | 5 E-04 |
| $^{125}Sb$ | <5 E-12 | <7 E-05 |
| $^{129}I$ | 4 E-11 | 6 E-04 |
| $^{137}Cs$ | <9 E-15 | <1 E-07 |

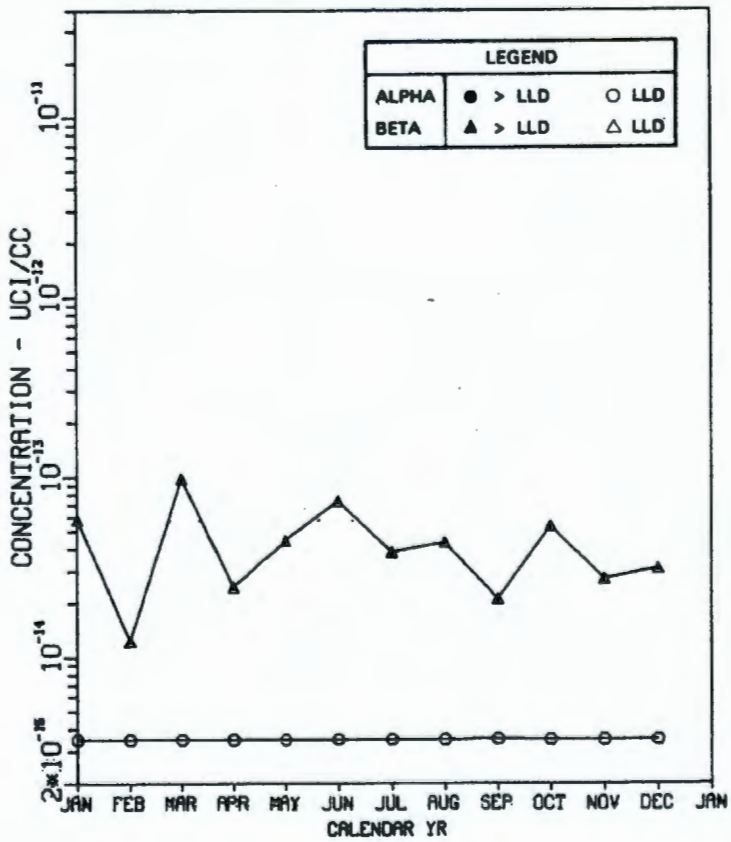



Comments: Gross alpha, gross beta, and specific radionuclide concentrations, except for $^{129}I$, were below ACV. Corrective actions for control of quantities of $^{129}I$ in decladding waste delivered to 241-AW Tank Farm from PUREX are being formulated. Gross beta activity reflects the rate of delivery of decladding waste from PUREX. The June increase also reflects receipt of silver reactor-flush solution from PUREX.

241-AW Tank Farm Annuli Exhaust
(296-A-28)

EDP Code: E272
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <3 E-07 |
| Gross beta | 4 E-14 | 3 E-06 |

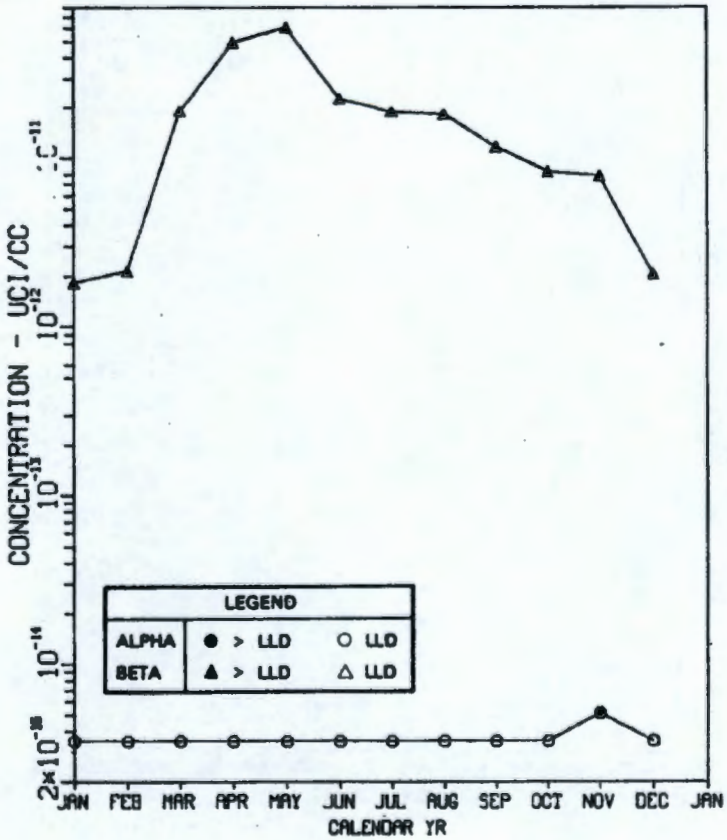



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

241-AN Tank Exhaust
(296-A-29)

EDP Code: E901
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <4 E-08 |
| $^{89,90}Sr$ | <3 E-15 | <3 E-08 |
| $^{137}Cs$ | <2 E-14 | <2 E-07 |

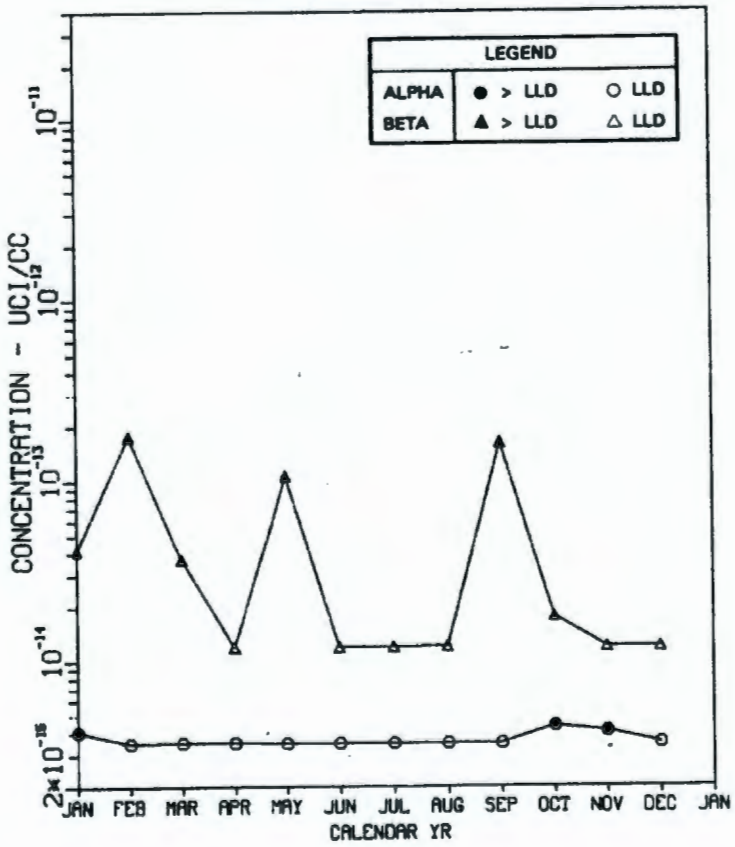



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

241-AN Tank Farm Annuli Exhaust
(296-A-30)

EDP Code: E903
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <4 E-07 |
| Gross beta | <6 E-14 | <5 E-06 |

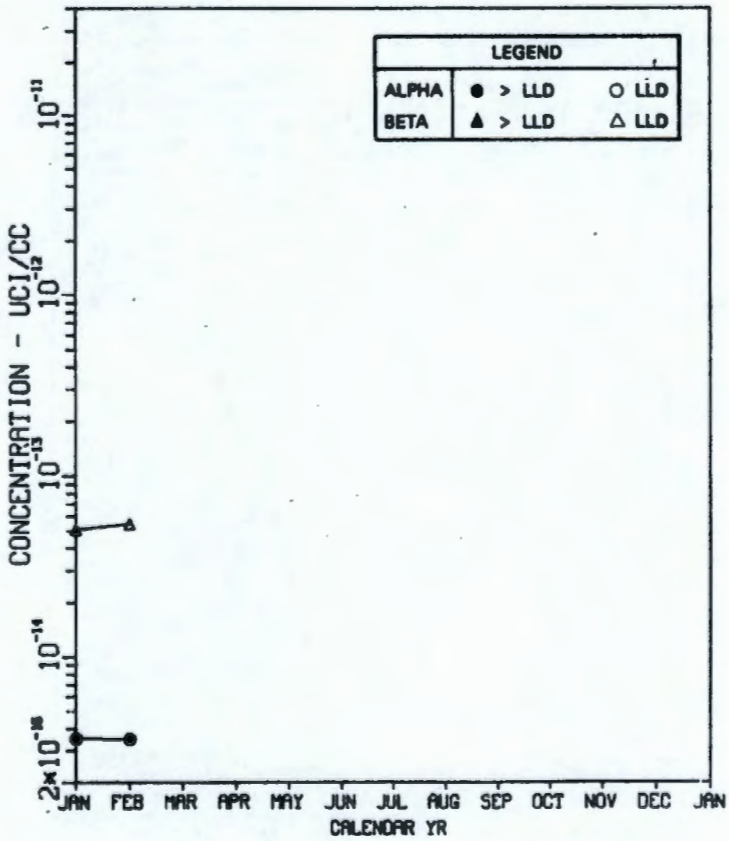



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Vacuum Pump Exhaust
(296-A-32)

EDP Code: A563
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-08 |
| Gross beta | 5 E-14 | 2 E-07 |

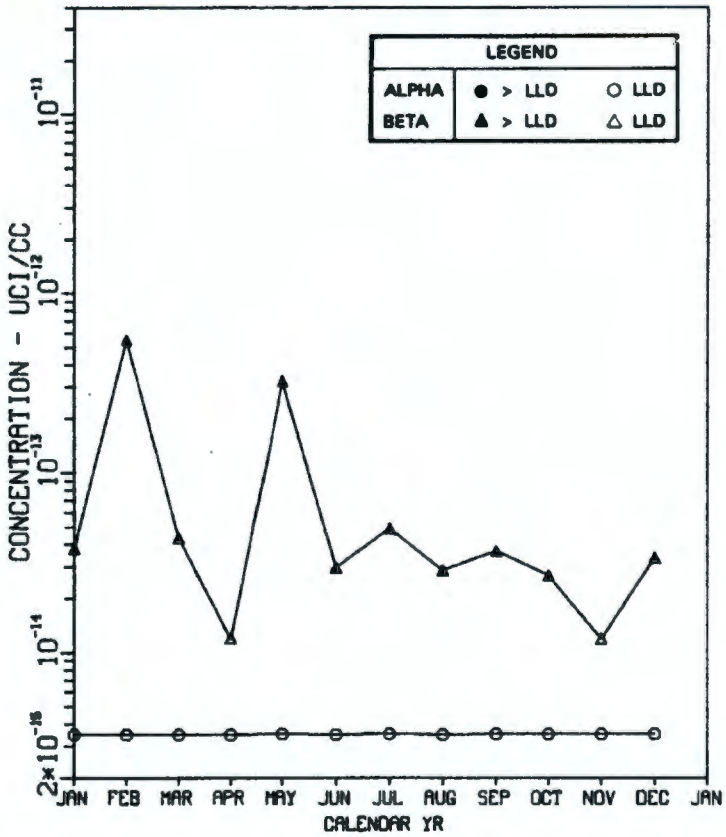



Comments: Annual average gross alpha and gross beta concentrations were below ACV. Vacuum pump exhaust was routed to another exhaust point at PUREX in February and use of this sample point was discontinued.

PUREX Wall Exhauster (EF-3-5)
(296-A-33)

EDP Code: A578
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <3 E-07 |
| Gross beta | 9 E-14 | 5 E-06 |

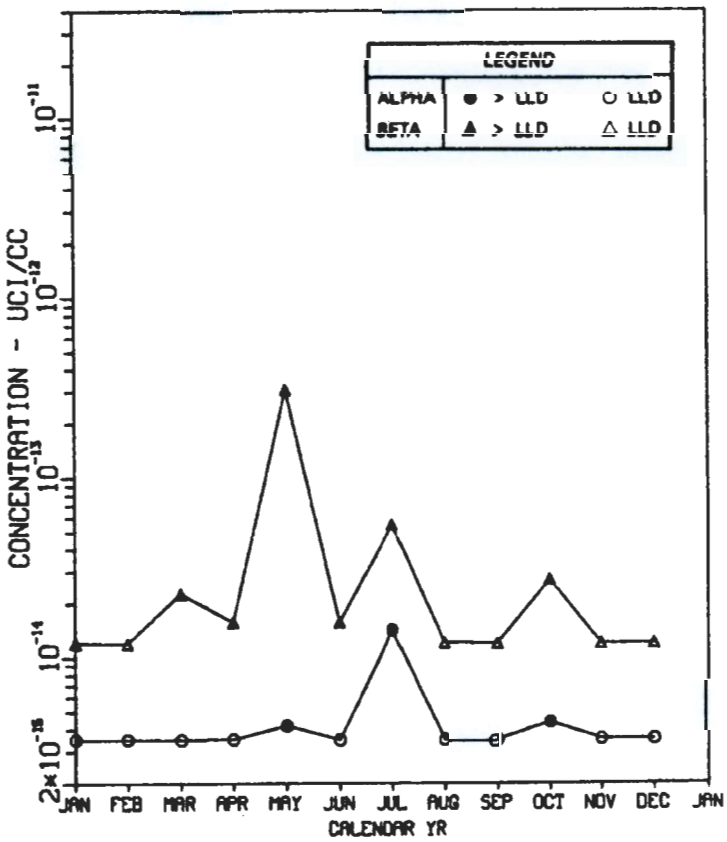



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Wall Exhauster (EF-3-6)
(296-A-34)

EDP Code: A579
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <4 E-07 |
| Gross beta | <5 E-14 | <4 E-06 |

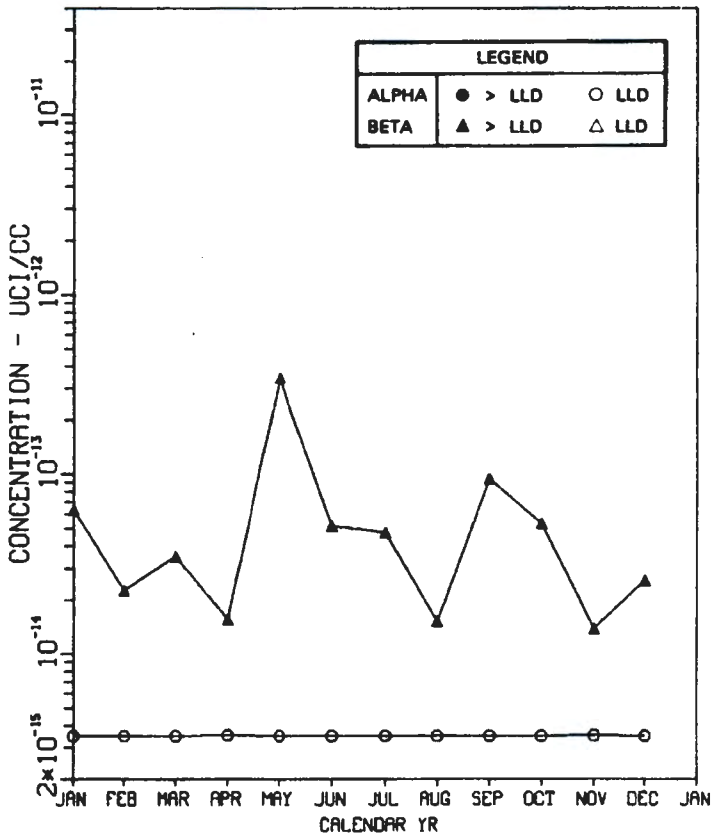



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Wall Exhauster (EF-3-7)
(296-A-35)

EDP Code: A580
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <4 E-07 |
| Gross beta | 7 E-14 | 8 E-06 |

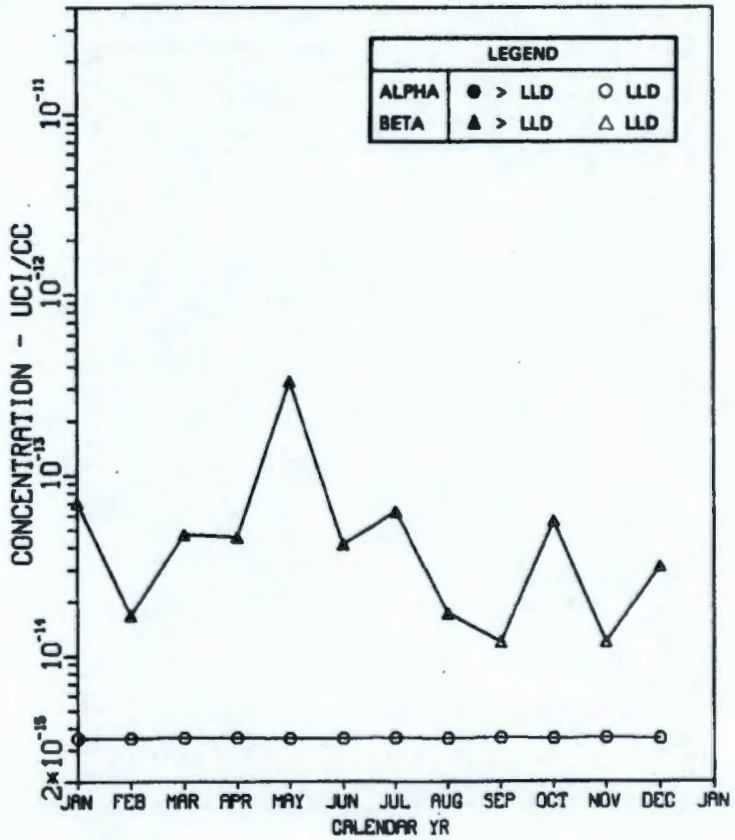



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Wall Exhauster (EF-3-8)
(296-A-36)

EDP Code: A582
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <3 E-07 |
| Gross beta | 7 E-14 | 4 E-06 |

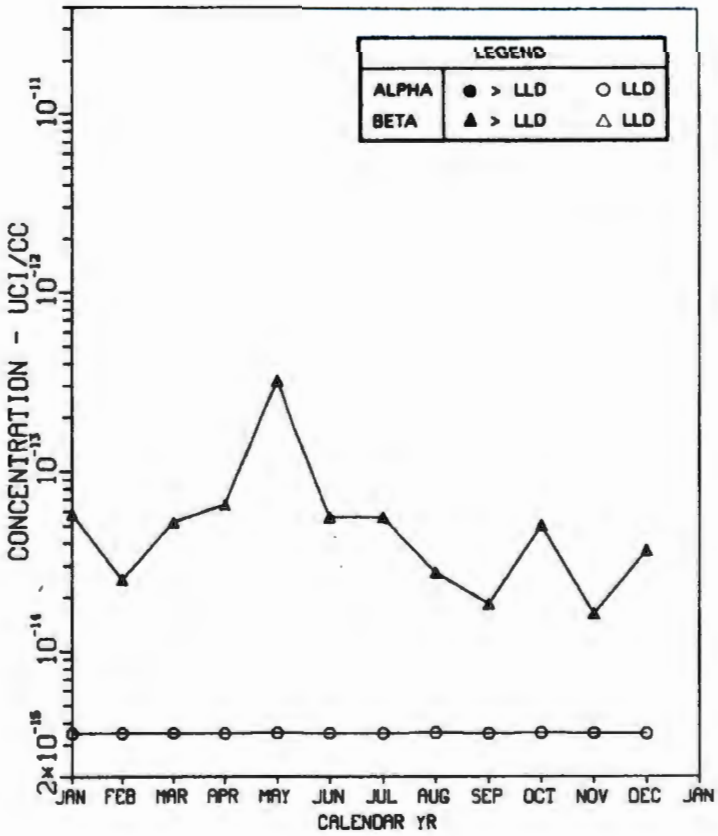



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Wall Exhauster (EF-3-9)
(296-A-37)

EDP Code: A583
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <5 E-07 |
| Gross beta | 7 E-14 | 8 E-06 |

