WHC-EP-0165-1

Westinghouse Hanford Company 100 Areas Environmental Releases For 1988

EDMC

Prepared for the U.S. Department of Energy
Assistant Secretary for Defense Programs

Westinghouse Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Available from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
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NTIS Price Codes:
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Printed in the United States of America

DISCLM-1.CHP (2-89)

WHC-EP-0165-1

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Date Manuscript Completed
September 1989

Date Published
March 1990

Prepared for the U.S. Department of Energy
Assistant Secretary for Defense Programs

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P.O. Box 1970
Richland, Washington 99352

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Title: WESTINGHOUSE HANFORD COMPANY 100 AREAS ENVIRONMENTAL RELEASES FOR 1988

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DOE-RL	U.S. Department of Energy-Richland Operations Office
EF	Exhaust Fan
EPA	U.S. Environmental Protection Agency
FS	Fog Spray
GSCS	Graphite and Shield Cooling System
LWDF	Liquid Waste Disposal Facility
NPDES	National Pollutant Discharge Elimination System
ND	Not Detected
PCS	Primary Cooling System
RCS	Rod Cooling System
RWR	Raw Water Return
SCS	Secondary Cooling System
SLR	Short-Lived Radionuclide
UO	Unusual Occurrence
WDOE	Washington State Department of Ecology

WESTINGHOUSE HANFORD COMPANY
100 AREAS ENVIRONMENTAL
RELEASES FOR 1988

D. J. Rokkan

ABSTRACT

In 1988, there were no adverse trends observed from the routine radioactive and chemical discharges in the 100 Areas. Also, releases specifically from the N Reactor in the 100-N Area were within the technical specifications that limit operation of the plant. These releases were as expected, for the N Reactor has been shut down since January 7, 1987. The radiological and chemical releases in 1988 were generally less than those in 1987 due to the continued shutdown of the N Reactor. Initially this extended shutdown was ordered for upgrading of the reactor safety systems. However, N Reactor has remained shut down, in "cold standby," due to the uncertain role it has in producing special nuclear materials. This document contains information on nonradioactive and radioactive substances released to the environment from Westinghouse Hanford Company (Westinghouse Hanford) facilities in the 100 Areas during calendar year 1988.

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WESTINGHOUSE HANFORD COMPANY 100 AREAS ENVIRONMENTAL RELEASES FOR 1988

1.0 SUMMARY

This document contains information on nonradioactive and radioactive substances released to the environment from Westinghouse Hanford Company (Westinghouse Hanford) facilities in the 100 Areas during calendar year 1988.

In 1988, there were no adverse trends observed from the routine radioactive and chemical discharges in the 100 Areas. Also, releases specifically from the N Reactor in the 100-N Area were within the technical specifications that limit operation of the plant. These releases were as expected, for the N Reactor has been shut down since January 7, 1987. The radiological and chemical releases in 1988 were generally less than those in 1987 due to the continued shutdown of the N Reactor. Initially this extended shutdown was ordered for upgrading of the reactor safety systems. However, N Reactor has remained shut down, in "cold standby," due to the uncertain role it has in producing special nuclear materials.

Releases of ^{90}Sr via the N Springs in 1988 totaled 2.0 Ci while averaging 6.5×10^3 pCi/L. The total release in 1987 was 2.4 Ci, with a 6.0×10^3 pCi/L average concentration. Comparing 1988 to 1987, the activity released decreased by 17%, while the average concentration increased by 8%. A 69% lower total flow from the N Springs in 1987 is responsible for the smaller release. The lesser total flow in 1988 owes to reduced operational activities and the continued high performance of the 107-N Basin Recirculation Facility. This facility was designed in part to curtail the previously unavoidable discharge of cooling water from the 100-N irradiated fuel storage basin to the soil column of the 1325-N Liquid Waste Disposal Facility (LWDF).

The 1301-N LWDF, situated about 800 feet from the river shoreline, was retired from service in September 1985 and replaced with the 1325-N LWDF, which lies 1,800 feet further inland. For over 20 years, ^{90}Sr accumulated in the soil column of 1301-N, being retained out of radioactive liquid discharged from the reactor. The ^{90}Sr that wasn't adsorbed by the soil column would enter the groundwater and be carried to the nearby riverbank. However, since 1301-N was retired there has been no downward hydraulic means for transporting ^{90}Sr to the N Springs. The groundwater remains as the only transport mechanism for re-mobilizing the old deposits. Strongly indicated from monitoring data is that the deposits in 1301-N, as opposed to 1325-N, are the primary source-term of ^{90}Sr discharges to the river in 1988. Compared to the N Springs average, the groundwater concentrations of ^{90}Sr near 1301-N but between it and the riverbank are typically less by only 50% to 70%. Yet near 1325-N but between it and 1301-N the concentrations are about 0.03% of the average. In addition, the continuous-monitoring well from which record samples for the N Springs are collected is directly in line of the historical flowpath of 1301-N. This well continues to exhibit the highest average concentrations of radionuclides of all the monitoring wells and seepage spots along the roughly 2,000-foot length of the riverbank that is routinely sampled.

In 1988, 15 Ci of ^{90}Sr were discharged to the 1325-N LWDF, which is the same amount discharged in 1987. The concentration averaged 2.5×10^4 pCi/L in 1988 and 1.9×10^4 pCi/L in 1987. A 20% smaller total flow to 1325-N in 1988 accounts for both the increase in concentration and no resultant increase in total activity discharged. Because of the shutdown of the reactor, there were fewer demands for the types of system operations that result in water losses.

Approximately 110 Ci of radionuclides with half-lives greater than 48 h were discharged to 1325-N in 1988, as compared to about 630 Ci in 1987, an 83% decrease. About 2,000 Ci of radionuclides with half-lives shorter than 48 h were measured in 1987. In 1988, none of these radionuclides were detected, all having previously decayed to less than detectable levels.

In 1988, releases of both ^{131}I and ^{60}Co decreased at the N Springs from amounts measured in 1987. For ^{131}I, having a relatively short half-life of 8.1 days, a total of 0.0043 Ci was released in 1987; and in 1988, it was undetectable. For ^{60}Co, 0.052 Ci were released in 1987 and 0.028 Ci in 1988, a 46% reduction. These reductions are attributed primarily to the shutdown of the reactor.

Production of short-lived noble gases ceases when the reactor is shutdown. In 1988, there was no radioactivity detected associated with these gases. Only 4,400 Ci were released in 1987, all in early January.