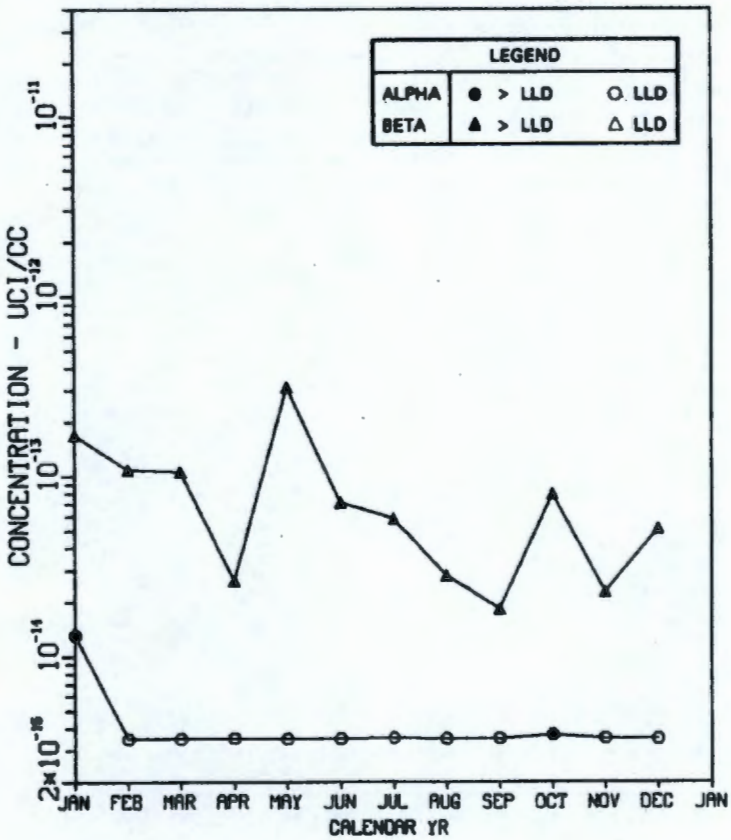



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PUREX Wall Exhauster (EF-3-10)
(296-A-38)

EDP Code: A584
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <2 E-07 |
| Gross beta | 9 E-14 | 3 E-06 |

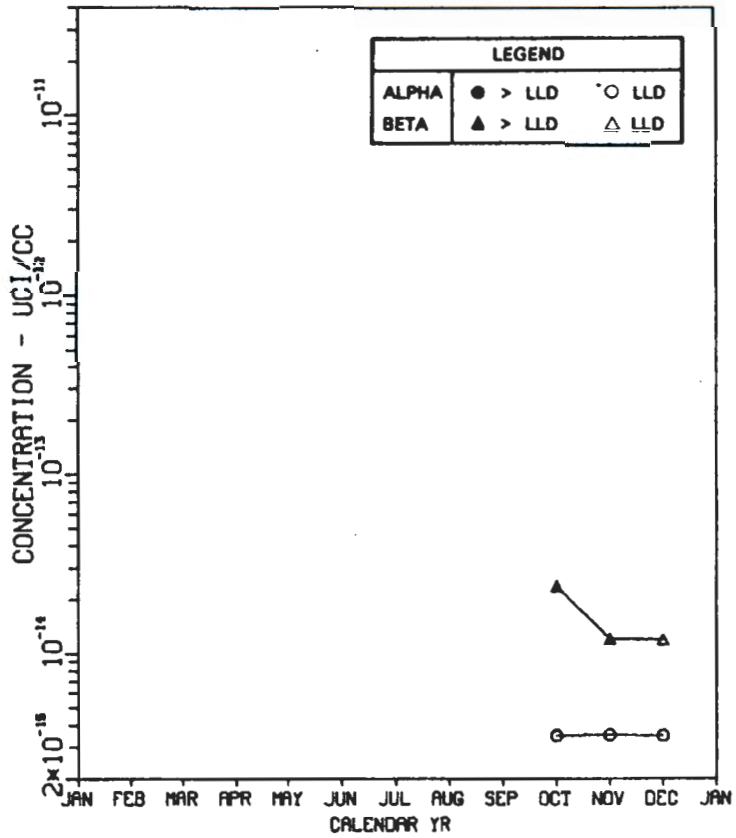



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

AP Tank Farm Primary Exhaust
(296-A-40)

EDP Code: E013
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-08 |
| Gross beta | <2 E-14 | <7 E-08 |

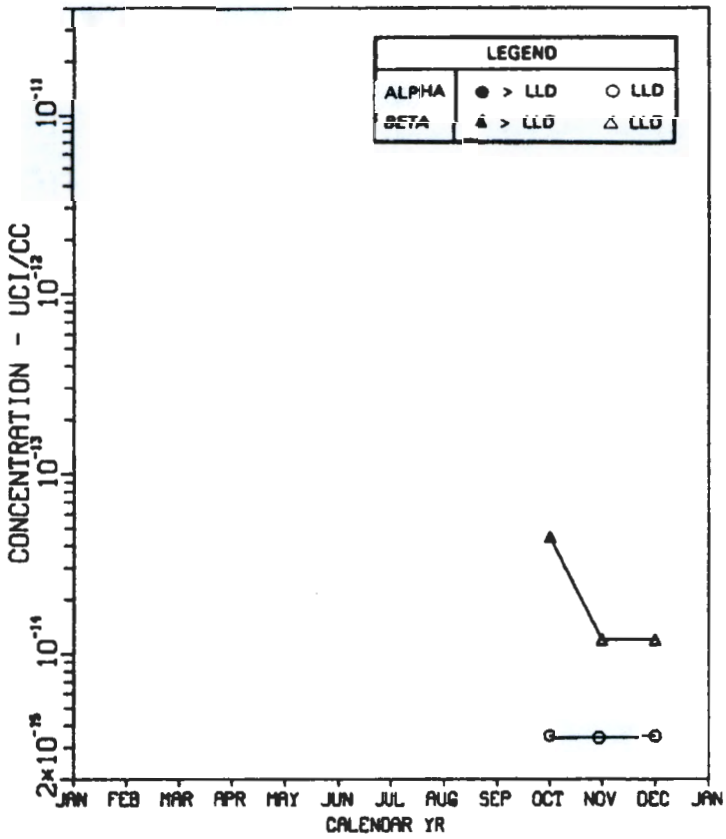



Comments: Annual average gross alpha and gross beta concentrations were below ACV. The 241-AP Tank Farm began operation in October 1986.

AP Tank Farm Annuli Exhaust
(296-A-41)

EDP Code: E015
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <9 E-08 |
| Gross beta | <3 E-14 | <6 E-07 |

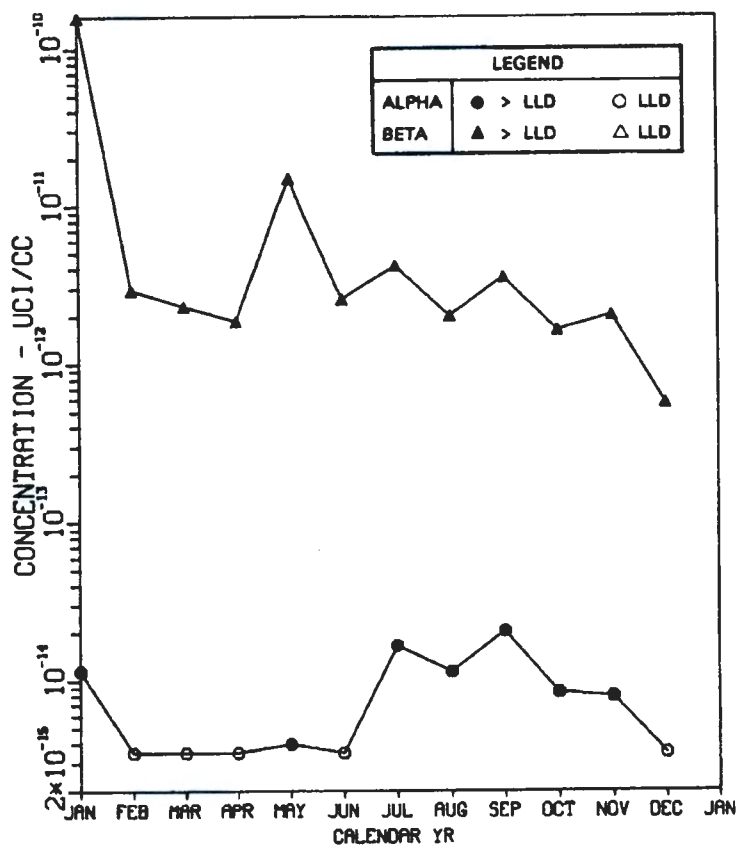



Comments: Annual average gross alpha and gross beta concentrations were below ACV. The 241-AP Tank Farm began operation in October 1986.

B Plant Process and Canyon Exhaust
(291-B-1)

EDP Code: B691
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <9 E-15 | <6 E-06 |
| $^{89,90}Sr$ | 1 E-13 | 9 E-05 |
| $^{137}Cs$ | 1 E-11 | 8 E-03 |
| Uranium (gross) | 5 E-16 | 3 E-07 |

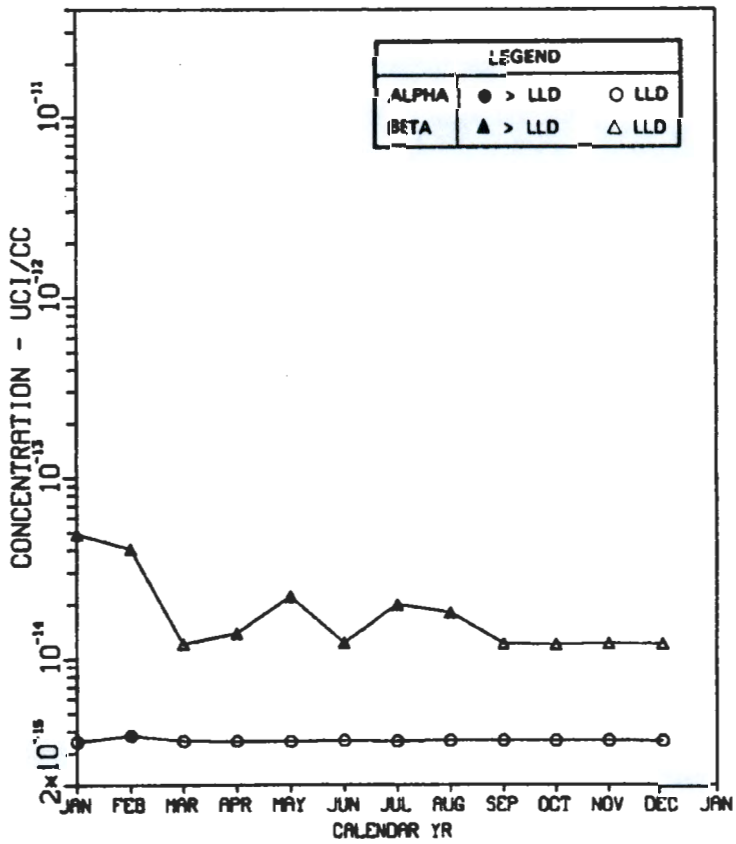



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV. The increased gross beta activity in January was due to the presence of a leak in a process sampler located in the 221-B canyon.

221-BB Building Exhaust
(296-B-5)

EDP Code: B686
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <8 E-08 |
| Gross beta | <3 E-14 | < 5 E-07 |

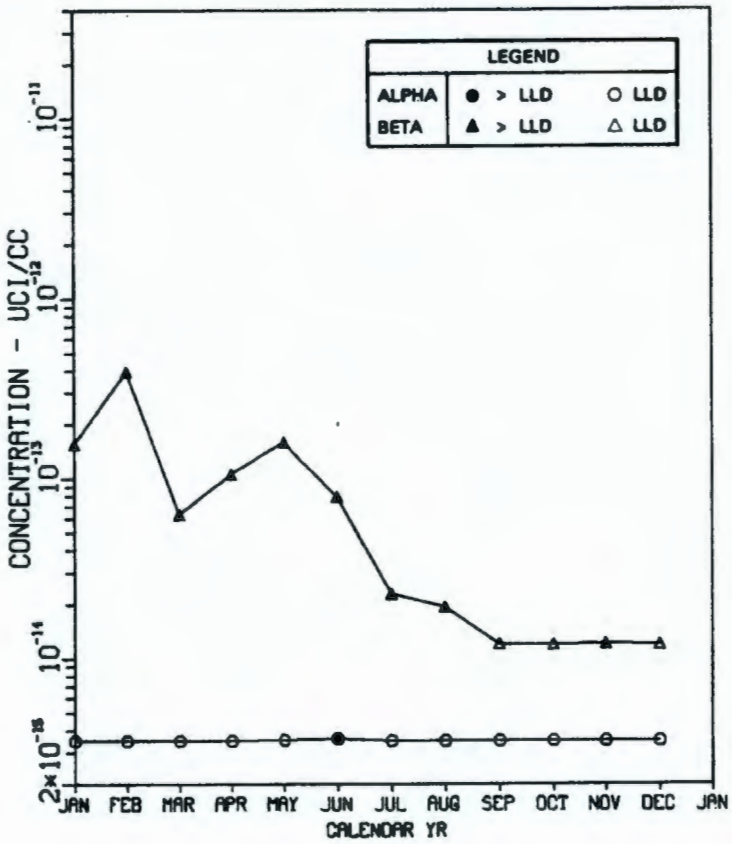



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

225-B Building Waste Encapsulation and Storage Facility (WESF) Exhaust (296-B-10)

EDP Code: B748
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <1 E-06 |
| Gross beta | 9 E-14 | 2 E-05 |

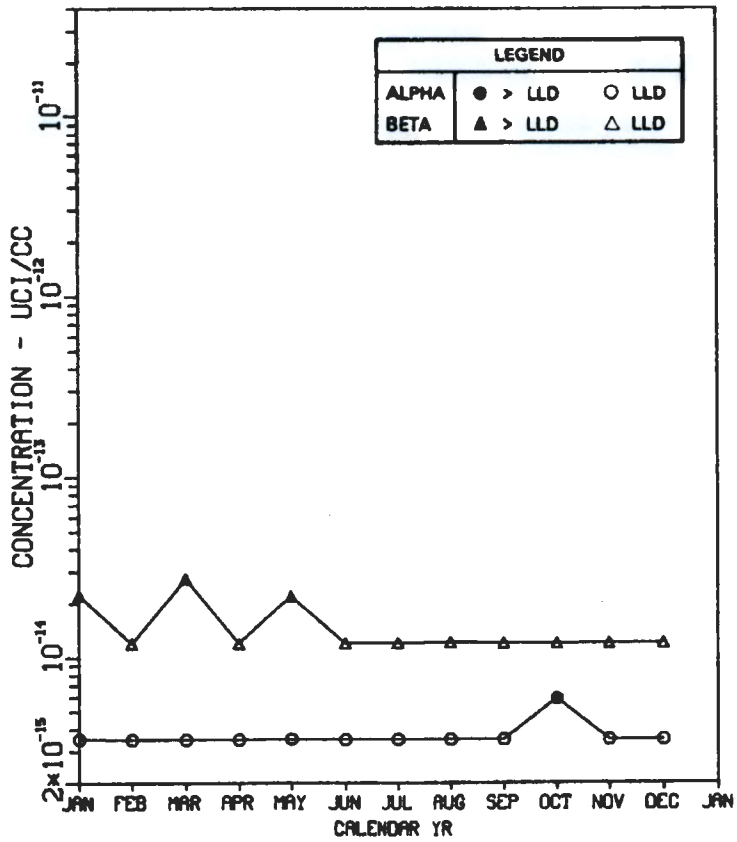



Comments: Annual average gross alpha and gross beta concentrations were below ACV. The WESF stopped processing cesium and strontium capsules in late 1985. The decline in gross beta activity occurred as decontamination was performed and the inventory of radioactive material was reduced.

221-BF Building Ventilation
(296-B-13)

EDP Code: B690
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <4 E-08 |
| Gross beta | <2 E-14 | <2 E-07 |

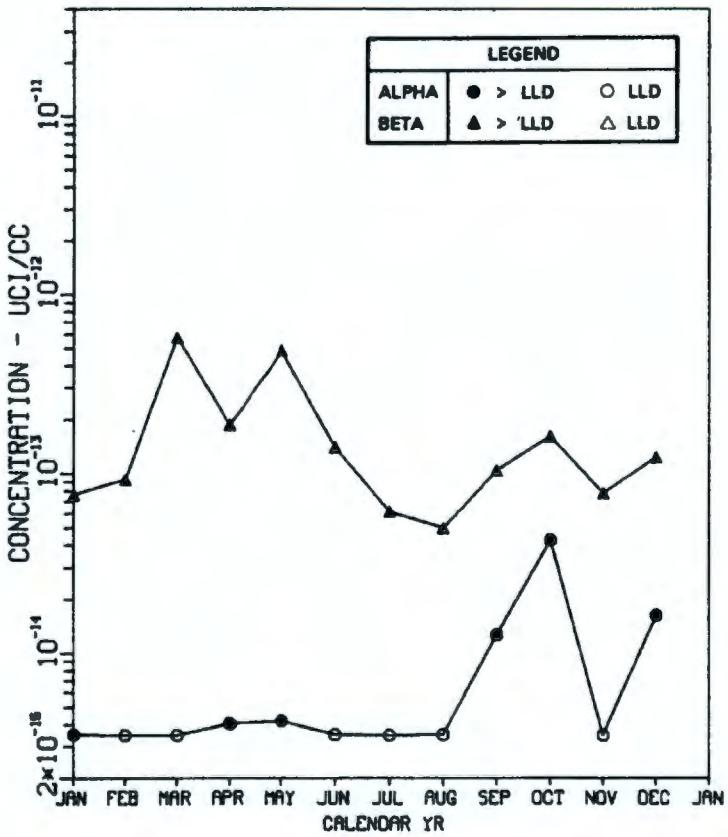



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

B Plant Vessel Vent Number 2 Exhaust
(296-B-14)

EDP Code: B678
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Total alpha | <1 E-14 | <4 E-08 |
| Total beta | 2 E-13 | 7 E-07 |

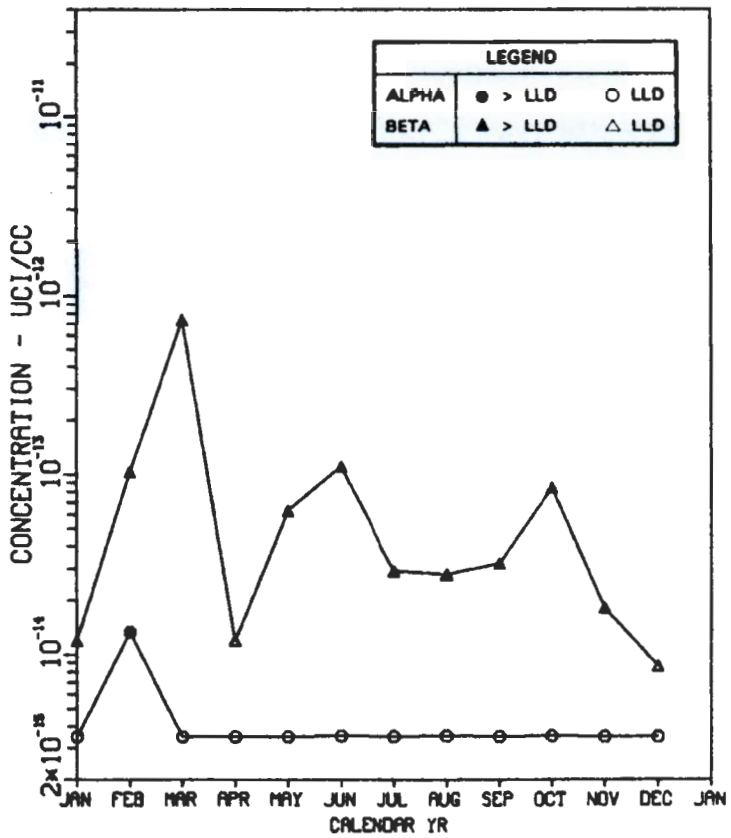



Comments: Annual average gross alpha and gross particulate beta concentrations were below ACV.

244-BX Salt Well Receiver and Annulus Exhaust (296-B-28)

EDP Code: E886
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Total alpha | <5 E-15 | <2 E-08 |
| Total beta | 1 E-13 | 4 E-07 |

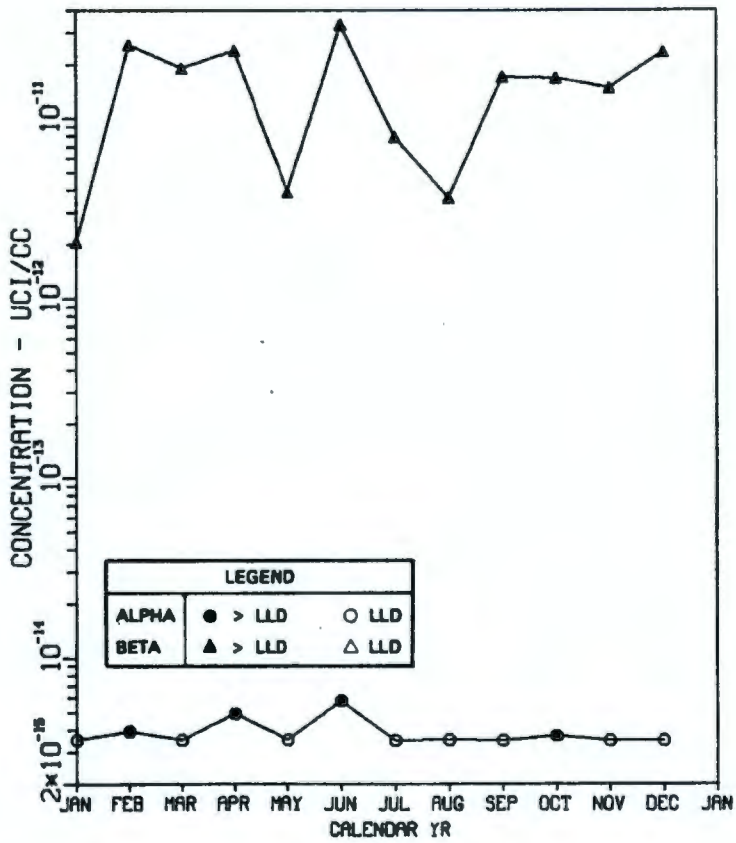



Comments: Annual average gross alpha and gross particulate beta concentrations were below ACV.