For chemical releases, the amount of hydrazine estimated to have been released in 1988 to 1325-N (39 lb) increased 550% over the release total of 1987 (6 lb). This increase is an effect of the shutdown. More hydrazine (an oxygen-scavenging chemical) is required to control corrosion in the coolant piping systems of the reactor when it is not operating. Also, the operating time of the boilers was reduced in 1988, allowing the temperature of the coolant to drop. A lower coolant temperature generally requires a larger concentration of hydrazine to maintain adequate oxygen control. As a result of these conditions, more unreacted hydrazine persists in liquid discharges from the plant.

Analyses of samples routinely collected from radioactive liquid and airborne streams were performed using the Westinghouse Hanford 100-N radioanalytical laboratory and the services of U.S. Testing Company. Analyses of nonradioactive constituents were performed in the Westinghouse Hanford 100-N water chemistry laboratory and by the Hanford Environmental Health Foundation.

The graphs in Figures 1-1 through 1-4 depict the releases of radionuclides from 100-N that are or have been significant contributors to offsite doses or that are chemically or physically indicative of the behavior of other radionuclides released. The graphs compare the cumulative effluent releases of each of these "indicator" radionuclides in 1986, 1987, and 1988. Releases from 1986 are included because it was the most recent regular operating year for N Reactor. The remainder of this document consists of tables, other graphs, and narratives detailing routine and unplanned releases in the 100 Areas.

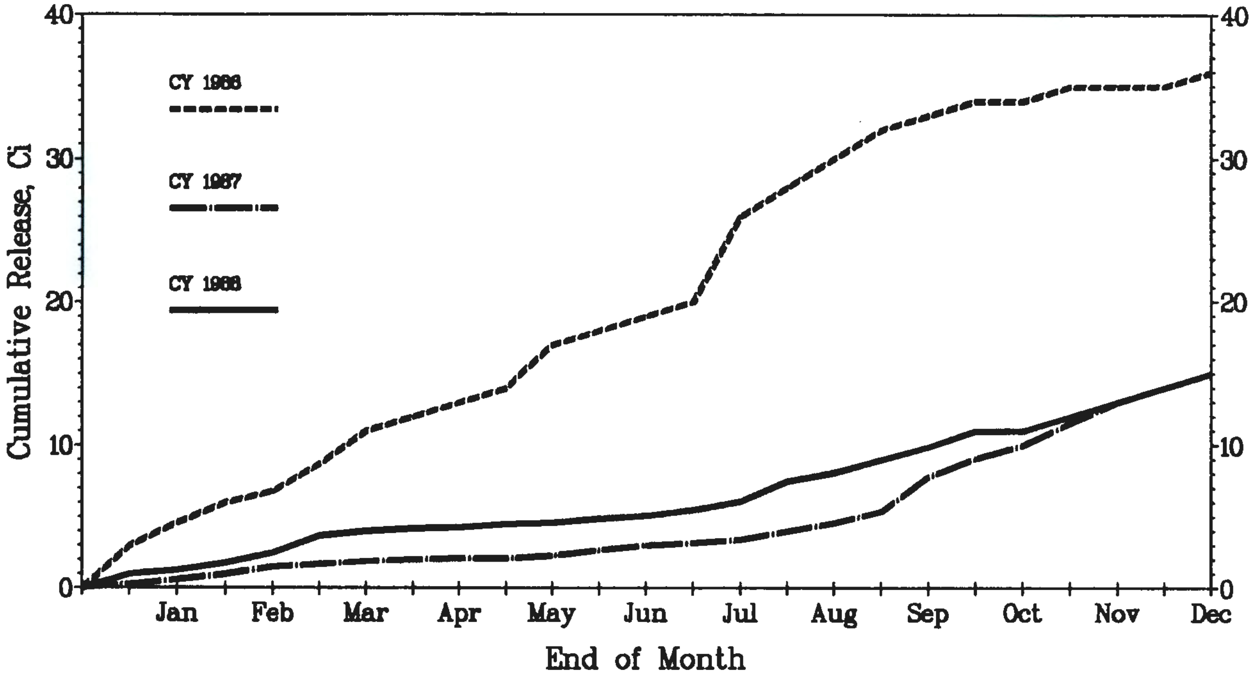

Figure 1-1. Strontium-90 Discharges to the 1325-N Liquid Waste Disposal Facility.

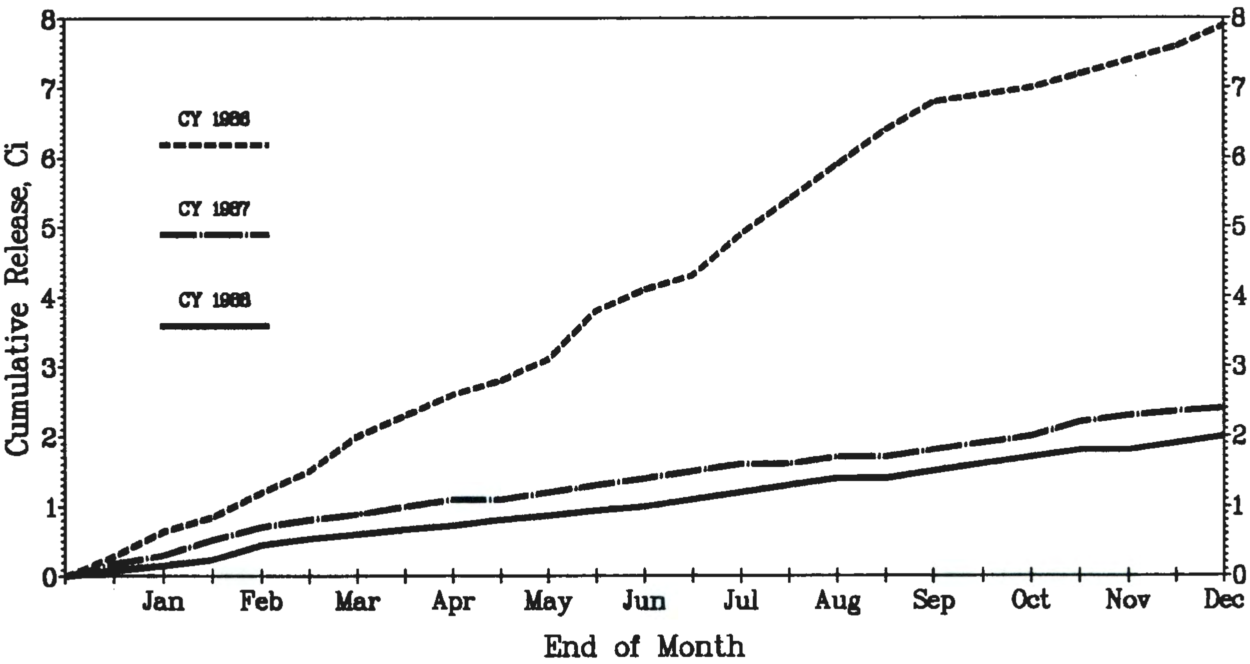

Figure 1-2. Strontium-90 Discharges via the N Springs.

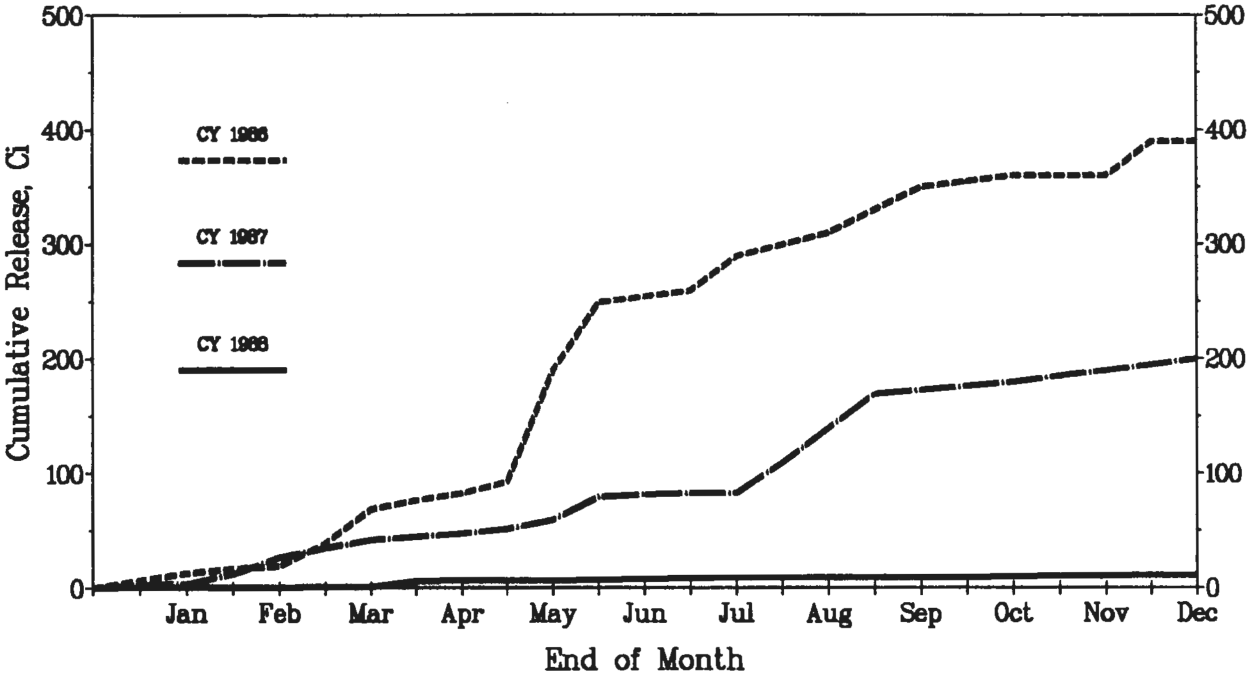

Figure 1-3. Cobalt-60 Discharges to the 1325-N Liquid Waste Disposal Facility.

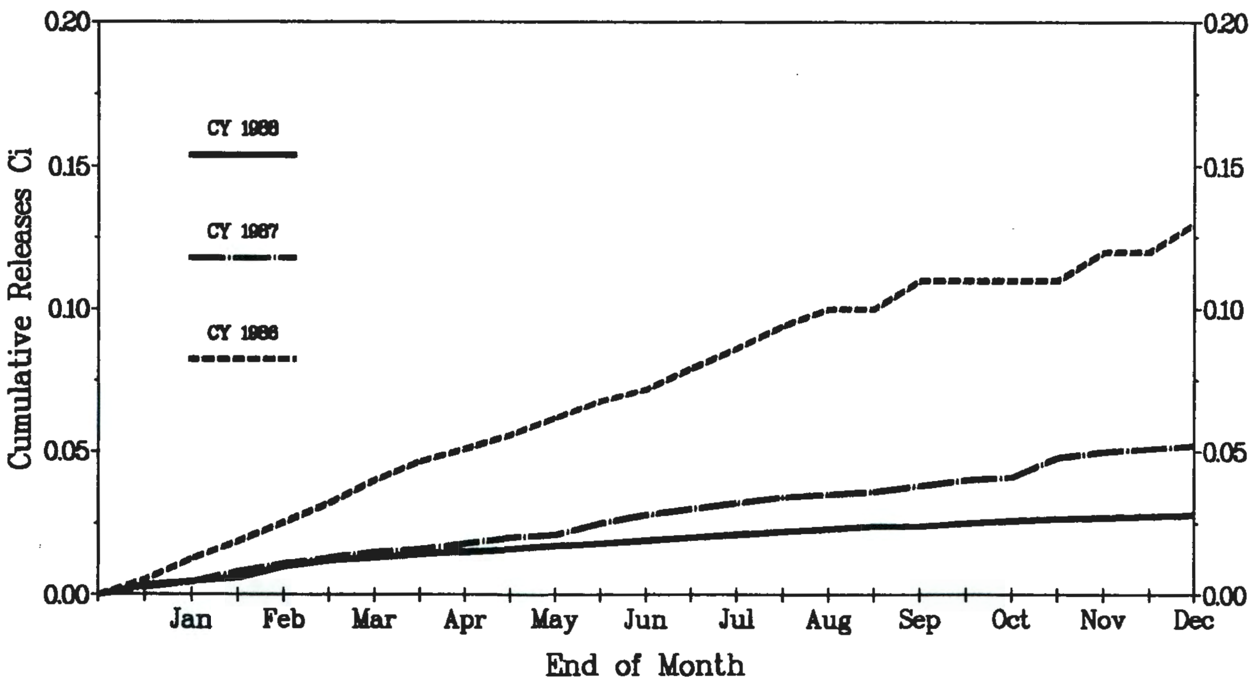

Figure 1-4. Cobalt-60 Discharges via the N Springs.

2.0 ATMOSPHERIC RELEASES TO THE ENVIRONMENT FROM THE 100 AREAS

2.1 RADIOACTIVE AIRBORNE EMISSIONS FROM THE 100-N AREA

Radioactive airborne emissions and associated flow rates from the 100-N Area are shown in Tables 2-1 through 2-3.

2.2 RADIOACTIVE AIRBORNE EMISSIONS FROM THE 100-K AREA

Radioactive airborne emissions and associated flow rates from the 100-K Area are shown in Tables 2-4 through 2-7.