Semiworks Process and Cells Exhaust
(291-C-1)

EDP Code: E073
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <5 E-07 |
| $^{89,90}Sr$ | 4 E-12 | 4 E-04 |
| $^{137}Cs$ | <1 E-14 | <1 E-06 |

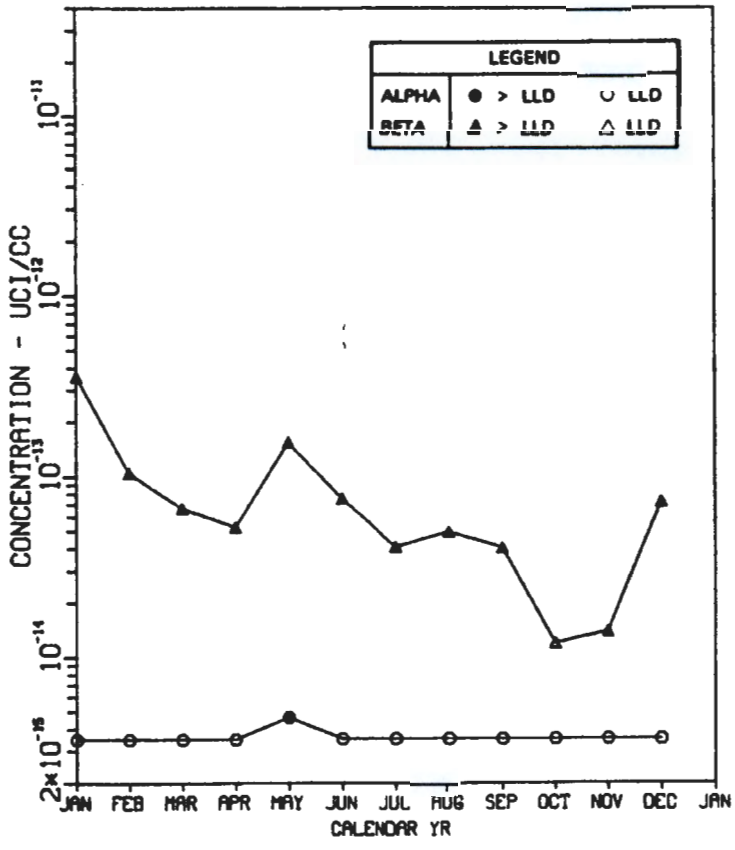



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

CR Vault Cell and Vessel Ventilation
(296-C-5)

EDP Code: E069
Old Facility

| Radionuclide | Annual average concentration (µCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-07 |
| Gross beta | 9 E-14 | 5 E-06 |

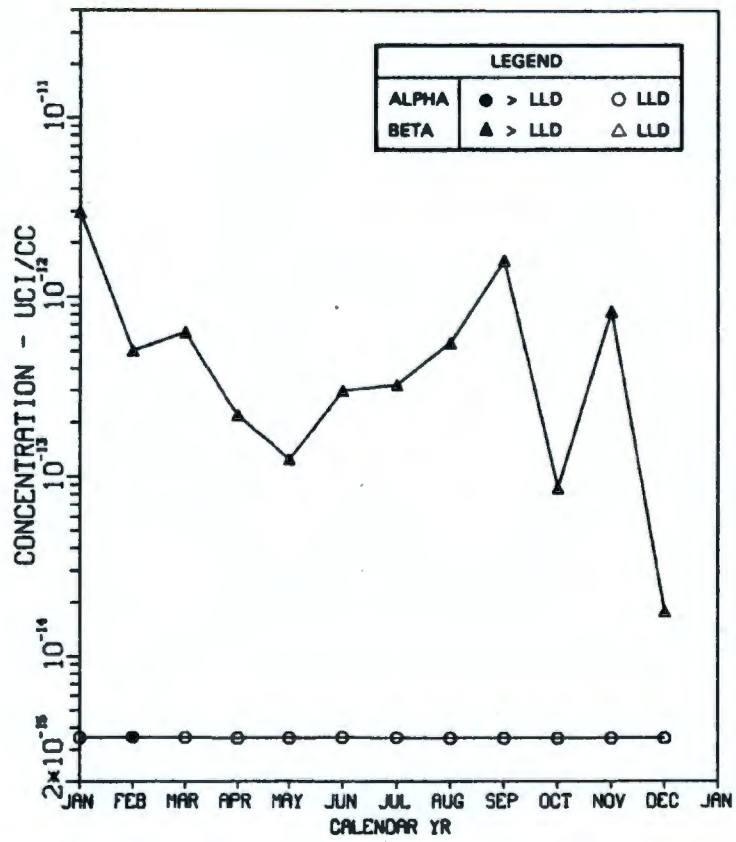



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

241-C-105, -106 Tanks Exhaust
(296-P-16)

EDP Code: E068
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| $^{89,90}Sr$ | 2 E-13 | 7 E-06 |
| $^{137}Cs$ | 5 E-13 | 2 E-05 |
| $^{239,240}Pu$ | 8 E-16 | 3 E-08 |

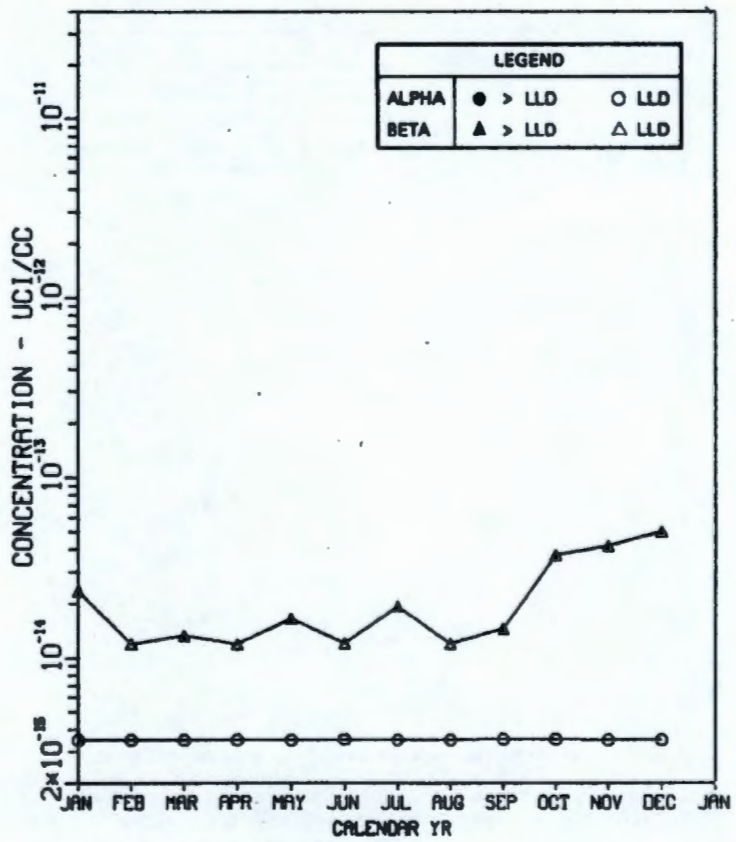



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

241-A-105 Tank Exhaust
(296-P-17)

EDP Code: E120
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <9 E-08 |
| Gross beta | <2 E-14 | <5 E-07 |

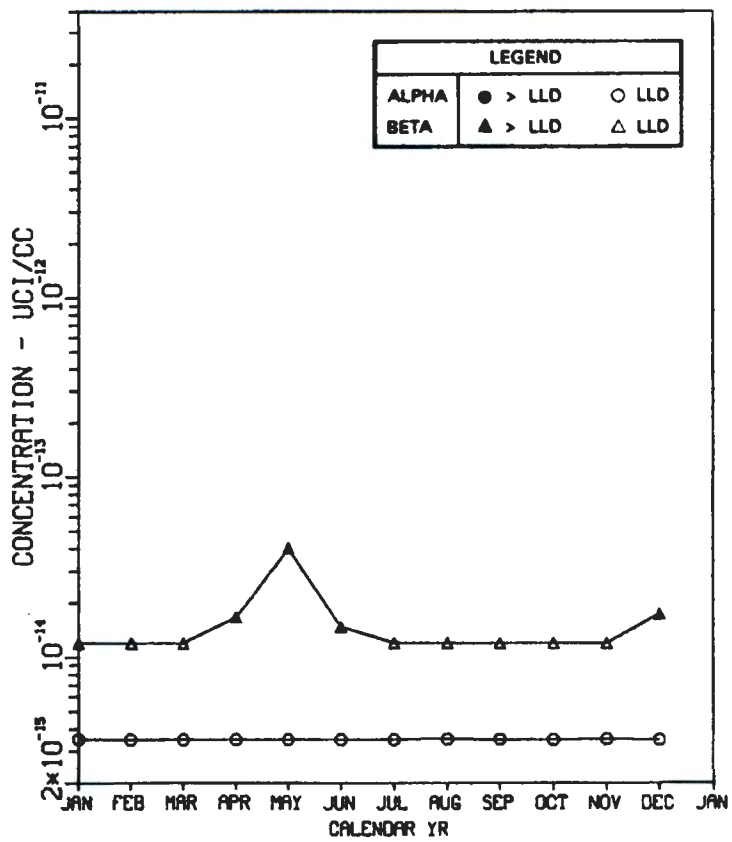



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

241-SY Annulus Ventilation
(296-P-22)

EDP Code: W191
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <3 E-08 |
| Gross beta | <2 E-14 | <1 E-07 |

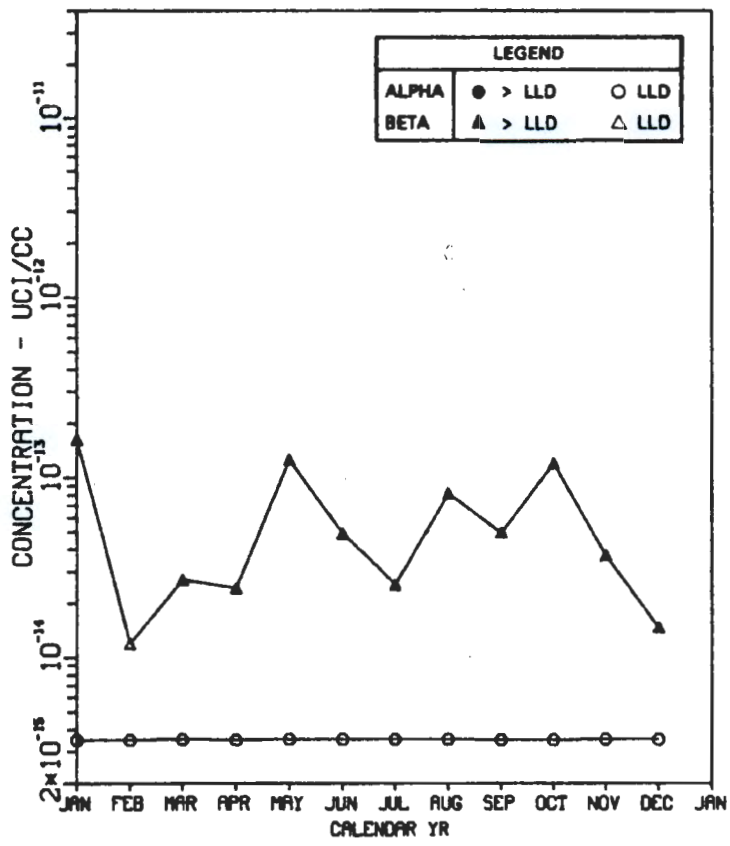



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

241-SY Tank Farm Ventilation
(296-P-23)

EDP Code: W190
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <5 E-08 |
| Gross beta | 6 E-14 | 7 E-07 |

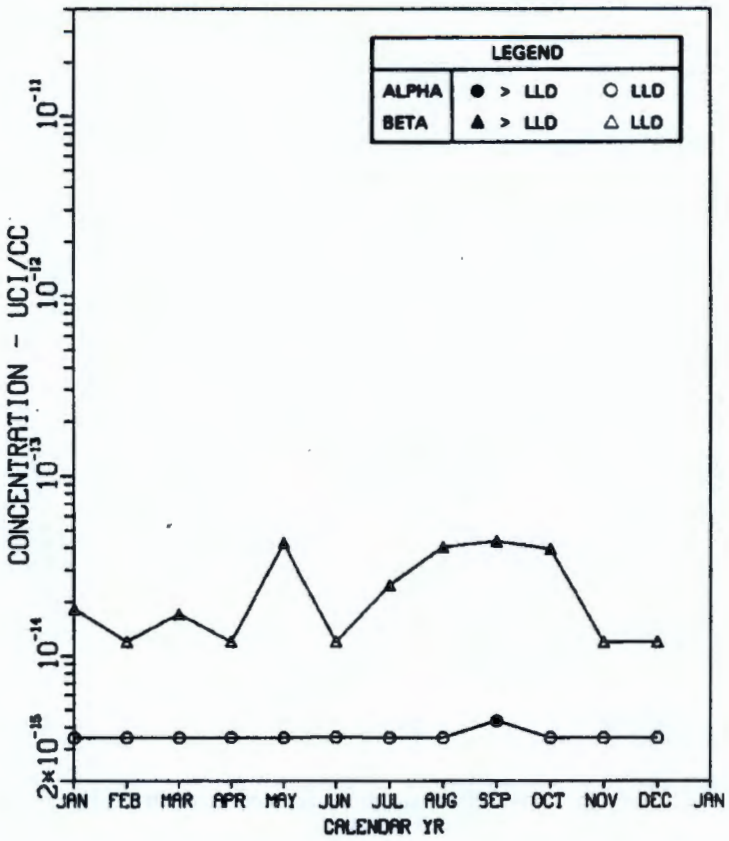



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

REDOX Process and Canyon Ventilation
(291-S-1)

EDP Code: S006
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <9 E-07 |
| Gross beta | <3 E-14 | <6 E-06 |

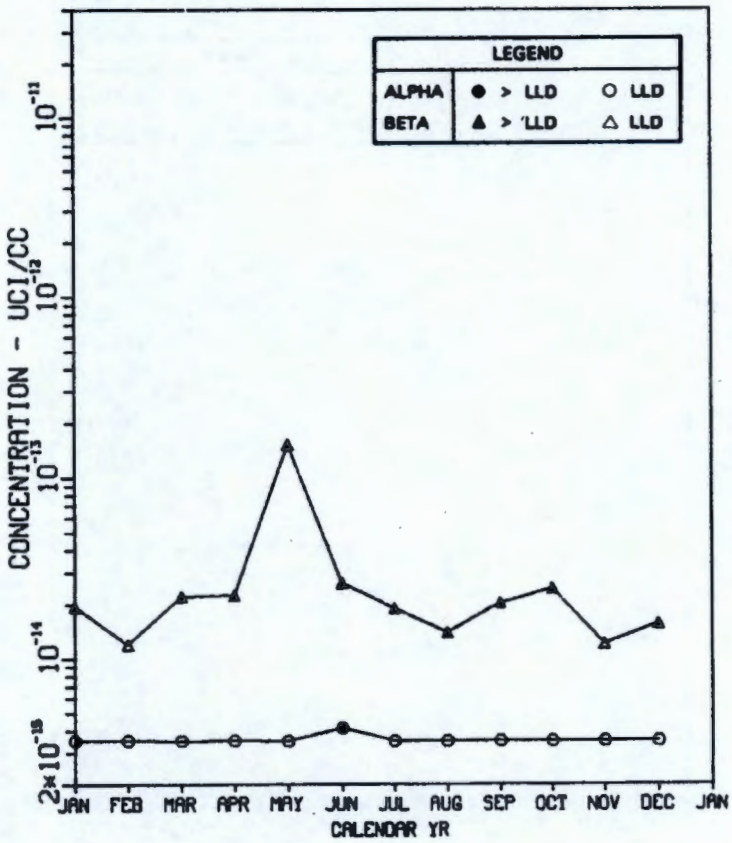



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

REDOX North and South Sample Gallery
PR Cage (296-S-2)

EDP Code: S032
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <4 E-08 |
| Gross beta | 3 E-14 | 3 E-07 |

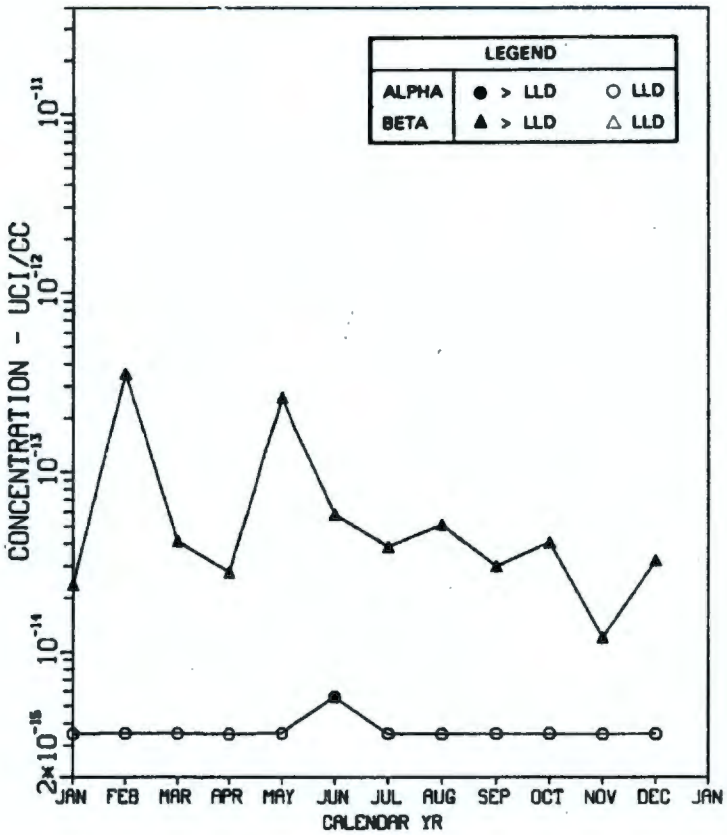



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

REDOX SWP Lobby, Tool Room,
Decontamination Room,
and Shop Exhaust (296-S-4)

EDP Code: S008
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <3 E-07 |
| Gross beta | 8 E-14 | 6 E-06 |

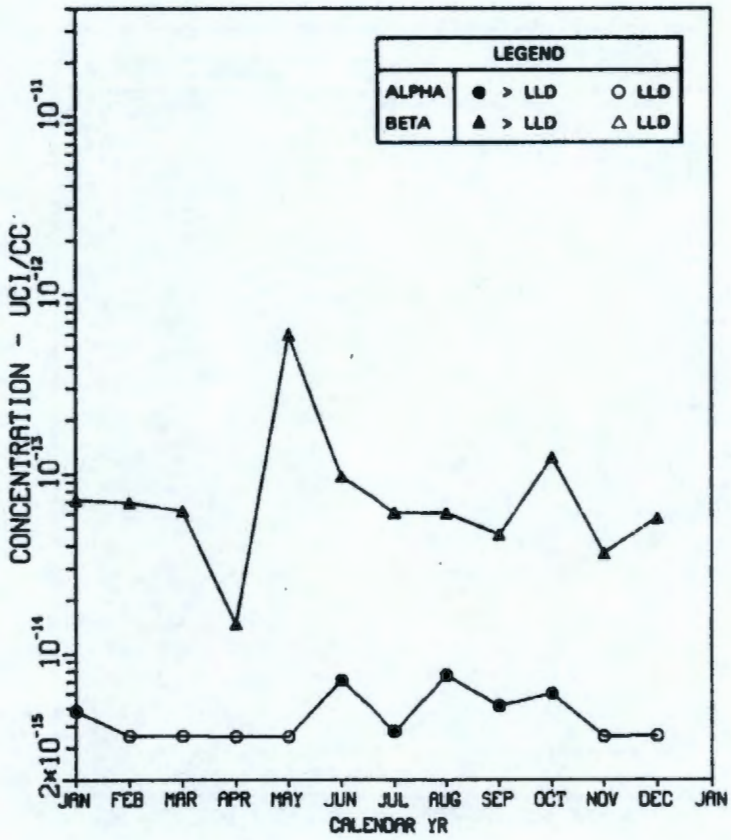



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

REDOX Silo Ventilation
(296-S-6)

EDP Code: S004
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <7 E-07 |
| Gross beta | 1 E-13 | 1 E-05 |