2.3 NONRADIOACTIVE AIRBORNE EMISSIONS FROM THE 100-N AREA

Listed in Table 2-8 are the calculated amounts of airborne emissions produced at the 100-N Area from the combustion of No. 2 diesel oil and No. 6 fuel oil. The weights of listed materials emitted were determined using the factors and formulae published by the Environmental Protection Agency (EPA) in "Compilation of Air Pollutant Emission Factors" (EPA 1985).

Table 2-1. Emissions from the 116-N Stack, 109-Zone I Vent, and 109-N Cell 6 Vent.

Radio-nuclide	116-N Stack			109-N Zone I Vent			109-N Cell 6 Vent		
	Release (Ci)	Average concen-tration (pCi/L)	Peak concen-tration (pCi/L)	Release (Ci)	Average concen-tration (pCi/L)	Peak concen-tration (pCi/L)	Release (Ci)	Average concen-tration (pCi/L)	Peak concen-tration (pCi/L)
^{60}Co	5.5 E−04	1.8 E−04	6.0 E−04	5.9 E−04	3.3 E−04	1.9 E−03	3.6 E−04	8.6 E−04	5.4 E−03
^{90}Sr	2.0 E−06	6.2 E−07	1.3 E−06	2.2 E−06	1.2 E−06	2.5 E−06	1.2 E−06	3.0 E−06	5.7 E−06
^{137}Cs	2.1 E−04	6.7 E−05	4.1 E−05	ND	--	--	ND	--	--
^{238}Pu	3.7 E−08	1.2 E−08	2.4 E−08	2.3 E−08	1.2 E−08	2.6 E−08	1.0 E−08	2.4 E−08	3.6 E−08
$^{239,240}Pu$	1.1 E−07	3.5 E−08	5.1 E−08	1.5 E−07	8.1 E−08	2.0 E−07	5.7 E−08	1.4 E−07	1.8 E−07

NOTE: ND = Not Detected.

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Table 2-2. Miscellaneous Emissions (Ci).

Radio-nuclide	Zone II EF 7, 8	Zone III EF 10	Zone IV EF 14, 15	105-N Transfer Area	105-N Spacer Decon. Fac.	105-N 14-ft Decon. Fac.	107-N Exhaust	Total
^{54}Mn	ND	ND	ND	ND	ND	ND	6.3 E−06	5.1 E−05
^{60}Co	4.5 E−04	2.0 E−04	2.1 E−05	4.3 E−06	2.5 E−05	6.3 E−06	1.6 E−05	1.2 E−03

NOTE:
ND = Not Detected.
EF = Exhaust Fan.
Decon. Fac. = Decontamination Facility.

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Table 2-3. Emission Flow Rates at the 100-N Area.

Emission point	Flow rate (ft^3/min)
116-N Stack	210,000
109-N Zone I Vent	120,000
109-N Cell 6 Vent	28,000
Zone II, EF 7, 8	23,000
Zone III, EF 10	130,000
Zone IV, EF 14, 15	16,000
105-N Transfer Area	28,000
105-N Spacer Decontamination Facility	4,800
105-N 14-ft Decontamination Facility	6,400
107-N Exhaust	7,300

NOTE: EF = Exhaust Fan.

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Table 2-4. Emissions from 105-KE.

Radionuclide	Release (Ci)	Average concentration (pCi/L)
^{60}Co	7.6 E−05	1.9 E−04
^{90}Sr	1.4 E−05	3.5 E−05
^{137}Cs	7.4 E−05	1.8 E−04
^{238}Pu	7.1 E−08	1.8 E−07
$^{239,240}Pu$	3.1 E−07	7.8 E−07

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Table 2-5. Emissions from 105-KW.

Radionuclide	Release (Ci)	Average concentration (pCi/L)
^{60}Co	6.1 E−05	1.5 E−04
^{90}Sr	2.5 E−07	6.1 E−07
^{137}Cs	3.1 E−05	7.8 E−05
^{238}Pu	1.7 E−09	4.2 E−09
$^{239,240}Pu$	8.9 E−09	2.2 E−08

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Table 2-6. Emissions from 1706-KE.

Radionuclide	Release (Ci)	Average concentration (pCi/L)
^{60}Co	3.2 E−06	1.8 E−05
^{90}Sr	4.2 E−07	2.4 E−06
^{238}Pu	4.0 E−10	2.5 E−09
$^{239,240}Pu$	7.0 E−10	3.8 E−09

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Table 2-7. Emission Flow Rates at the 100-K Area.

Emission point	Flow rate (ft^3/min)
105-KE Vents	27,000
105-KW Vents	27,000
1706-KE	12,000

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Table 2-8. Emissions from the 184-N Boiler Stacks.

Material	Emissions from	
	No. 2 oil (lb)	No. 6 oil (lb)
Particulate	29,100	19,000
Sulfur dioxide	930,000	250,000
Sulfur trioxide	13,000	3,200
Carbon monoxide	71,000	4,500
Hydrocarbons	14,000	910
Nitrogen oxides	310,000	54,000

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3.0 LIQUID RELEASES TO THE ENVIRONMENT FROM THE 100 AREAS

3.1 RADIOACTIVE LIQUID RELEASES FROM THE 100-N AREA

Radioactive liquid releases from the 100-N Area are shown in Tables 3-1 through 3-3.

3.2 RADIOACTIVE LIQUID RELEASES FROM THE 100-K AREA

Radioactive liquid releases from the 100-K Area are shown in Tables 3-4 and 3-5.

3.3 NONRADIOACTIVE LIQUID RELEASES FROM THE 100-N AND 100-K AREAS

The discharge of nonradioactive water from facilities in the 100 Areas to the Columbia River is regulated by the Hanford National Pollutant Discharge Elimination System (NPDES) permit for the Hanford Site. Shown in Tables 3-6 and 3-7 are the NPDES discharge points and a summary of the analytical results of samples collected from these locations during 1988.

Table 3-1. Discharges to the 1325-N Liquid Waste Disposal Facility and to the Columbia River via Seepage from the N Springs.