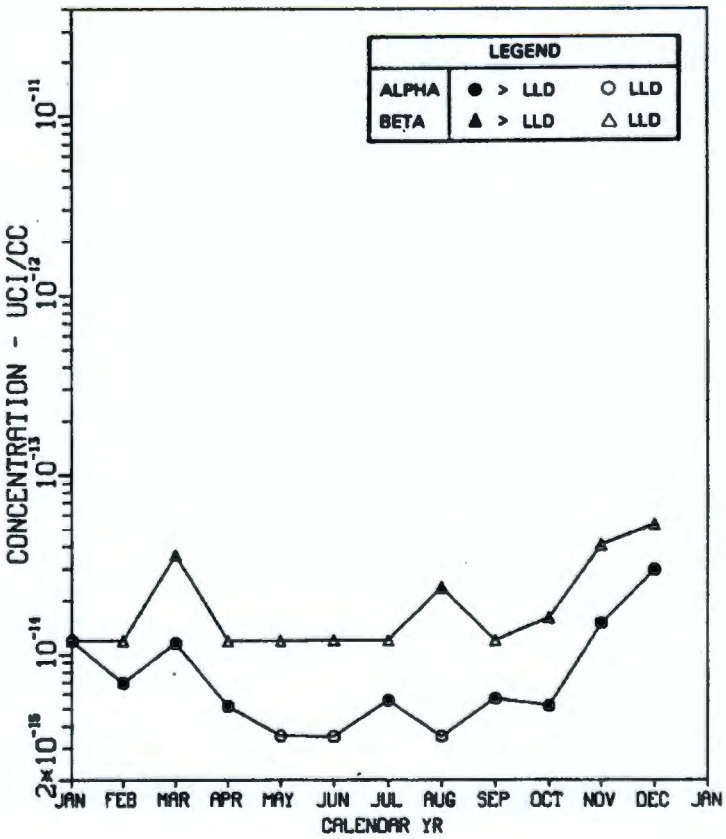



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

REDOX Product Building (233-S)
Ventilation (296-S-7w)

EDP Code: S016
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross beta | <3 E-14 | <3 E-06 |
| $^{239,240}Pu$ | 2 E-14 | 1 E-06 |

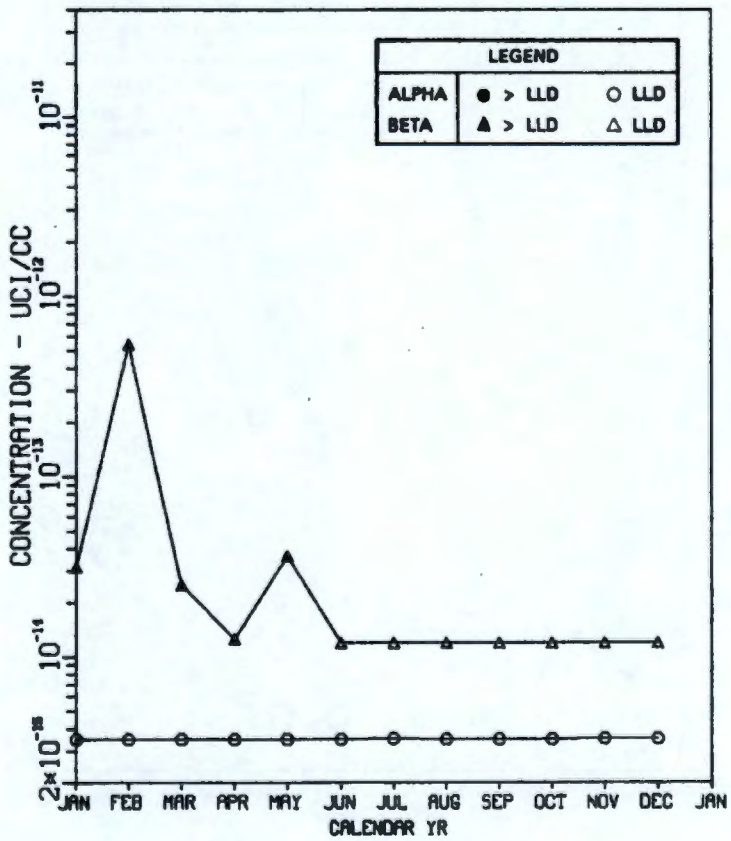



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

241-SX Sludge Cooling Exhaust
(296-S-15)

EDP Code: W111
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <3 E-07 |
| Gross beta | <6 E-14 | <5 E-06 |

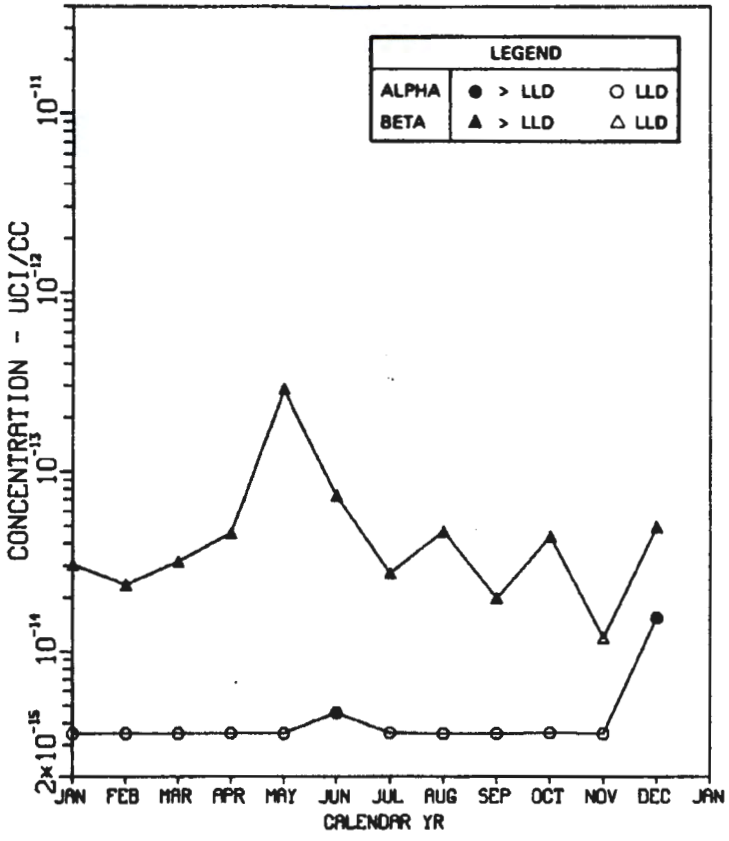



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

222-S Laboratory Waste Vault
(296-S-16)

EDP Code: S264
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <1 E-08 |
| Gross beta | 6 E-14 | 1 E-07 |

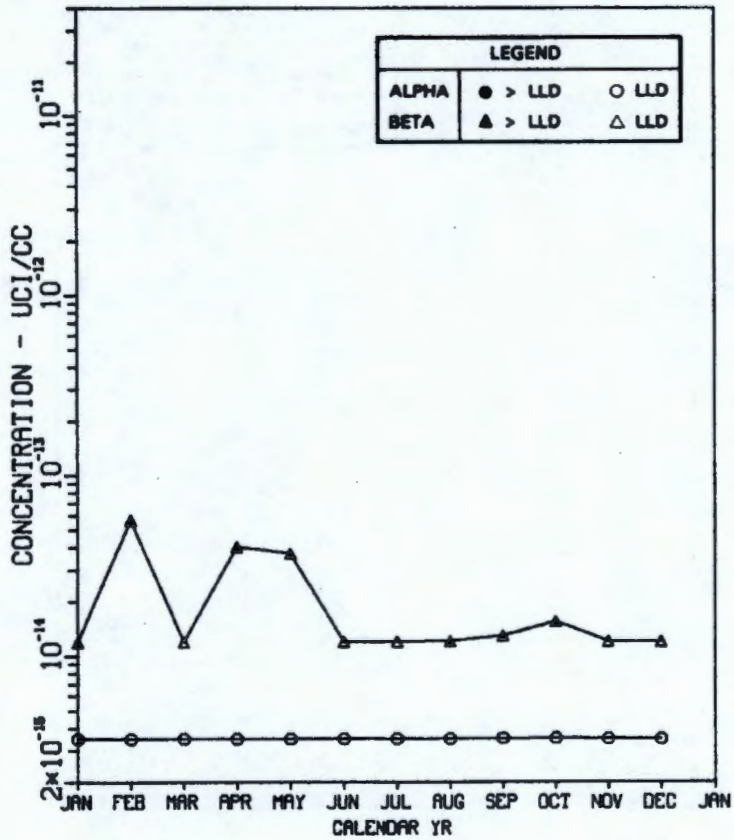



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

242-S Evaporator-Crystallizer Building
Exhaust (296-S-18)

EDP Code: W096
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-06 |
| Gross beta | <3 E-14 | <6 E-06 |

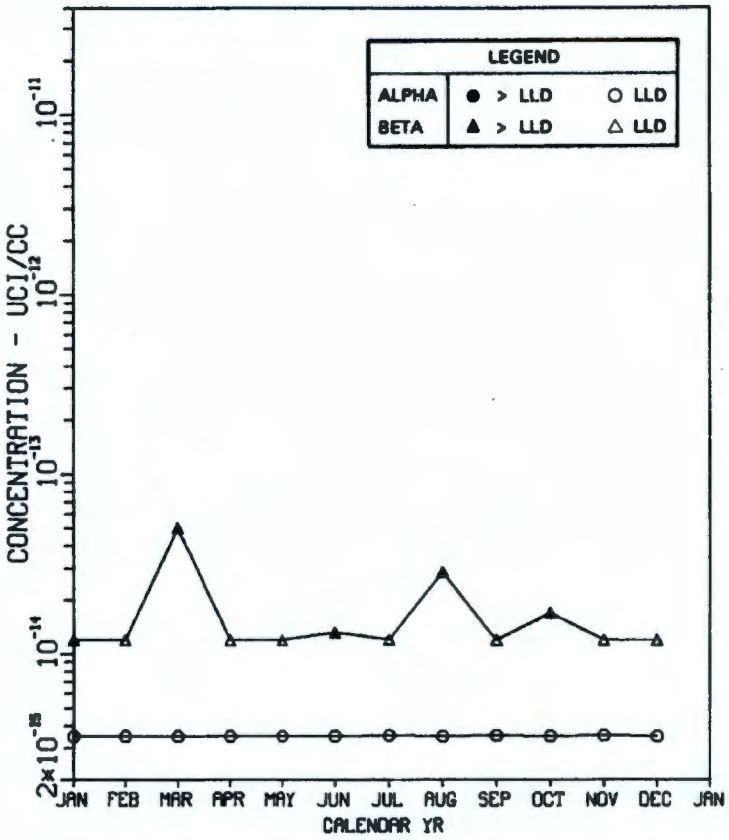



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

222-S Laboratory Ventilation
(296-S-21)

EDP Code: S289
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <4 E-06 |
| Gross beta | <2 E-14 | <2 E-05 |

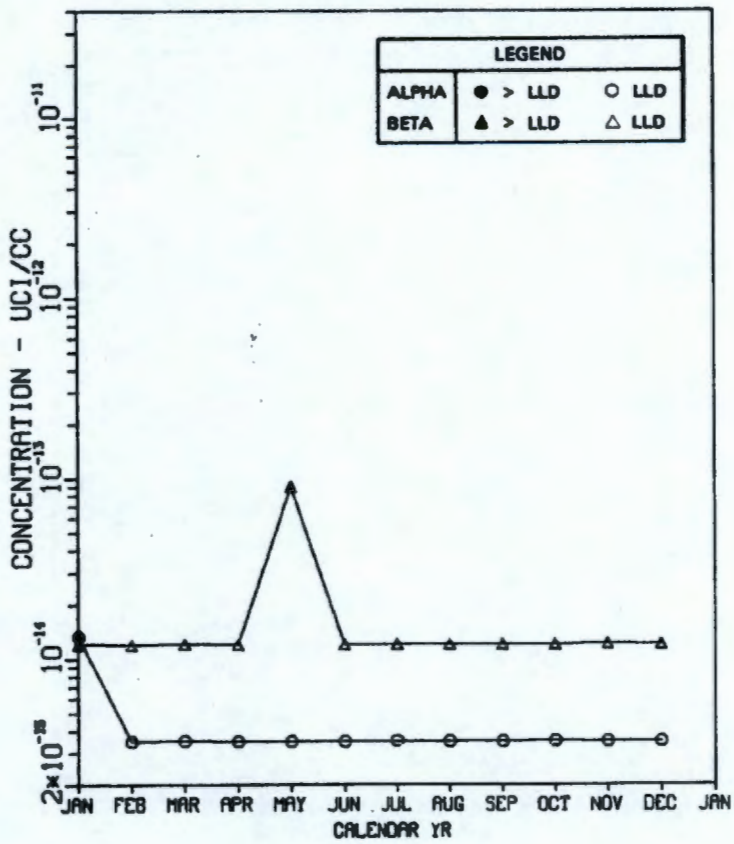



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

244-S Salt Well Receiver Tank and
Annulus Exhaust (296-S-22)

EDP Code: W880
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <2 E-08 |
| Gross beta | <2 E-14 | <5 E-08 |

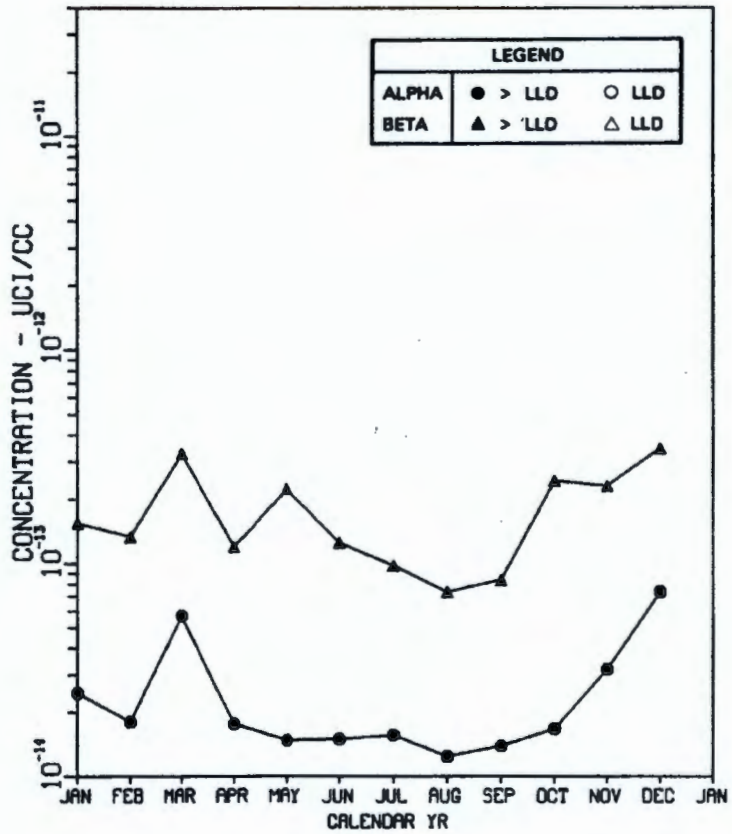



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

T Plant Canyon Exhaust (Main)
(291-T-1)

EDP Code: T785
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| $^{89,90}Sr$ | 3 E-14 | 1 E-05 |
| $^{137}Cs$ | 3 E-14 | 1 E-05 |
| $^{239,240}Pu$ | 2 E-14 | 1 E-05 |

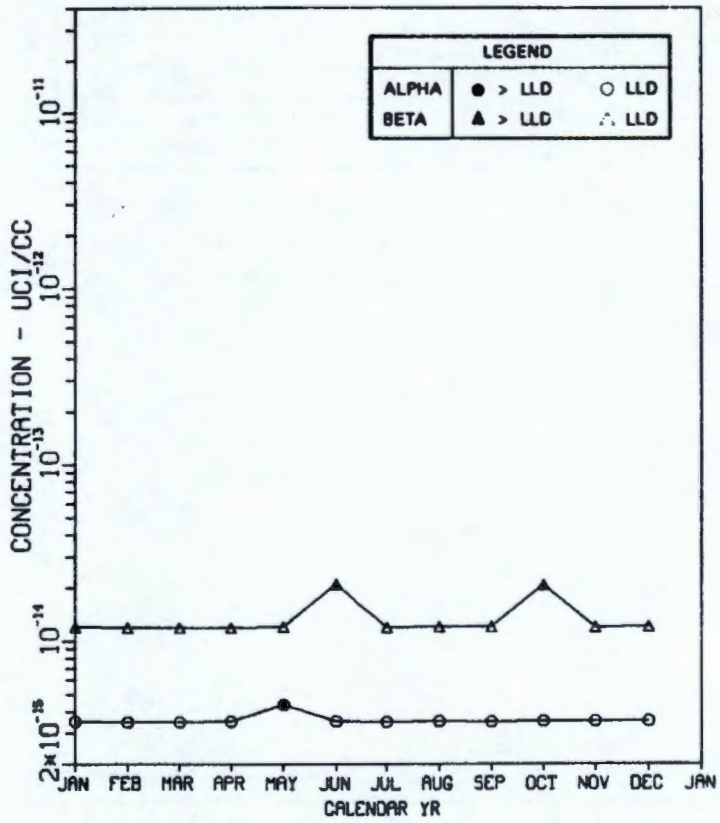



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV. The increases in gross alpha and gross beta activities between August and December were due to leaks in steam heater coils and subsequent wetting of the first stage of HEPA filters.

224-T Building Exhaust, East Stack
(296-T-11)

EDP Code: T783
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <8 E-07 |
| Gross beta | <2 E-14 | <3 E-06 |

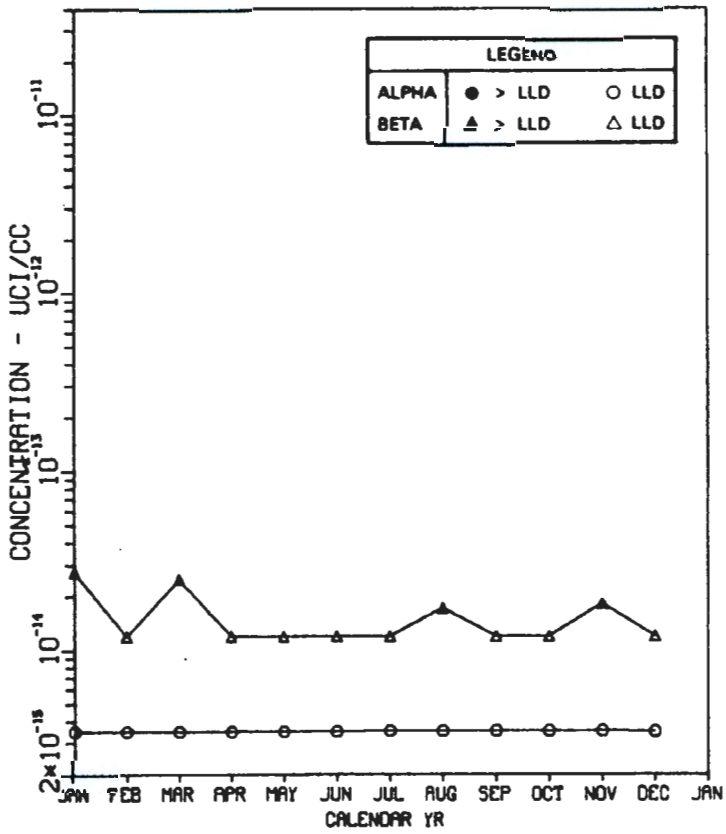



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

224-T Building Exhaust, West Stack
(296-T-12)

EDP Code: T784
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <7 E-07 |
| Gross beta | <2 E-14 | <3 E-06 |

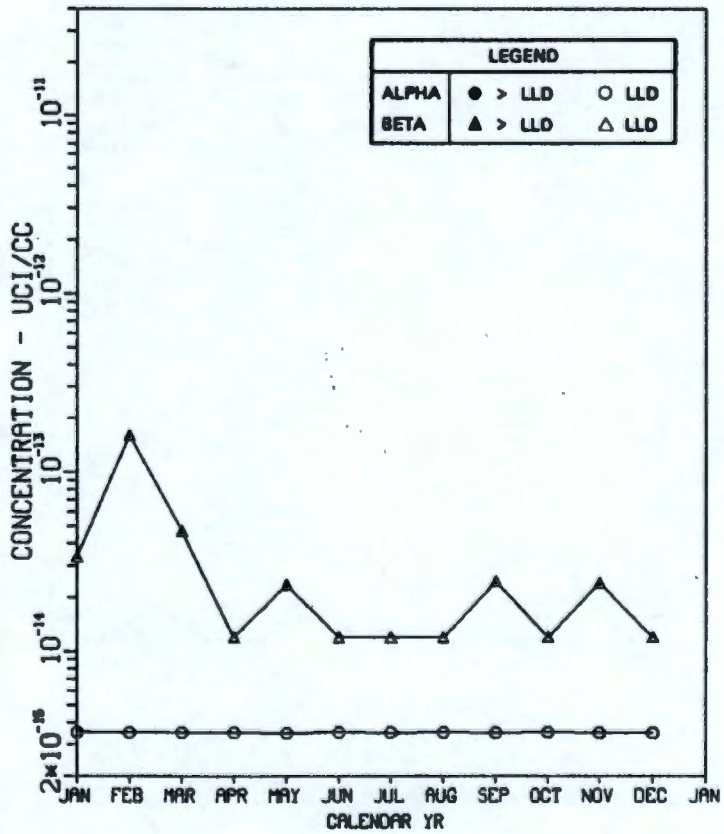



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

T Plant Canyon Exhaust (Roof)
(296-T-13)