Radio-nuclide	1325-N Liquid Waste Disposal Facility			N Springs		
	Release (Ci)	Average concen-tration (pCi/L)	Peak concen-tration (pCi/L)	Release (Ci)	Average concen-tration (pCi/L)	Peak concen-tration (pCi/L)
^{3}H	6.4 E+01	1.1 E+05	7.9 E+05	6.4 E+01[a]	8.4+04	1.0 E+05
^{54}Mn	5.9 E+00	9.8 E+03	1.3 E+05	b	--	--
^{60}Co	1.1 E+01	1.8 E+04	4.9 E+05	2.8 E−02	9.1 E+01	4.8 E+02
^{90}Sr	1.5 E+01	2.5 E+04	1.5 E+05	2.0 E+00	6.5 E+03	8.0 E+03
^{106}Ru	2.8 E+00	4.6 E+03	1.7 E+03	1.5 E−02	4.8 E+01	8.4 E+01
^{125}Sb	8.3 E−01	1.4 E+03	2.0 E+03	1.4 E−02	4.4 E+01	6.0 E+01
^{134}Cs	3.2 E−01	5.3 E+02	1.3 E+03	b	--	--
^{137}Cs	8.0 E+00	1.3 E+04	6.5 E+04	1.7 E−03	5.3 E+00	6.0 E+00
^{144}Ce-Pr	2.1 E+00	3.4 E+03	8.8 E+03	b	--	--
^{238}Pu	8.1 E−03	1.3 E+01	1.1 E+02	7.3 E−07	2.3 E−03	2.5 E−02
$^{239,240}Pu$	4.4 E−02	7.3 E+01	7.0 E+02	2.0 E−06	6.5 E−03	1.1 E−01

[a]This value is the same as for ^{3}H (tritium) discharged to 1325-N. Because of its high affinity with water, all ^{3}H discharged to 1325-N is assumed to eventually reach the Columbia River, but not within one year from the time of discharge. The average and peak concentrations of ^{3}H at the N Springs for 1988 were calculated from analyses of samples routinely collected using a continuous composite sampler system located there.

[b]Indicates that the radionuclide, as a particulate or of high ionic-exchange potential, is retained sufficiently within the soil column of 1325-N so as to be undetectable at the N Springs.

PST88-3283-3-1

Table 3-2. Activity Discharged to the Columbia River via the 102-in. Outfall.

Radionuclide	Release (Ci)	Average concentration (pCi/L)	Peak concentration (pCi/L)
^{54}Mn	1.3 E-01	2.3 E-01	4.4 E-02
^{60}Co	3.0 E-01	5.3 E-01	7.2 E-01
^{90}Sr	1.5 E-01	2.5 E-01	6.3 E-01
^{137}Cs	1.1 E-02	1.8 E-01	1.5 E-01
^{239,240}Pu	5.1 E-04	8.8 E-04	2.5 E-03

PST88-3283-3-2

Table 3-3. Total Flow from the 100-N Area.

Stream	Total flow (gal)
To 1325-N	1.6 E+08
To Columbia River via N Springs	8.2 E+07
To Columbia River via 102-in. Outfall	1.5 E+11

PST88-3283-3-3

Table 3-4. Activity Discharged to the Columbia River via the 1908-K Outfall.

Radionuclide	Release (Ci)	Average concentration (pCi/L)	Peak concentration (pCi/L)
^{60}Co	1.8 E-02	1.3 E+01	4.8 E+01
^{90}Sr	4.6 E-03	3.3 E+00	3.2 E+01
^{137}Cs	6.9 E-03	4.9 E+00	9.8 E+00
^{239,240}Pu	6.3 E-06	4.5 E-03	3.0 E-02

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Table 3-5. Total Flow from the 100-K Area.

Stream	Total flow (gal)
To Columbia River via 1908-K Outfall	3.7 E+08

PST88-3283-3-5

Table 3-6. National Pollutant Discharge Elimination System Discharge Points.

Designation	Description
003	181-KE Inlet Screen Backwash
004	1908-K Outfall
005	182-N Tank Farm Overflow (36-in. RWR*)
006	182-N Drain System (42-in. RWR)
007	181-N Inlet Screen Backwash
009	102-in. Outfall (RWR)
N Springs	100-N Riverbank Springs

*Raw water return.

PST88-3283-3-6

Table 3-7. Summary of National Pollutant Discharge Elimination System Data for 1988.

Sample parameter		003	004	005[a]	005[b]	006[c]	006[d]	007	009	N Springs
Flow (Mgal/d)	Max. Avg.	0.021 0.01	3.46 2.5	5.8 2.4	15.8 e	6.2 1.0	7.0 e	1.12 0.44	302 197	1.4 e
Temperature (°F)	Max. Avg.	e e	71 57	88 58.2	e e	69 59[a]	e e	e e	72 55	72 70
pH	Max. Min. Avg.	e e e	7.7 6.9 7.3	8.5 6.6 7.5	e e e	8.0 7.0 7.7	e e e	e e e	8.0 6.9 7.7	7.6 7.4 7.5
Total suspended solids (mg/L)	Max. Avg.	11.7 4.8	14.0 2.5	8.9 3.7	e e	4.4 1.3	e e	8.8 3.7	e e	e e
Oil and grease (mg/L)	Max. Avg.	e e	e e	1.0 <1.0	e e	1.8 <1.0	e e	e e	e e	<1 <1
Iron (mg/L)	Max. Avg.	e e	e e	e e	e e	e e	e e	e e	e e	<0.08 <0.08
Ammonia (mg/L)	Max. Avg.	e e	e e	e e	e e	e e	e e	e e	e e	<0.050 <0.050
Chromium (mg/L)	Max. Avg.	e e	e e	e e	e e	e e	e e	e e	e e	<0.018 <0.01
Chlorine (mg/L)	Max. Avg.	<0.04 <0.04	e e	<0.04 <0.04	e e	e e	e e	e e	<0.04 <0.04	e e

[a]Without low-lift pumps.
[b]With low-lift pumps.
[c]Without fog sprays.
[d]With fog sprays.
[e]Measurement not required.

PST88-3283-3-7

4.0 HISTORICAL RELEASE TRENDS AT THE 100-N AREA

Shown in Figures 4-1 through 4-5 are graphs of the annual release totals of selected radionuclides discharged from the 100-N Area over the past 14 yr. These radionuclides were chosen on the basis of their importance to offsite dose and how well they represent the release behavior of other chemically or physically similar nuclides. Displayed in Figure 4-5 are data only through 1987 because there were no measurable releases in 1988 for the radionuclides represented.

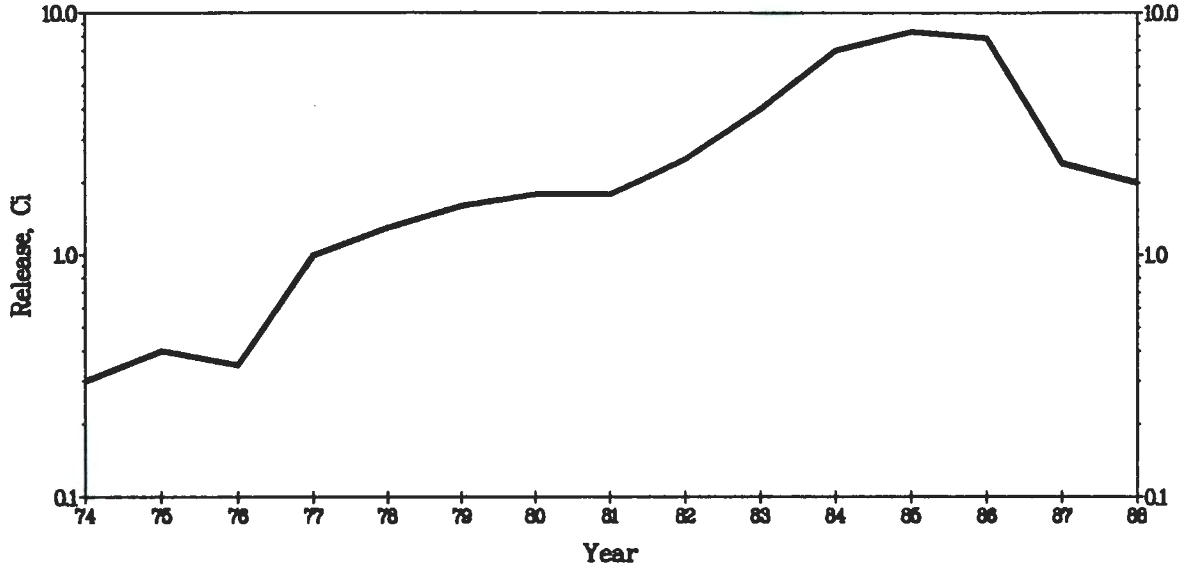

Figure 4-1. Strontium-90 Releases via the N Springs.

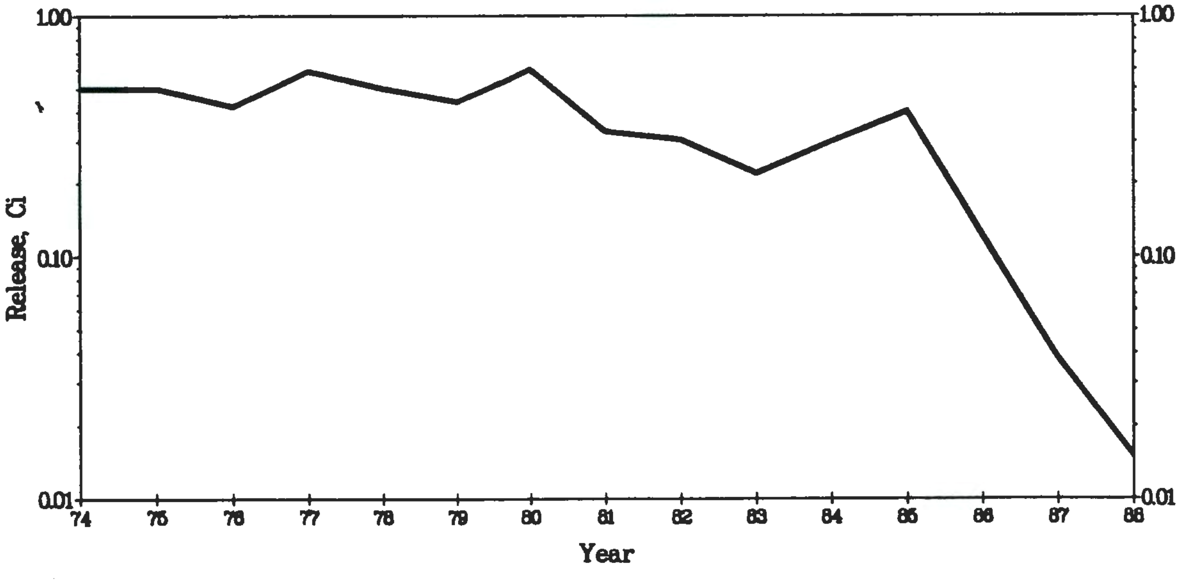

Figure 4-2. Ruthenium-106 Releases via the N Springs.

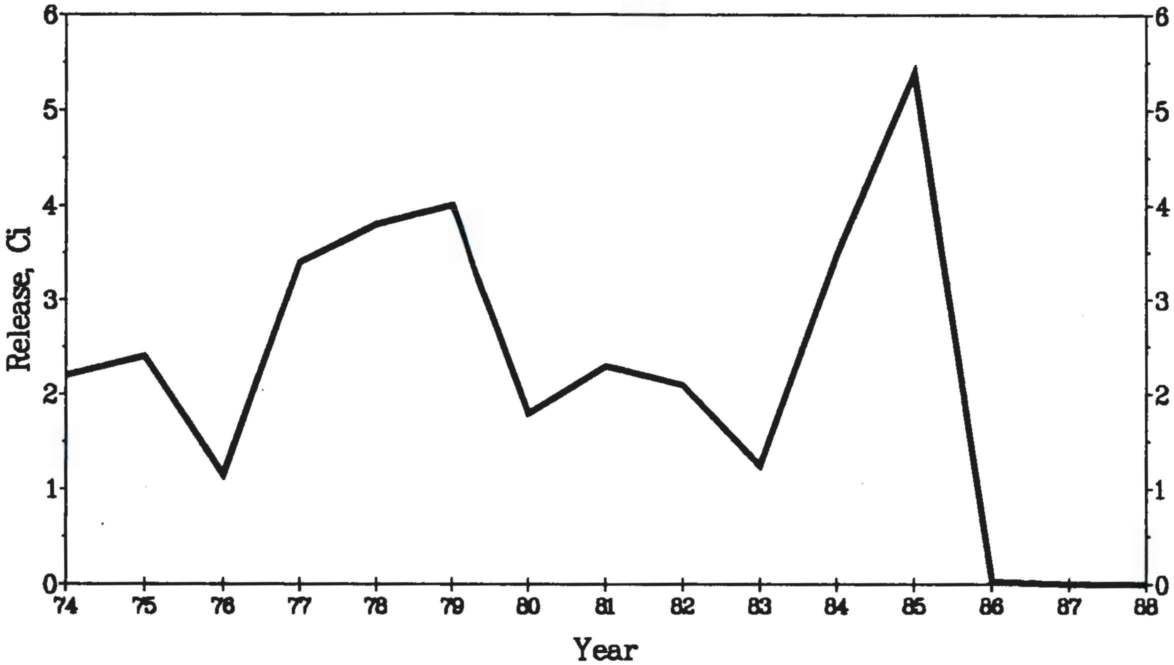

Figure 4-3. Iodine-131 Releases via the N Springs.