EDP Code: T786
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-06 |
| Gross beta | <4 E-14 | <2 E-05 |

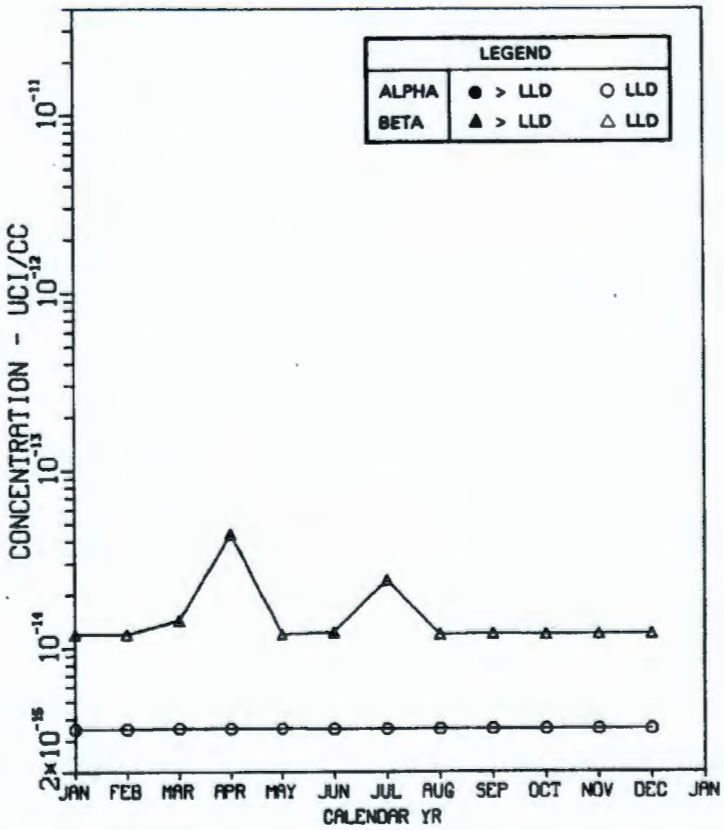



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

242-T Evaporator-Crystallizer Exhaust
(296-T-17)

EDP Code: W117
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <9 E-08 |
| Gross beta | <2 E-14 | <5 E-07 |

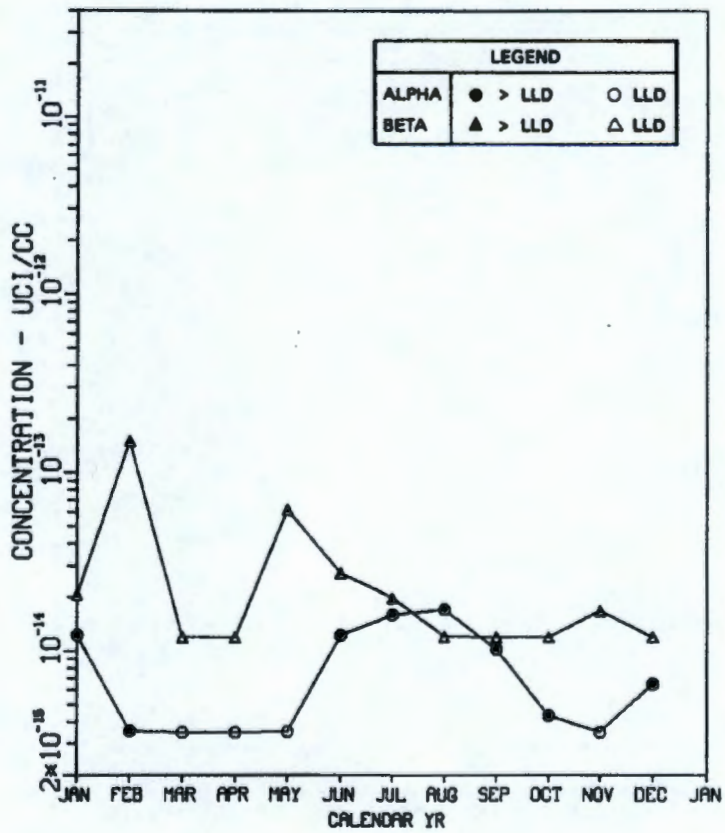



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

244-TX Salt Well Receiver Tank and Annulus Exhaust (296-T-18)

EDP Code: W882
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <9 E-15 | <4 E-08 |
| Gross beta | <3 E-14 | <2 E-07 |

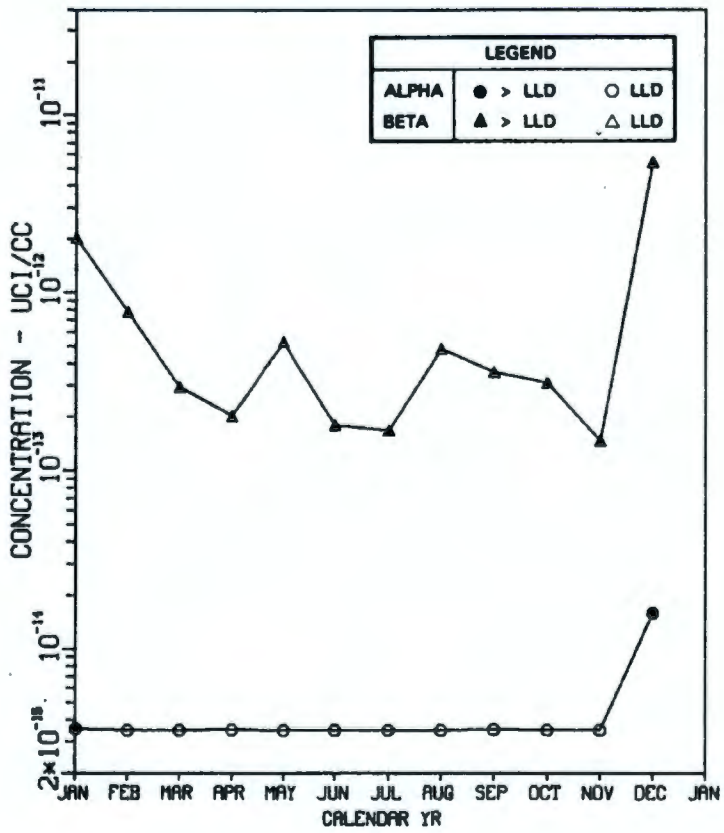



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

U Plant Canyon Exhaust
(291-U-1)

EDP Code: U771
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-15 | <2 E-06 |
| Gross beta | 9 E-13 | 3 E-04 |

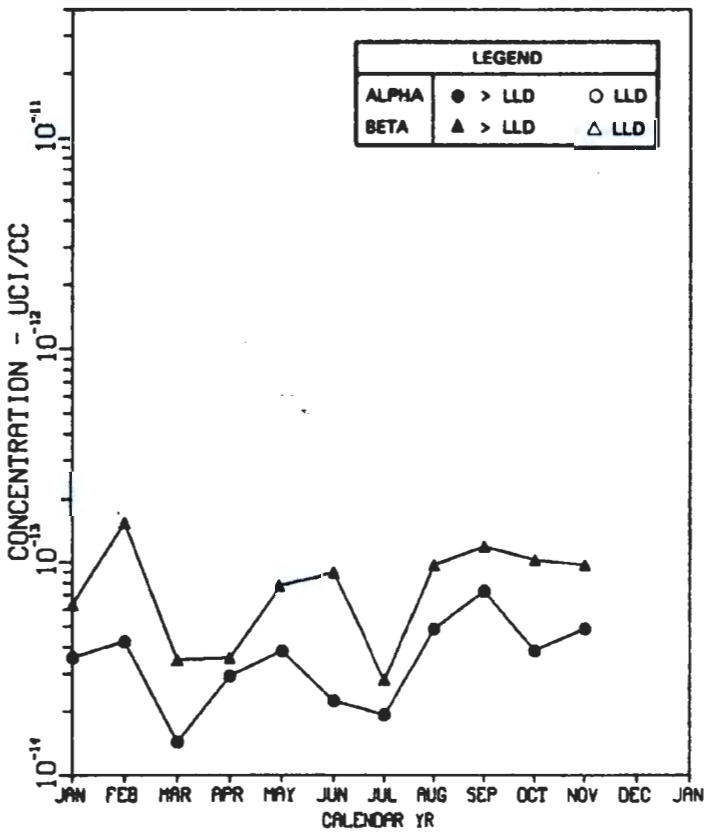



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

$UO_3$ Powder-Handling Exhaust
(296-U-2)

EDP Code: U133
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Uranium | 2 E-14 | 6 E-07 |

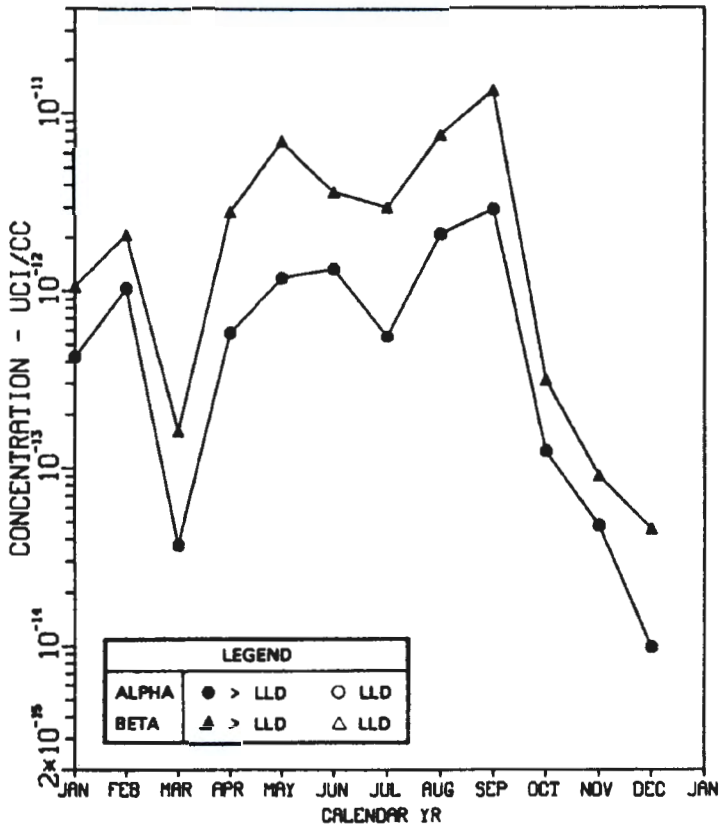



Comments: Annual average gross alpha, gross beta, and uranium concentrations were below ACV. The 296-U-2 stack did not operate in December.

$UO_3$ Calciner Exhaust
(296-U-4)

EDP Code: U777
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Uranium | 2 E-13 | 7 E-06 |

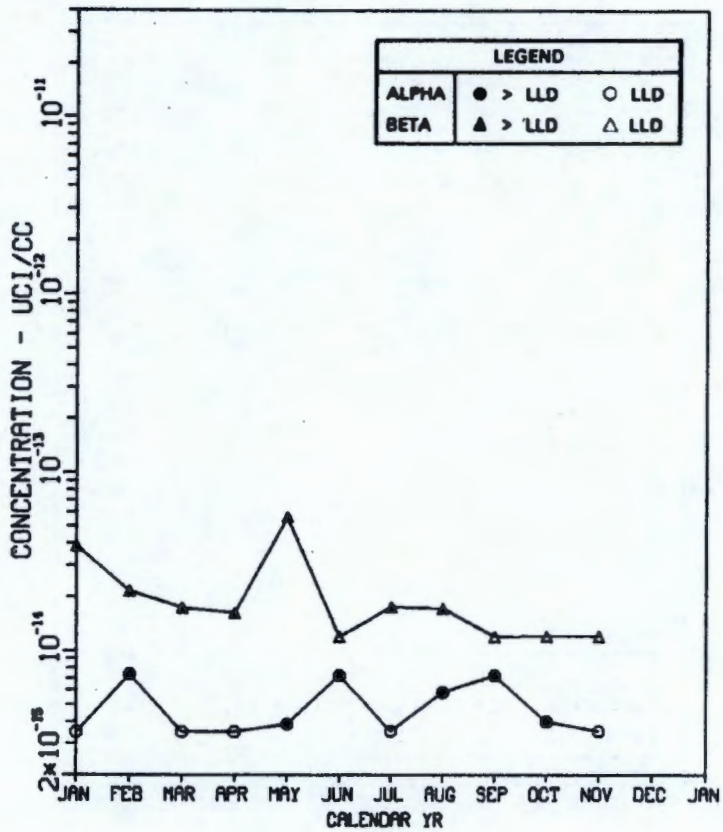



Comments: Annual average gross alpha, gross beta, and uranium concentrations were below ACV. Monthly fluctuations in activity are normal and represent the level of plant operations. The $UO_3$ Plant was not operating from October to December.

$UO_3$ Loadout Room Exhaust
(296-U-13)

EDP Code: U878
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Uranium | <1 E-14 | <1 E-06 |

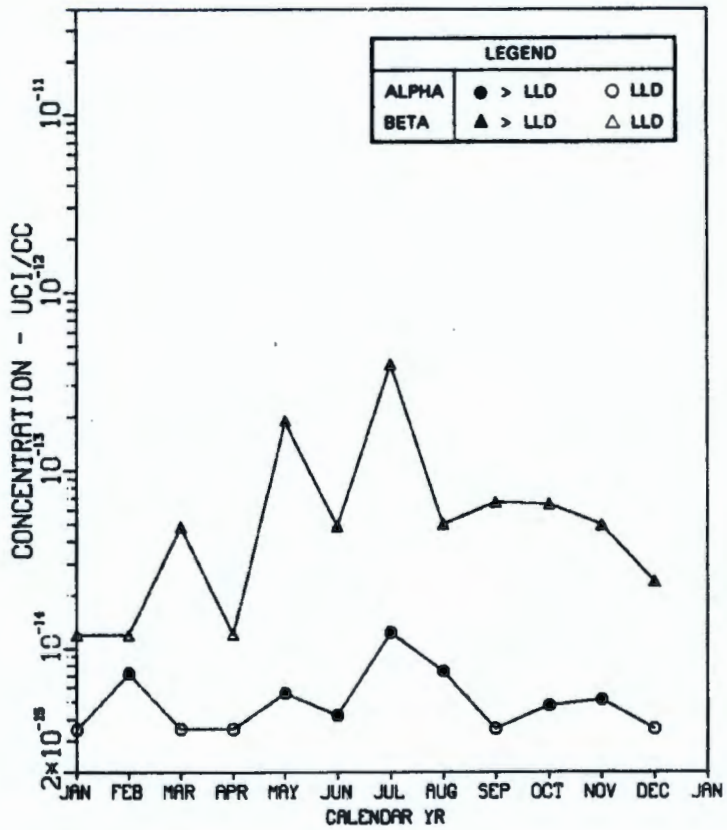



Comments: Annual average gross alpha, gross beta, and uranium concentrations were below ACV. The 296-U-13 stack did not operate in December.

2724-W Dryer/Rotoclone Exhaust
(296-W-1)

EDP Code: L100
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <6 E-15 | <2 E-06 |
| Gross beta | 7 E-14 | 1 E-05 |

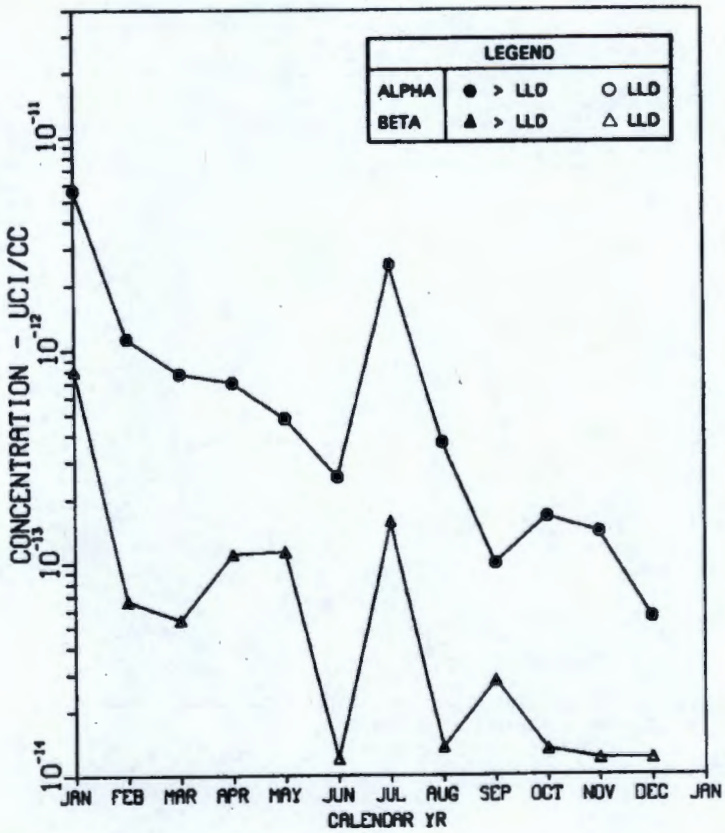



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PFP Process and Building
Ventilation (291-Z-1)

EDP Code: Z810
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross beta | 1 E-13 | 4 E-04 |
| $^{238}Pu$ | 5 E-14 | 2 E-04 |
| $^{239,240}Pu$ | 9 E-13 | 3 E-03 |
| $^{241}Pu$ | 4 E-12 | 1 E-02 |

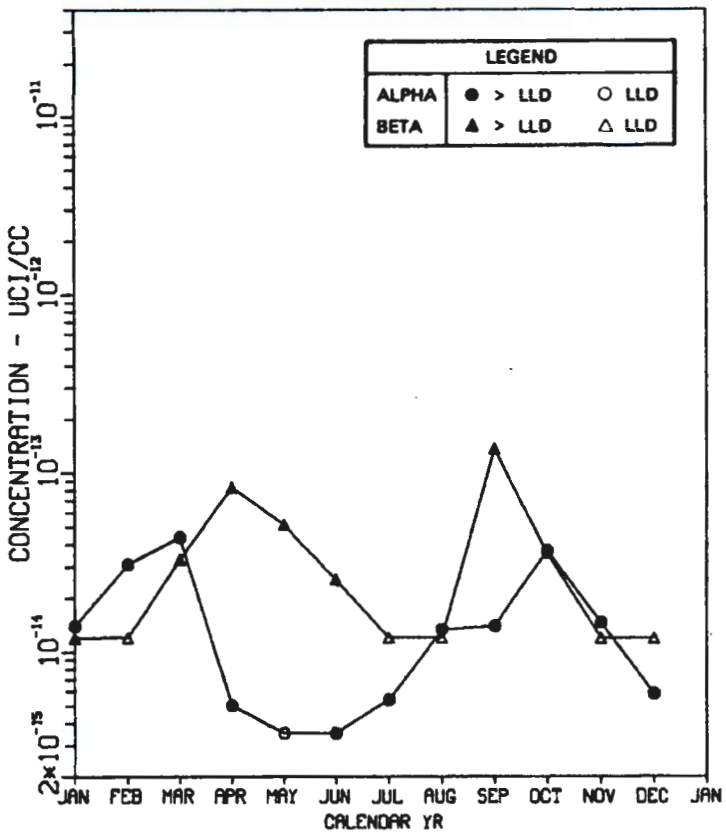



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV. The increased activity in January and July was due to breaches in the 9AB filter box filters caused by out-of-specification concentrations of hydrogen fluoride gas in the Remote Mechanical-C Line fluorinator.