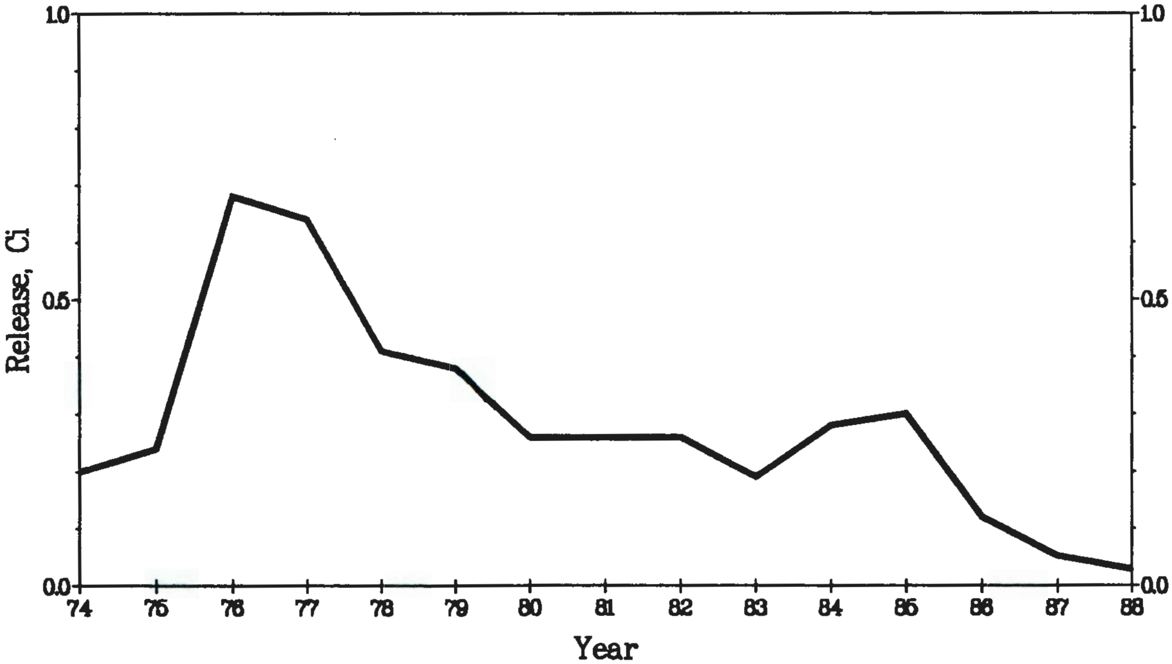

Figure 4-4. Cobalt-60 Releases via the N Springs.

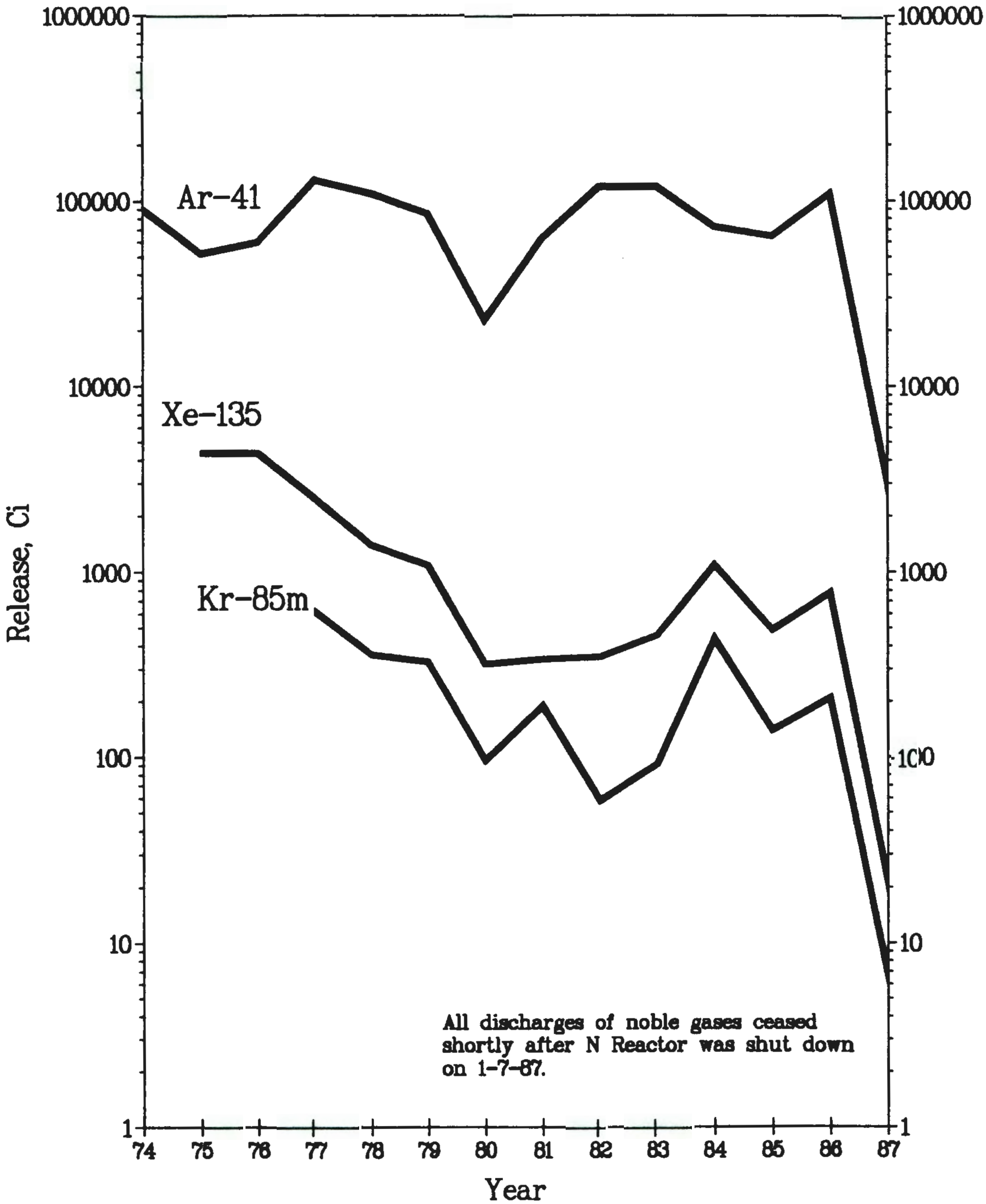

Figure 4-5. Noble Gas Releases via the 116-N Stack.