241-Z Vault Ventilation
(296-Z-3)

EDP Code: Z813
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross beta | <4 E-14 | <7 E-07 |
| $^{239,240}Pu$ | 4 E-14 | 6 E-07 |

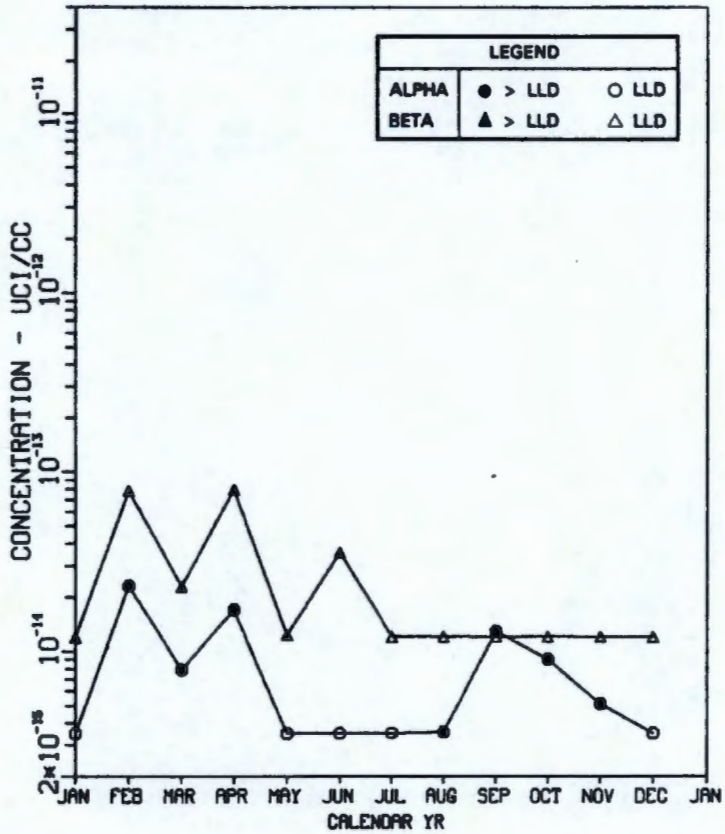



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

2736-ZB Building Exhaust
(296-Z-5)

EDP Code: Z913
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <9 E-15 | <2 E-06 |
| Gross beta | <3 E-14 | <4 E-06 |

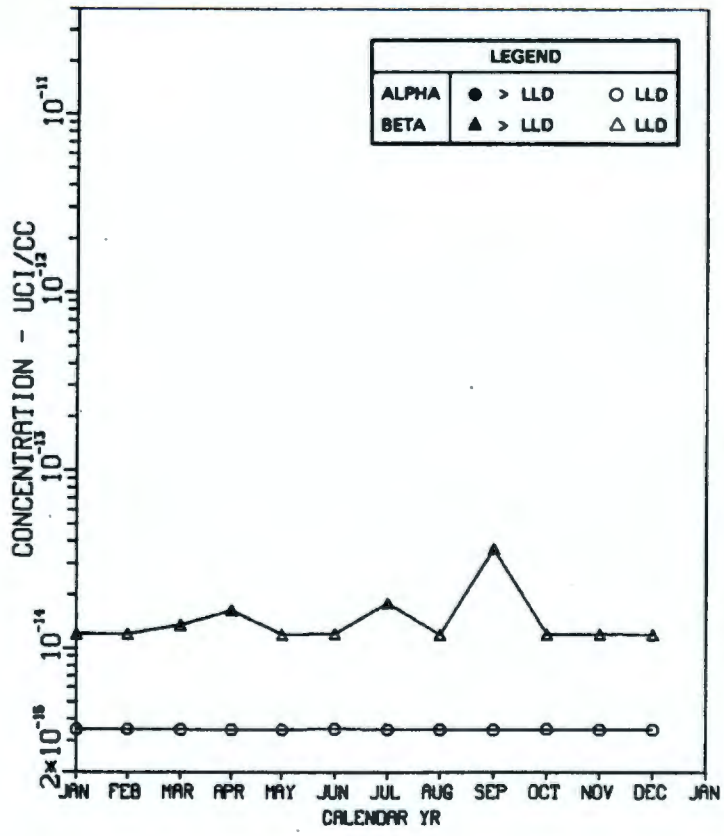



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

2736-ZB Plutonium Storage Vault Exhaust
(296-Z-6)

EDP Code: Z802
New Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <5 E-07 |
| Gross beta | <2 E-14 | <2 E-06 |

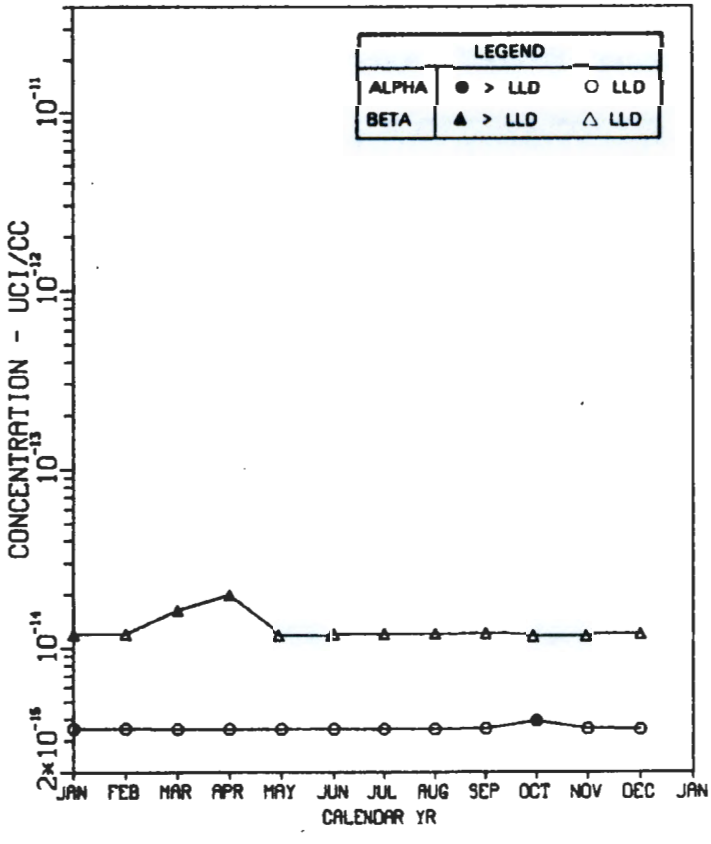



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

231-Z Building Exhaust
(296-Z-10)

EDP Code: W860
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <2 E-07 |
| Gross beta | <2 E-14 | <7 E-07 |

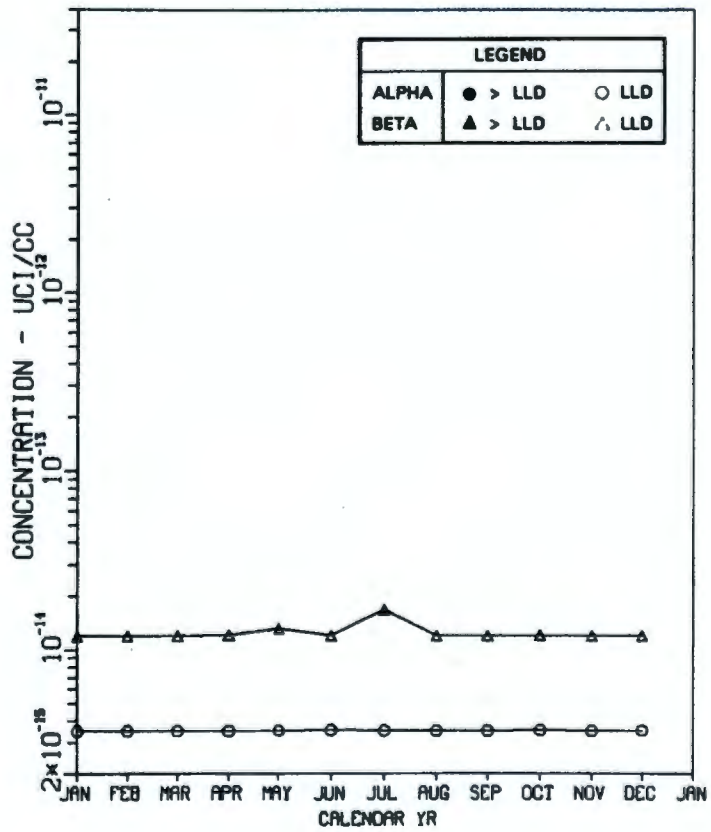



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

231-Z Change Room Exhaust
(296-Z-11)

EDP Code: W861
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <4 E-15 | <1 E-07 |
| Gross beta | <2 E-14 | <4 E-07 |




Comments: Annual average gross alpha and gross beta concentrations were below ACV.

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# APPENDIX C

## RADIOACTIVE LIQUID DISCHARGE DATA FOR 1986

Liquid effluent streams are identified by name, name initials, or in some instances, by the location of the discharge point (i.e., S-11 ditch or U-12 crib). This identification appears as the "site code" in the pages of this appendix. Facilities in which the streams originate are designated as either old or new for purposes of regulation at the point of release. Discharges are compared to Rockwell Hanford Operations (Rockwell) administrative control values (ACV). The ACV are listed in table 1-1 of this document. The ACV for gross alpha and gross beta in discharges to the surface (ponds and ditches) and to the subsurface soil column (cribs) are given below as a reference when viewing the graphs and tables.

| | Old facility | New facility |
|---|---|---|
| Discharges to surface | | |
| Gross alpha ($\mu Ci/cm^3$) | 5 E-06 | 5 E-06 |
| Gross beta ($\mu Ci/cm^3$) | 3 E-07 | 3 E-07 |
| Discharges to subsurface | | |
| Gross alpha ($\mu Ci/cm^3$) | 5 E-06 | 5 E-06 |
| Gross beta ($\mu Ci/cm^3$) | 1 E-05 | 3 E-07 |

When a monthly average concentration is greater than the lower limit of detection (LLD), the symbol on a graph is enclosed in a square. When a monthly average concentration is less than the LLD, the symbol on the graph is the LLD and is not enclosed in a square. In the tables, an annual average concentration that is below the LLD is preceded by the less than symbol.

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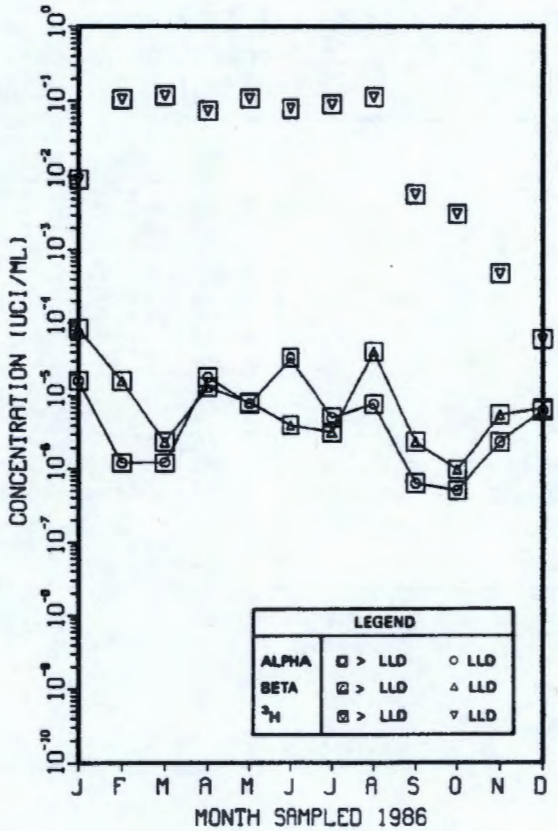
PUREX Process Condensate
To 216-A-10 Crib

Site Code: PDD
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| $^{3}H$ | 8 E-02 | 6 E+03 |
| $^{89,90}Sr$ | <6 E-08 | <5 E-03 |
| $^{95}Nb$ | 6 E-07 | 5 E-02 |
| $^{99}Tc$ | 1 E-06 | 8 E-02 |
| $^{103}Ru$ | 4 E-07 | 3 E-02 |
| $^{106}Ru$ | 1 E-05 | 1 E+00 |
| $^{129}I$ | 2 E-07 | 2 E-02 |
| $^{137}Cs$ | <7 E-08 | <5 E-03 |
| $^{147}Pm$ | 1 E-06 | 1 E-01 |
| $^{238}Pu$ | 8 E-07 | 6 E-02 |
| $^{239,240}Pu$ | 9 E-06 | 7 E-01 |
| $^{241}Pu$ | 1 E-04 | 7 E+00 |
| $^{241}Am$ | <2 E-06 | <2 E-01 |
| Uranium | 5 E-08 | 3 E-03 |

PUREX Process Condensate
To 216-A-10 Crib

Site Code: PDD
Old Facility




Comments: Average annual plutonium releases exceeded the ACV due to overflows from backcycle waste concentrator H-4 to the PDD header, and absorption of plutonium into the PDD from the L Cell vessel vent offgas. Specific radionuclide analyses indicate that ACV were met for all other radionuclides. Crib 216-A-10 was deactivated at the end of 1986 and was replaced with the 216-A-45 crib. The downward trend in $^{3}H$ concentrations after August is due to the shutdown of PUREX operations.

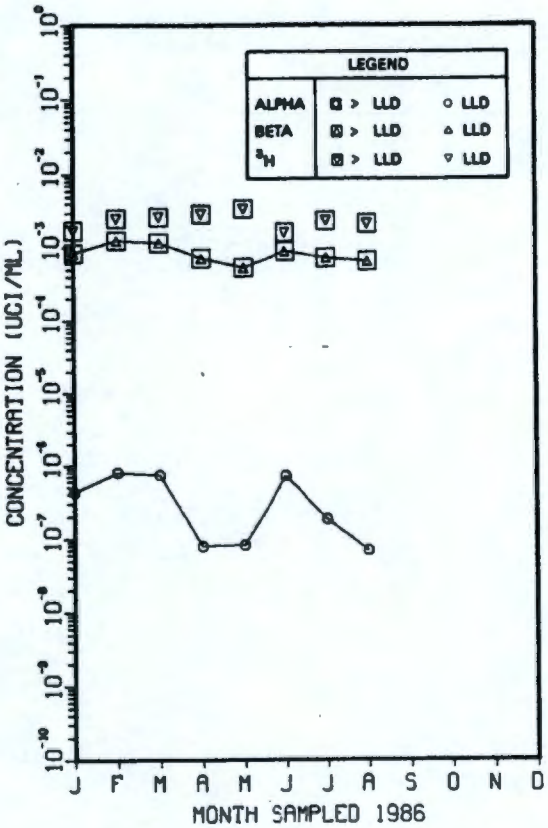
PUREX Ammonia Scrubber
To 216-A-36B Crib

Site Code: ASD
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| $^{3}H$ | 2 E-03 | 1 E+02 |
| $^{89,90}Sr$ | 4 E-06 | 2 E-01 |
| $^{99}Tc$ | 2 E-06 | 1 E-01 |
| $^{95}Nb$ | 1 E-06 | 8 E-02 |
| $^{95}Zr$ | 5 E-07 | 3 E-02 |
| $^{103}Ru$ | 4 E-05 | 2 E+00 |
| $^{106}Ru$ | 4 E-04 | 2 E+01 |
| $^{113}Sn$ | 3 E-05 | 2 E+00 |
| $^{129}I$ | <4 E-08 | <3 E-03 |
| $^{137}Cs$ | 6 E-06 | 3 E-01 |
| $^{147}Pm$ | 4 E-05 | 2 E+00 |
| $^{239,240}Pu$ | 4 E-08 | 2 E-03 |
| $^{241}Pu$ | 4 E-07 | 2 E-02 |
| $^{241}Am$ | <2 E-06 | <7 E-02 |

PUREX Ammonia Scrubber
To 216-A-36B Crib

Site Code: ASD
Old Facility

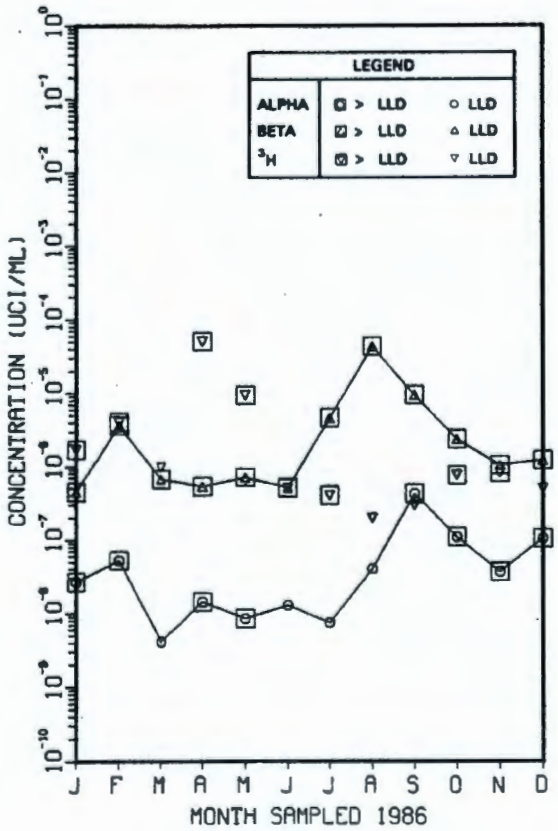



Comments: The $^{106}Ru$ concentration exceeded the ACV on an annual average due to volitilization of ruthenium in the F-11 bottoms. Annual average gross alpha and other specific radionuclide concentrations were below ACV. The ammonia scrubber stream was inactive during the last four months of 1986.

PUREX Steam Condensate
To 216-A-30 (67%) and
216-A-37-2 (33%) Cribs

Site Code: SCD
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-08 | <3 E-02 |
| $^{3}H$ | 8 E-06 | 4 E+00 |
| $^{89,90}Sr$ | 6 E-07 | 3 E-01 |
| $^{137}Cs$ | 3 E-07 | 2 E-01 |

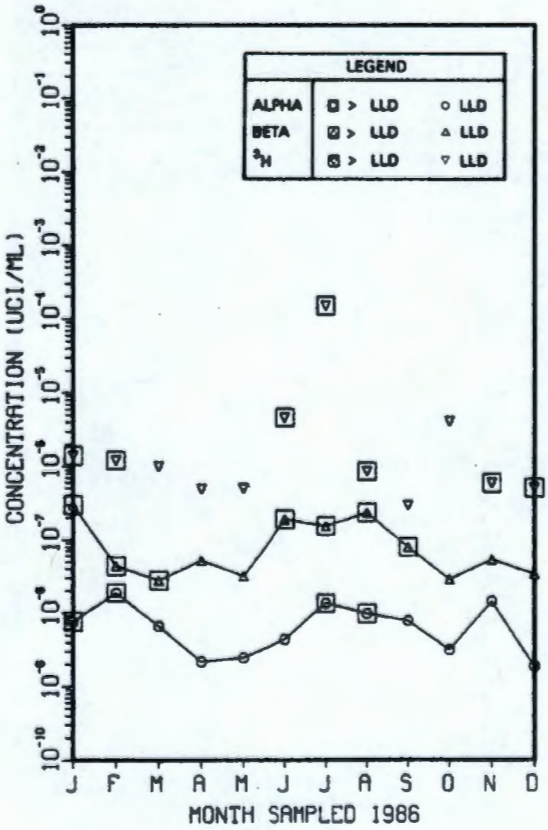



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

PUREX Cooling Water
to 216-B-3 Pond

Site Code: CWL
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <9 E-09 | <9 E-02 |
| $^{3}H$ | 2 E-05 | 3 E+02 |
| $^{89,90}Sr$ | <3 E-08 | <3 E-01 |
| $^{137}Cs$ | <6 E-08 | <6 E-01 |

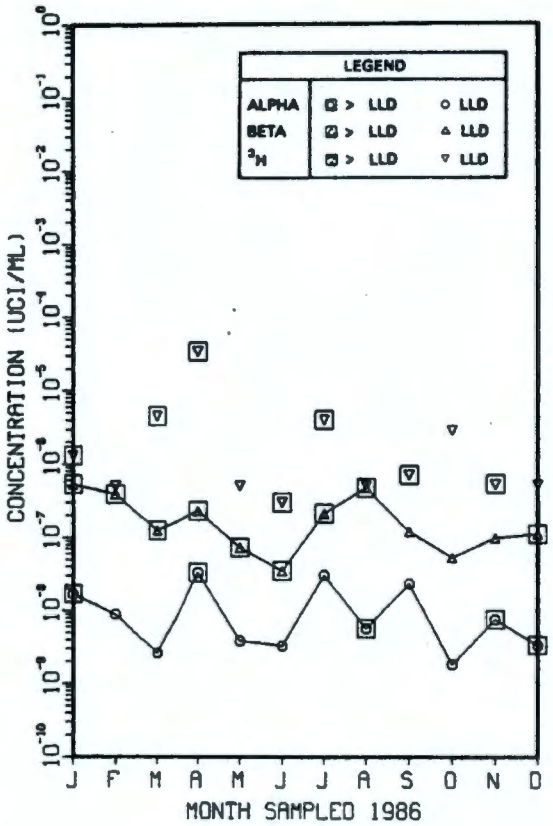



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

PUREX Chemical Sewer
To 216-B-3 Pond

Site Code: CSL
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <2 E-08 | <3 E-02 |
| $^{3}H$ | 5 E-06 | 8 E+00 |
| $^{89,90}Sr$ | <3 E-08 | <5 E-02 |
| $^{137}Cs$ | <5 E-08 | <9 E-02 |