5.0 CHEMICALS AT THE 100 AREAS

5.1 CHEMICALS CONSUMED AT THE 100 AREAS

Shown in Table 5-1 are the primary chemicals consumed during operations at the 100 Areas. Descriptions of the uses and dispositions of these chemicals are provided in Section 5.3.

5.2 CHEMICALS RELEASED TO THE ENVIRONMENT FROM THE 100 AREAS

Shown in Table 5-2 are the primary chemicals released to the environment from the 100 Areas during operations in 1988. Descriptions of the uses and dispositions of these chemicals are in Section 5.3.

5.3 USES AND DISPOSITIONS OF CHEMICALS IN THE 100 AREAS

The following sections contain descriptions of the primary chemicals used by operations in the 100 Areas and any related environmental discharges.

5.3.1 Aluminum Sulfate

Aluminum sulfate is used as a flocculent in the production of filtered water at the 100-N and 100-KE Areas. This chemical is used routinely in the 183-N filter beds and backwashed to the 183-N filter backwash pond. At 100-KE Area, this chemical is also used in filter beds but is backwashed to a settling basin instead of a backwash pond.

5.3.2 Chlorine

Chlorine is used as an algicide and in the production of potable water for the 100-N and 100-K Areas. After reacting with water, chlorine changes to a chloride ion and is discharged to the sanitary sewage lagoon and 1325-N LWDF at 100-N or to a sanitary tile field at 100-K.

5.3.3 Sulphuric Acid

Sulphuric acid is used at 100-N Area to regenerate the cation resins in the demineralized water plant. In November 1988, the lined 1324-N facility was retired when the Elementary Neutralization Unit (ENU) began operation. Before this time, however, the acid used in resin regeneration was flushed to 1324-N and neutralized with sodium hydroxide before being released primarily as sodium sulfate to the 1324-NA Percolation Pond. Sulphuric acid is also used in the water demineralization process at 100-KE Area. Following resin regeneration, it is discharged to a clearwell and retained there until neutralized with sodium hydroxide. Once neutralized it is released primarily as sodium sulfate to the river via the 1908-K Outfall.

Table 5-1. Chemical Consumption in the 100 Areas.

Material	Total consumed at:	
	100-KE (lb)	100-N (lb)
Aluminum sulfate	110,000	400,000
Ammonium hydroxide	--	2,300
Chlorine	8,000	22,000
Hydrazine	--	14,000
Morpholine	--	6,390
Sodium hydroxide	280	500,000
Sodium hypochlorite	580	2,000
Sulphuric acid	250	680,000

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Table 5-2. Chemicals Released to the Environment from the 100 Areas.

Material	Total Released from	
	100-KE (lb)	100-N (lb)
Aluminum sulfate	110,000	400,000
Ammonia	--	110
Hydrazine	--	39
Morpholine	--	6,390
Sodium hydroxide	53	- -
Sodium sulfate	350	900,000
Sulphuric acid	--	64,000
Trichlorotrifluoroethane	--	220

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5.3.4 Sodium Hydroxide

Sodium hydroxide is used at 100-N Area to regenerate the anion resins in the demineralized water plant. In November 1988, the lined 1324-N facility was retired when the ENU began operation. Before this time, however, the caustic used in resin regeneration was flushed to 1324-N and neutralized with sulfuric acid before being released primarily as sodium sulfate to the 1324-NA Percolation Pond. Sodium hydroxide is also used in the water demineralization process at 100-KE Area. Following resin regeneration, it is discharged to a clearwell and retained there until neutralized with sulfuric acid. Once neutralized it is released primarily as sodium sulfate to the river via the 1908-K Outfall.

5.3.5 Ammonium Hydroxide

Ammonium hydroxide is used to control the pH of the water in the reactor primary cooling system (PCS) and the graphite and shield cooling system (GSCS). Small quantities of this chemical are discharged as ammonia to the 1325-N LWDF due to water purity bleeds maintained on the PCS and GSCS.

5.3.6 Hydrazine

Hydrazine is used to suppress the oxygen concentration in the secondary cooling system (SCS), rod cooling system (RCS), PCS, and GSCS. Small quantities of hydrazine are discharged to the 1325-N LWDF because of system purity bleeds and leaks. Although never detected, trace amounts of unreacted hydrazine may reach the Columbia River if discharged from the SCS by way of steam generator blowdowns and steam air ejectors.

5.3.7 Morpholine

Morpholine is used to control the pH of the SCS and may be discharged to the Columbia River in the same way as described for hydrazine, although it has never been detected there.

5.3.8 Miscellaneous Chemicals

After their use in laboratory facilities or by maintenance crafts personnel, small quantities of chemicals are properly contained and disposed of by way of the 616 Nonradioactive Dangerous Waste Storage Facility.

6.0 UNPLANNED RELEASES

6.1 GASOLINE SPILL AT THE 100-N GAS STATION

On January 18, 1989, at approximately 2:30 p.m., a spill of gasoline occurred while it was being dispensed into underground storage tanks near the 1716-N gas station at 100-N Area. The amount spilled to ground was estimated to be 89 gal. All proper notifications and cleanup work were performed.

7.0 SANITARY SEWAGE DISCHARGED TO THE GROUND IN THE 100 AREAS

Sewage flows in the 100 Areas (Table 7-1) are calculated by assuming 25 gal of sewage discharged per person per day.

Table 7-1. Sanitary Sewage Discharged (gal/d).

100-B	100-D	100-K	100-N*
50	100	3,800	25,000

*In addition to the daily flow amounts of sanitary sewage from 100 N facilities, a total of 360,000 gal of septic tank sewage from the 200 and 600 Areas were discharged to the 100-N sanitary sewage lagoon. PST88-3283-7-1

8.0 IN-GROUND DISPOSAL OF SOLID WASTE

8.1 RADIOACTIVE SOLID WASTE

Radioactive solid waste from operations in the 100 Areas is buried in the 200 Areas waste disposal sites. Volumes of waste disposed of are reported by the waste site managers.

8.2 NONRADIOACTIVE SOLID WASTE

Nonradioactive solid waste from operations in the 100 Areas is compacted, when possible, and buried in the 200 Areas central landfill. The waste site managers report the volume of waste received for disposal.

9.0 REFERENCES

EPA, 1985, "Compilation of Air Pollutant Emission Factors," U.S. Environmental Protection Agency, Washington, D.C.

Westinghouse, 1988, "Gasoline Spilled to the Ground," WHC-UO-88-004 R, D & EO-01, Westinghouse Hanford Company, Richland, Washington.

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