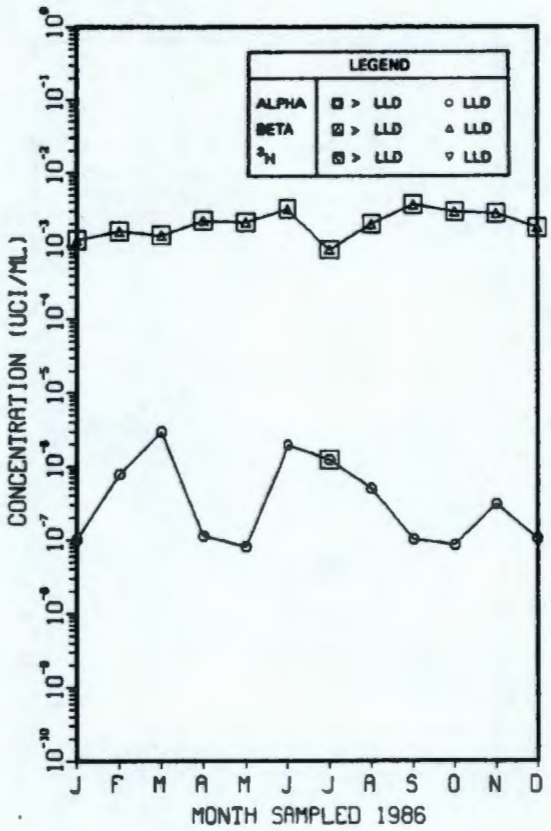



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

B Plant Process Condensate
To 216-B-62 Crib

Site Code: BCP
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <8 E-07 | <4 E-03 |
| $^{89,90}Sr$ | 5 E-04 | 2 E+00 |
| $^{137}Cs$ | 9 E-05 | 3 E-01 |

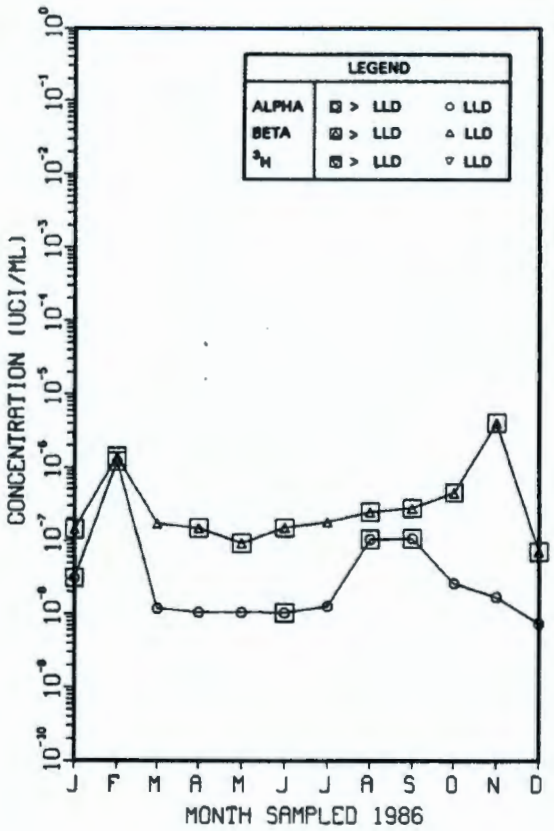



Comments: Radionuclide concentrations of this stream were maintained within limitations of the BCP deviation to Rockwell ACV. Actions planned to reduce the radioactivity of this discharge include replacement of the deentrainer on the E-23-3 concentrator and addition of a reverse osmosis system and an ion exchange column to the BCP system. The new deentrainer is scheduled for October 1987. A reverse osmosis and an ion exchange system will be installed if further reductions in radioactivity concentrations are necessary. This stream was diverted to underground storage tanks at the end of 1986. Resumption of flow will resume after the deentrainer is proven effective in reducing radionuclide concentrations to RHO-MA-139 guidelines.

B Plant Steam Condensate
To 216-B-55 Crib

Site Code: BCS
Old Facility

| Radionuclide | Annual average concentration (µCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | 2 E-07 | 9 E-04 |
| Gross beta | 5 E-07 | 2 E-03 |

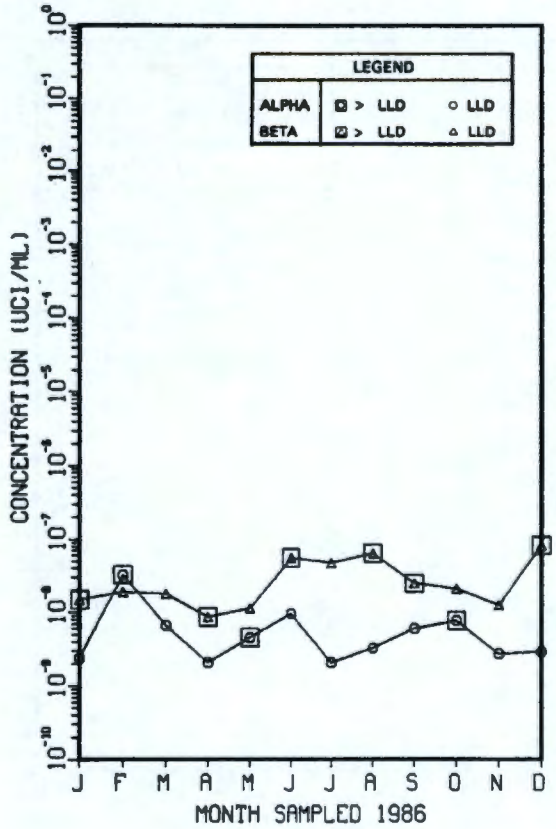



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

B Plant Cooling Water
To 216-B-3 Pond

Site Code: CBC
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <7 E-09 | <3 E-02 |
| Gross beta | <4 E-08 | <2 E-01 |

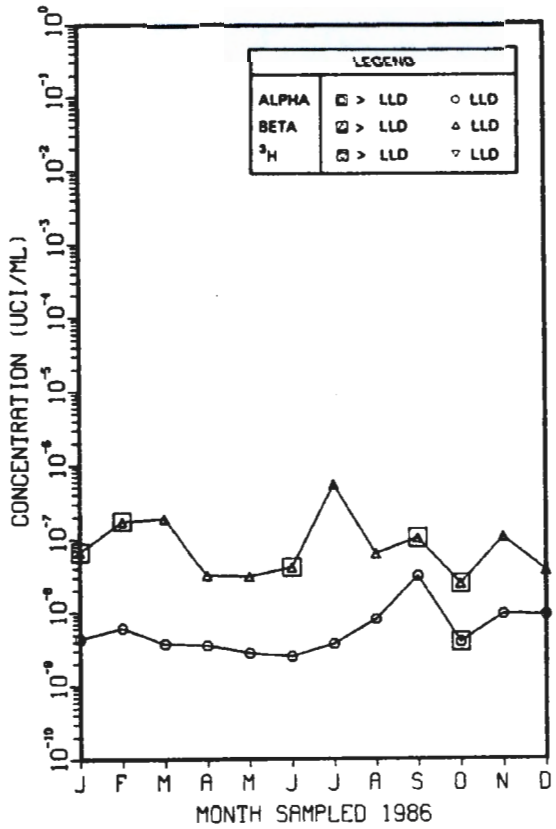



Comment: Annual average gross alpha and gross beta concentrations were below ACV.

B Plant Chemical Sewer
To 216-B-63 Trench

Site Code: BCE
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <7 E-09 | <4 E-03 |
| Gross beta | <2 E-07 | <7 E-02 |

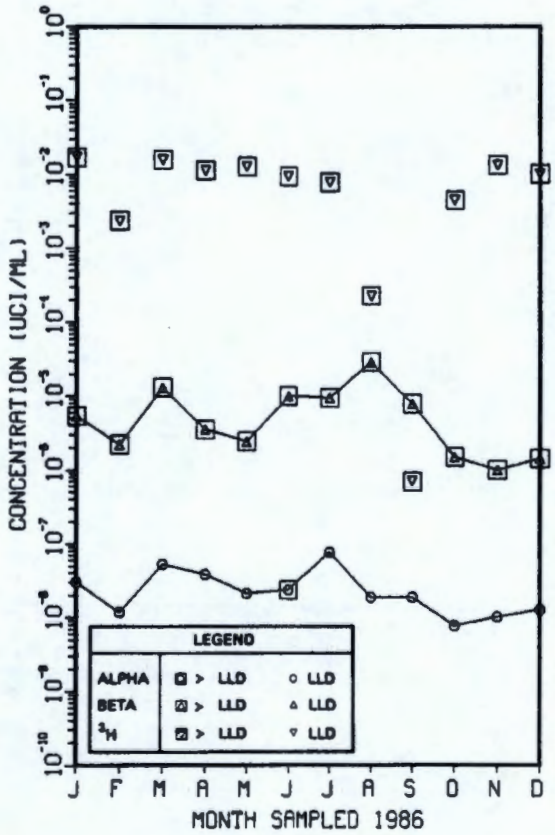



Comment: Annual average gross alpha and gross beta concentrations were below ACV.

242-A Process Condensate
To 216-A-37 Crib

Site Code: AFPC
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <3 E-08 | <2 E-03 |
| $^{3}H$ | 1 E-02 | 6 E+02 |
| $^{89,90}Sr$ | 4 E-07 | 2 E-02 |
| $^{129}I$ | <2 E-08 | <1 E-03 |
| $^{137}Cs$ | 6 E-07 | 3 E-02 |
| $^{147}Pm$ | 1 E-06 | 6 E-02 |
| Uranium | <1 E-09 | <6 E-05 |

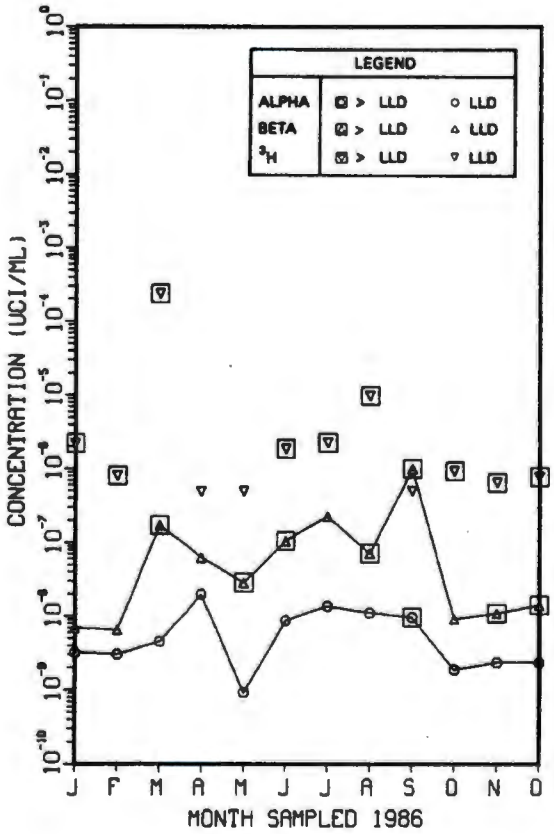



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

242-A Steam Condensate
to 216-B-3 Pond

Site Code: ASC
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-09 | <4 E-04 |
| Gross beta | <9 E-08 | <6 E-03 |
| $^{3}H$ | 3 E-05 | 2 E+00 |

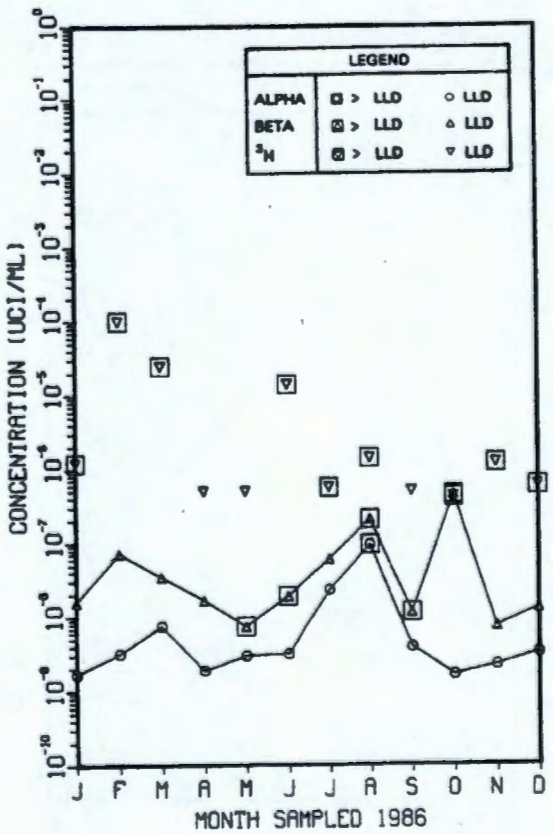



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

242-A Cooling Water
to 216-B-3 Pond

Site Code: ACW
Old Facility

| Radionuclide | Annual average concentration (µCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <6 E-09 | <3 E-02 |
| Gross beta | <1 E-07 | <4 E-01 |
| $^{3}H$ | 1 E-05 | 4 E+01 |

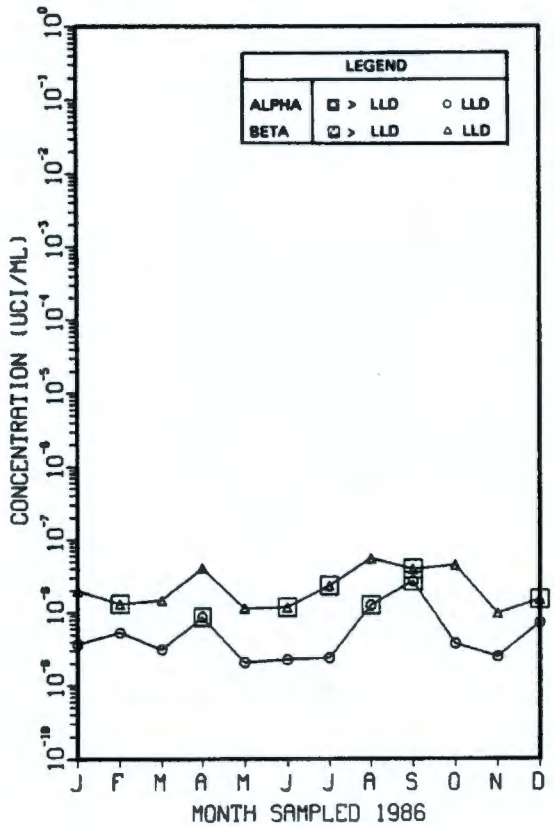



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

244-AR Vault Cooling Water
to 216-B-3 Pond

Site Code: CAR
Old Facility

| Radionuclide | Annual average concentration (µCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <8 E-09 | <1 E-03 |
| Gross beta | <3 E-08 | <4 E-03 |

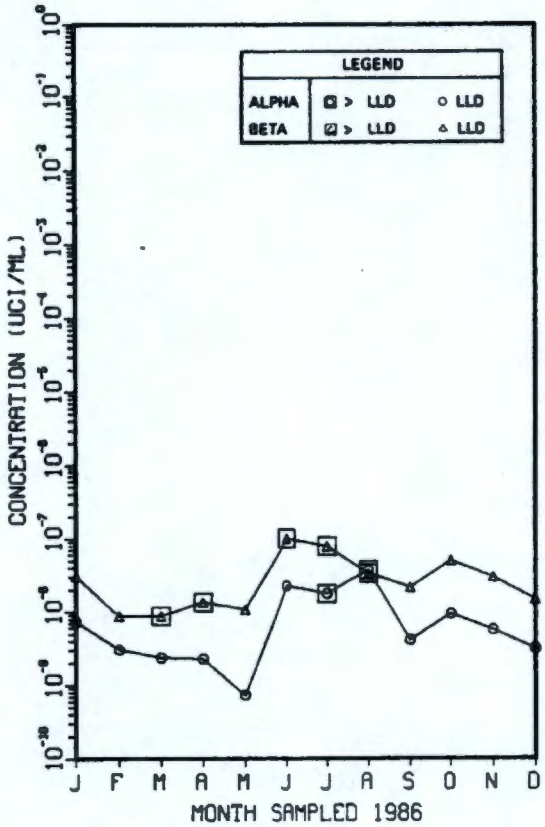



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

241-A Tank Farm Surface
Condenser Cooling Water
to 216-B-3 Pond

Site Code: CA8
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <1 E-08 | <7 E-03 |
| Gross beta | <4 E-08 | <3 E-02 |

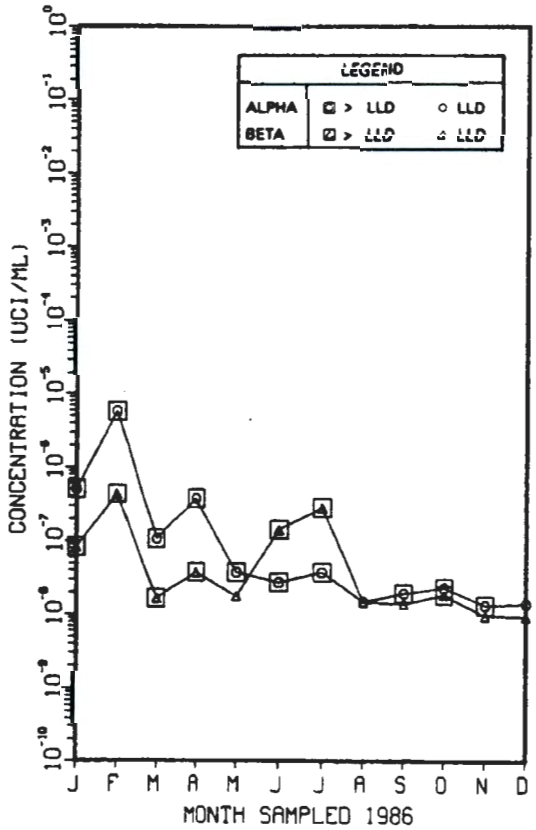



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

PFP Waste Water and
231-Z Waste Water
To 216-Z-20 Crib

Site Code: 2904-ZA
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross beta | 9 E-08 | 3 E-02 |
| $^{239,240}Pu$ | 4 E-07 | 1 E-01 |
| $^{241}Pu$ | 1 E-06 | 4 E-01 |
| $^{241}Am$ | <1 E-06 | <4 E-01 |

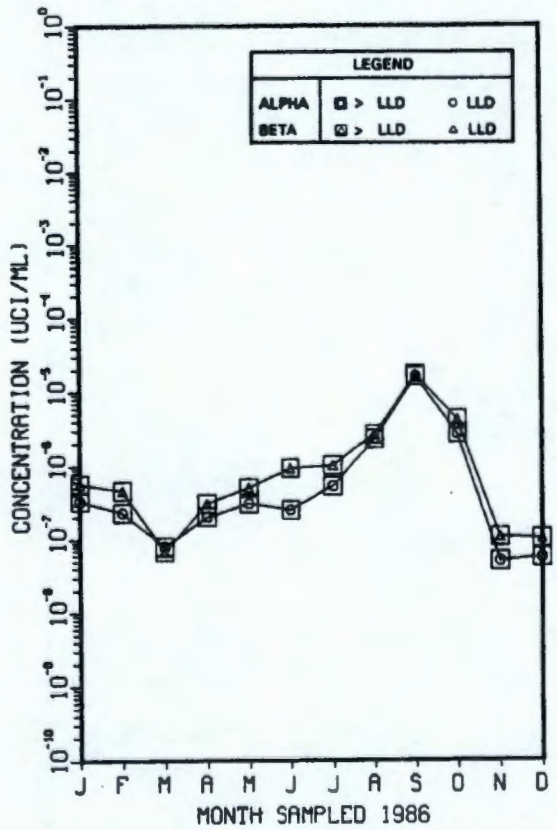



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

$UO_3$ Process Condensate
To 216-U-12 Crib

Site Code: U-12
Old Facility

| Radionuclide | Annual average concentration (µCi/mL) | Total activity (Ci) |
|---|---|---|
| Uranium | 4 E-06 | 2 E-02 |

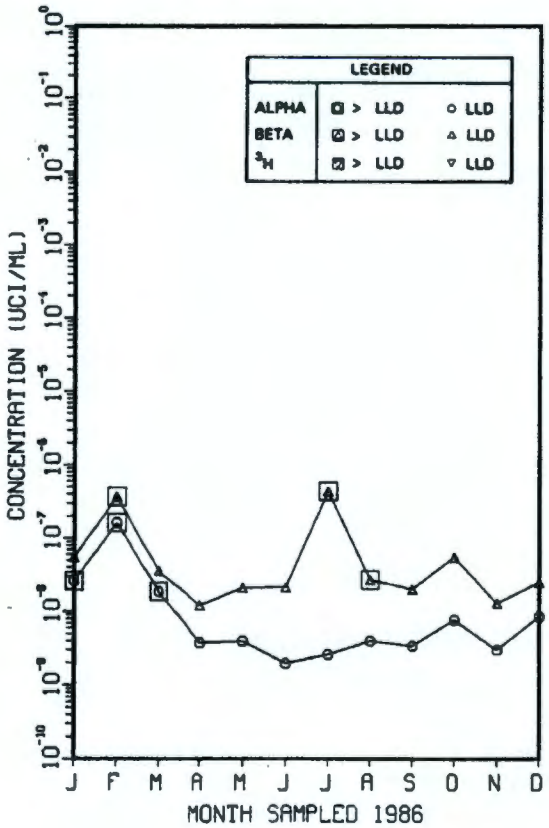



Comments: Annual average gross alpha, gross beta, and uranium concentrations were below ACV. Trends in gross alpha and gross beta are directly related to the level of $UO_3$ Plant operations.

$UO_3$ Steam Condensate and Cooling Water
To 216-U-14 Ditch

Site Code: 207-U
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Uranium | 2 E-08 | 1 E-02 |

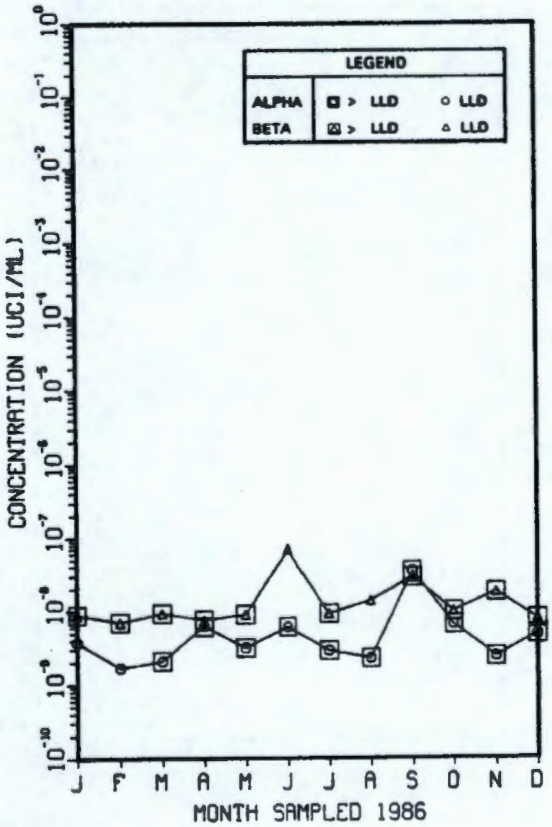



Comments: Annual average gross alpha, gross beta, and uranium concentrations were below ACV.

222-S Waste Water
To 216-S-26 Crib

Site Code: 207-SL
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | 7 E-09 | 3 E-04 |
| Gross beta | <2 E-08 | <7 E-04 |

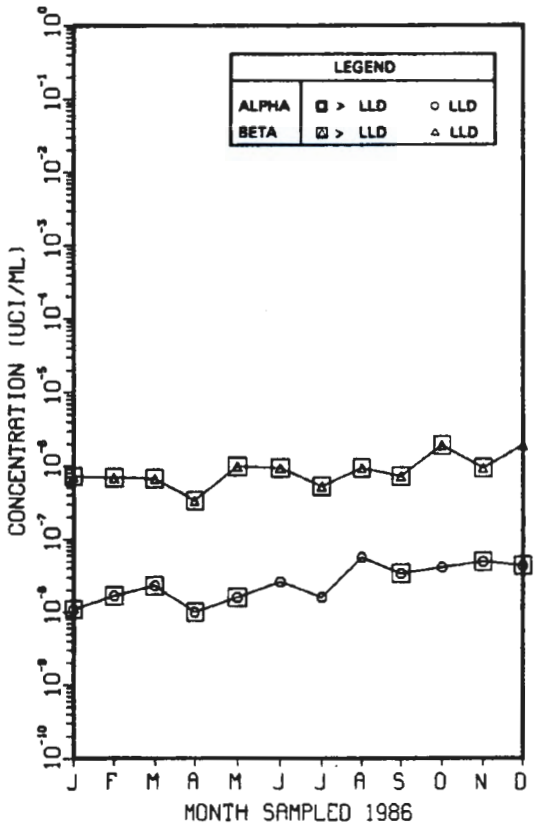



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

2724-W Laundry Waste Water
To 216-W-LWC Crib

Site Code: LWC
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <3 E-08 | <2 E-03 |
| $^{60}Co$ | 3 E-07 | 2 E-02 |
| $^{89,90}Sr$ | 8 E-08 | 4 E-03 |
| $^{137}Cs$ | <2 E-07 | <5 E-03 |

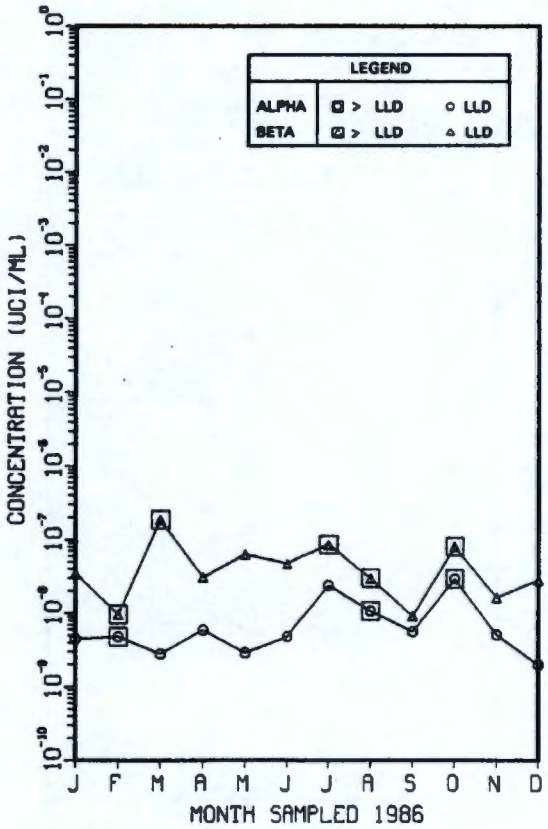



Comments: Annual average gross alpha, gross beta, and specific radionuclide concentrations were below ACV.

242-S Steam Condensate
To 216-U-14 Ditch

Site Code: RC1
Old Facility

| Radionuclide | Annual average concentration (µCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <9 E-09 | <2 E-04 |
| Gross beta | <6 E-08 | <9 E-04 |

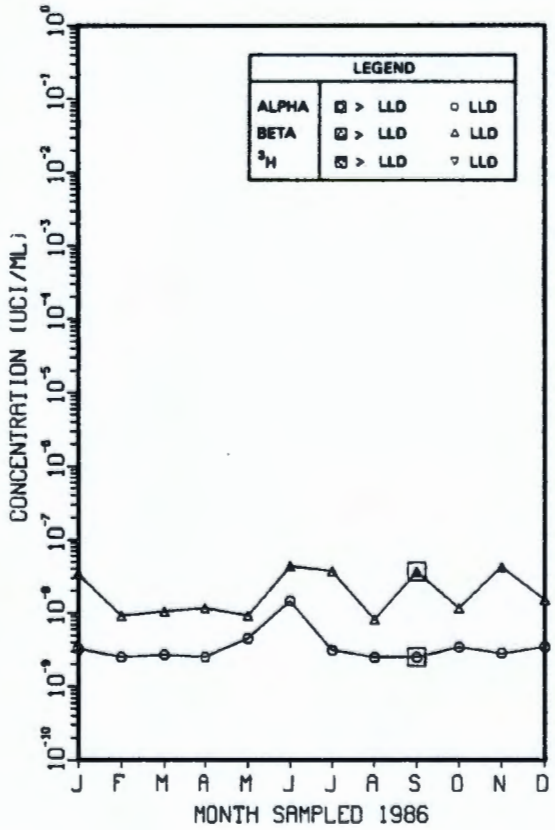



Comments: Annual average gross alpha and gross beta concentrations were below ACV.

REDOX Chemical Sewer
To 216-S-10 Ditch

Site Code: S-10
Old Facility

| Radionuclide | Annual average concentration (μCi/mL) | Total activity (Ci) |
|---|---|---|
| Gross alpha | <5 E-09 | <9 E-04 |
| Gross beta | <3 E-08 | <5 E-03 |




Comments: Annual average gross alpha and gross beta concentrations were below ACV.

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# APPENDIX D

## GLOSSARY

**Administrative Control Value (ACV)** - The concentration of a given radionuclide at the point of release in an effluent that provides an acceptable operation safety limit. The ACV used in 1986 is either a Table I or Table II value, as specified in RHO-MA-139, Environmental Protection Manual, Appendix A (Rockwell 1985). The ACV for $^{85}Kr$ and $^{3}H$ is a total discharge limit (see table 1-1 of this document). One liquid and one gas stream contain deviations from Table I and Table II values. While Rockwell continued to use Table I and Table II guides as the basis for ACV in 1986, a revision to RHO-MA-139 was initiated in 1986 that will change the basis for ACV to multiples or fractions of the DCG (Delaney 1986). Use of the ACV based on the DCG will take place in CY 1987 in accordance with the provisions of the revised version of RHO-MA-139 (Rockwell 1987).

Although Table I and Table II concentration guides have been eliminated as guidelines for offsite personnel protection by Vaughan (1985) and replaced by the DCG provided in Delaney (1986), Rockwell's interim use of Table I and Table II guides in 1986 provided at least the same or greater protection to the public as the DCG. The reason for this is that Rockwell applies the Table I and Table II guides at the point of release and not at the point of public exposure as is the case with the DCG.

**Background Radiation** - Naturally occurring radioactivity in the air, water, soil, and in man-made materials (i.e., cosmic rays, uranium, radium, thorium, and potassium).

**Calibration** - Determining the deviations of an instrument from a standard traceable to the National Bureau of Standards (NBS) or other recognized agency and eliminating the deviations by adjustment.

**Crib** - An underground structure into which liquid wastes are discharged so that most radionuclides are sorbed in the soil before the liquid reaches the groundwater.

**Derived Concentration Guide (DCG)** - The DCG are those concentrations of radionuclides in air or water that would result in maximum-effective committed-dose equivalent of 100 mrem/yr under conditions of continuous exposure or use (i.e., continuously breathing or being immersed in contaminated air or exclusively drinking contaminated water).

**Detection Limit Level** - See Lower Limit of Detection.

**Deviation** - A departure from normal requirements where economical, technological, or risk considerations forestall compliance in the near future.

**Effluent** - A stream (liquid or gaseous) released to the environment from a designed system. The effluents of concern are those which require evidence that contaminant concentrations are within regulatory guidelines.

**Effluent Monitoring** - Measuring contaminants in the effluent stream (liquid or air) continuously or in near real-time.

**Effluent Sampling** - Collecting a representative sample (liquid or air) and performing laboratory analyses.

**Exhaust System** - Any system which mechanically vents airborne or gaseous material to the atmosphere.

**Facility** - A processing plant, tank farm, shop, laboratory, powerhouse, or laundry. This includes all contiguous land, structures, storage and disposal sites.

**Fission Products** - Atoms, usually radioactive, formed by splitting large atoms such as uranium and plutonium.

**Flow Totalization** - The cumulative measurement of the quantity of liquid or gas in terms of mass or volume per unit time.

**Grab Sample** - A single sample removed from a stream over a short-time interval.

**Half-Life** - The length of time required for a radionuclide to lose one-half of its radioactivity.

**HEPA** - High-efficiency particulate air filter. To qualify as a HEPA, a filter must achieve an efficiency of 99.97% in the removal of airborne particulates of $>3.0 \times 10^{-5}$ cm (0.3 μm) in size.

**Isokinetic** - A condition that prevails when the velocity of the stream entering a sampling probe is identical to the velocity of the stream being sampled. (See Near Isokinetic.)

**Less Than Detectable** - See Lower Limit of Detection.

**Lower Limit of Detection** - The lower limit of detection (LLD) is given by:

$$LLD = \frac{(4.6 \times Sb) + (2.27/T)}{E \times V \times 2.22 \times 10^{6} \times Y \times e^{(-\lambda \Delta \tau)}}$$

where:

Sb = the standard deviation of the background counting rate (counts per minute)

T = the counting time (minutes)

E = the counting efficiency (counts per disintegration)

V = the sample size (mass or volume)

2.22 E+06 = the number of disintegrations per minute per microcurie

Y = the fractional radiochemical yield when applicable

e = the base of natural logs (i.e., 2.718 ...)

$\lambda$ = the radioactive decay constant for the particular radionuclide

$\Delta\tau$ = the elapsed time between sample collection (or end of the sample collection period) and time of counting.

**Minimum Detectable Concentration** - See Lower Limit of Detection.

**Mixed Waste** - Radioactive waste that also contains hazardous waste constituents.

**Monitoring System** - Instrumentation that provides the near real-time measurement of an airborne or liquid waste stream parameter. The system includes a detector and associated readout components. A continuous monitoring system measures the stream parameter(s) continuously. A radiation monitoring system is a system in which radiation is the measured parameter. An integrating monitoring system integrates the instantaneously measured parameter over a time period. A sampling system is distinguished from a monitoring system by the fact that a sampling system does not measure and read out a near real-time stream parameter.

**Near Isokinetic** - A condition in which the velocity of a stream entering a sampling probe is within $\pm$20% of the isokinetic condition.

**New Facility** - A facility with a Beneficial-Use Date after October 13, 1977. Until the end of 1986, the ACV for radionuclides in both liquid and gaseous effluents from new facilities are Table II values as specified in RHO-MA-139, Environmental Protection Manual.

**Noncompliance** - The facility, system, equipment, or procedure does not conform to the requirements of RHO-MA-139.

**Normally Contaminated** - An effluent from a facility or area that normally contains radioactive materials in quantities in excess of 10% of Table II administrative control values specific in RHO-MA-139.

**Old Facility** - A facility with a Beneficial-Use Date prior to October 13, 1977. Until the end of 1986, the ACV for radionuclides in liquid effluents to cribs, except for transuranics and in gaseous effluents are Table I values as specified in RHO-MA-139. The ACV for radionuclides in liquid effluents from old facilities to ponds and ditches are Table II values.

**Potentially Contaminated** - An effluent from a facility or area which may, due to an upset condition, release radioactive material in sufficient quantity to exceed 10% of the yearly average Table II administrative control values specified in RHO-MA-139.

**Proportional Sampling** - The ratio of the volume of the sample taken to the volume of the discharge is known as in batch sampling or is maintained constant as in flow-proportional sampling.

**Quality Assurance** - The method for verifying planning, implementation, methods, training, control, and management of all aspects of a program. Documentation provided should be adequate to permit a knowledgeable person to reconstruct results from information supplied or to obtain comparable results with similar instrumentation and procedures.

**Radioactive Solid Waste** - Any solid material that contains concentrations of radioactive materials exceeding the surface soil contamination standards specified in RHO-MA-139.

**Record Sample** - A representative sample collected in a sampling system for laboratory analysis and used as the basis for reporting the amount and concentration of radionuclides released to the environment.

**Representative Sample** - The average stream parameter being measured in the sample occurs in the same average proportion in the effluent.

**Sampling System** - Instrumentation and equipment that removes part of a liquid or airborne waste stream for subsequent quantitative determination of a stream parameter. The system generally employs such devices as filters, other sample collection media, or effluent traps of some kind. A continuous sampling system removes a part of the stream continuously except during sample change, maintenance, or other necessary outages. An incremental sampling system removes a part of the stream at the end of predefined increments of time or discharge volume. The increments are designed to be short enough to provide a representative sample. A grab sampling system removes an instantaneous part of the stream or removes a part of the stream over a period of time.

**Separations Area** - The fenced 200 Areas and those areas (such as B Pond and Gable Mountain Pond) which will have received or continue to receive liquid waste discharged from previous or current chemical processing operations.

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REQUIREMENTS FOR HANFORD LDR PLAN

1. Storage

The Hanford Land Disposal Restrictions Plan (LDR Plan) shall include a Storage Report that contains the following information on mixed wastes:

a. an identification and description of the mixed waste at Hanford. The identification and description shall include the RCRA hazardous waste code, process information necessary for waste identification and land disposal restrictions (LDR) determinations, including, where possible, a history of how the waste was generated, the source of the hazardous constituents, how the waste was managed prior to storage, and a general timeframe determination which serves to categorize when the waste was placed in storage, radioactivity type (i.e., high level waste, low level waste, transuranic waste), and physical form of the waste (e.g., solid, liquid, sludge);

b. the quantity of waste identified and described in a. above;

c. physical location and method of storage (e.g., container, tank, surface impoundment, waste pile) of waste identified and described in a. above, including a list of areas permitted for storage of these wastes;

d. the Department of Energy's (DOE) assessment of the compliance status of the storage methods pursuant to applicable State and Federal standards;

e. identification of any releases of hazardous waste or hazardous constituents into the environment from these storage units;

f. identification of LDR waste generation rates [on a annual basis, or as otherwise requested by EPA (or Ecology, upon authorization to administrator LDR pursuant to Section 3006 of RCRA)], and estimate of the storage capacity, and when storage capacity will be reached, including an identification of the bases and assumptions used in making such estimate.

g. plans to submit requests for variance(s), case-by-case extension(s) of the LDR requirements, or other exemptions pursuant to Section 3004 of RCRA, for those wastes identified in the Storage Report.

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2. The LDR Plan shall provide for the submission of requests for case by case extensions, variances, and other exemptions of the LDR requirements in accordance with Section 3004 of RCRA and applicable regulations, as required by EPA (or Ecology, upon authorization to administer LDR pursuant to Section 3006 of RCRA).

3. The LDR Plan shall include a comprehensive Waste Characterization Plan, that includes a plan and schedule to characterize all waste stored at Hanford and all waste streams generated at Hanford, and to report characterization results to EPA and Ecology. The Waste Characterization portion of the LDR Plan shall include the steps necessary to confirm which wastes and which waste streams are subject to the LDR.

4. For those wastes covered in the Storage Report, the LDR Plan shall include a Treatment Report, identifying:

   a. treatment and disposal technologies, and treatment capacity, needed to manage these LDR wastes, assuming current waste generation rates;

   b. commercial treatment technologies and extent of capacity currently available to manage these LDR wastes;

   c. DOE treatment technologies and extent of capacity currently available to manage these LDR wastes;

   d. whether any new commercial or DOE treatment capacity is scheduled to be available to manage these LDR wastes, and an assessment of when such new capacity will be available; and

   e. alternate technologies which are in development and which may be used to manage these LDR wastes, and an assessment of when such alternate technologies may become available.

   f. for items d. and e. above, identification of the basis and assumptions utilized in forming the response and in making the assessments, and any foreseeable contingencies (including permit reviews) which may affect the assumptions.

5. The LDR Plan shall include, a Treatment Plan for the LDR wastes identified in the Treatment and Storage Reports. The purpose of the Treatment Plan is to establish, for each LDR waste, milestones and schedules for the development and implementation of treatment technologies that will result in

all LDR wastes being treated to the applicable treatment standard or otherwise managed in accordance with LDR requirements. Such schedules and milestones may vary depending on the type of waste and the technical, legal and administrative requirements for establishing compliance with LDR requirements. The schedule for treatment or management of a particular LDR waste could, for example, range from a short period of time allowing for final permitting of an established, existing technology to a longer timeframe for LDR wastes where there are currently no known treatment technologies. The Treatment Plan, therefore, shall include all applicable milestones and associated schedules for the development and implementation of treatment or management technologies to achieve compliance with LDR requirements for each LDR waste including, as appropriate, such items as: waste characterization data, treatability testing and reporting, feasibility analyses and reports, bench scale and pilot testing and reports, research, development and demonstration projects and reports, design reports, permitting milestones, and treatment design reports, permitting milestones, and treatment milestones.

6. The LDR Plan shall also provide that DOE may treat LDR waste in accordance with applicable law in advance of approved milestone dates. DOE shall notify the parties of such accelerated treatment.

7. Waste Minimization

The LDR Plan shall include a Waste Minimization Plan, which, at a minimum, identifies methods for minimizing the generation of LDR wastes. This Waste Minimization Plan shall address, but not be limited to, process changes that can be made to reduce or eliminate LDR waste, methods to minimize the volume of regulated and restricted wastes through segregation and avoidance of commingling, and substitution of less toxic materials for materials currently utilized at Hanford. This Waste Minimization Plan shall include a schedule for implementation of waste minimization procedures set forth in the LDR Plan, and projections for the reduction of newly generated waste. The projections for reduction shall set forth the basis for the development of the projections, including any assumptions utilized in developing the projections. DOE shall annually revise and submit as part of the annual report that portion of the Storage Report associated with Item 1 above, to conform with the generation projections contained in the Waste Minimization Report. In addition, as part of the annual report, DOE shall submit an amendment to the Waste Minimization Plan containing the information required in this Section for those wastes covered in the Storage Report.

Annually, DOE shall revise and submit that portion of the Storage Report associated with Item 1 above, to conform with generation projections contained in the update to the Waste Minimization Plan.

8. The LDR Plan shall describe how information, plans, and schedules contained in the LDR Plan will be updated as part of the annual reports. The LDR Plan shall also describe how and when the LDR Plan will be revised and reissued, incorporating new information contained in the approved annual reports.

Paul T. Day Date: 4/10/90 Timothy L. Nord Date: 4/10/90

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