HANFORD WASTE DISPOSAL SUMMARY
1972

Battelle

Pacific Northwest Laboratories
Richland, Washington 99352

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by

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Environmental Evaluations Section
Occupational and Environmental Safety Department

December 1974

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HANFORD WASTE DISPOSAL SUMMARY - 1972INTRODUCTION

This is the sixth summary report of Hanford Waste Disposal experience as required by the AEC Manual, RL Appendix 0510, "Waste Disposal", hereafter called RL Appendix 0510. This report has been compiled from data furnished by four Hanford contractors: Atlantic Richfield Hanford Company (ARHCO), Battelle Pacific Northwest Laboratories (PNL), Douglas United Nuclear, DUN, changed to United Nuclear Industries, (UNI), and Westinghouse Hanford Engineering Development Laboratory (HEDL). The most recent summary report⁽¹⁾ is listed in the reference section along with other references used to compile this report. The purpose of this report is to provide a single summary of waste quantities disposed of at Hanford.

SUMMARY

All averages for waste release measurement were within 10% of RL Appendix 0510 Release Guides.⁽²⁾ Environmental measurements also demonstrated⁽³⁾ compliance with applicable environmental standards.

Releases of radionuclides to air and water from 100 Area and 200 Area facilities continued to show a downward trend, from previous years reflecting the effects of production facility retirement and the results of programs aimed at reducing releases. The apparent exceptions of tritium and argon-41 are due to relaxation of classification and requirements on tritium releases and the inclusion in reporting requirements of reactor-produced noble gases.

LIQUID WASTEDischarge to the River

N-Reactor, the only remaining operating Hanford reactor, uses recirculating demineralized water as a primary coolant. Cooling water and normally uncontaminated cooling and waste water from the reactor operation is discharged directly to the Columbia River. Data for this waste stream is presented in Table 1. In addition some low level liquid waste reaches the river via ground-water seepage from discharges to the 100-N Area crib. Radioactivity in this seepage is measured at the riverbank and results are shown in Table 2. There is no direct discharge of radioactive waste streams to the river from the 200 Areas or the 300 Area.

TABLE 1.
Direct Discharge of
Radionuclides to the Columbia River - 1972

	<u>(Ci)</u>		<u>(Ci)</u>
^{24}Na	500	^{103}Ru	0.4
^{51}Cr	20	^{106}Ru	4.
^{54}Mn	40	^{124}Sb	0.8
^{56}Mn	600	^{131}I	40.
^{58}Co	2	^{133}Xe	10.
^{59}Fe	10	^{134}Cs	0.5
^{60}Co	20	^{137}Cs	5.
$^{95}\text{ZrNb}$	8	$^{140}\text{BaLa}$	10.
^{99}Mo	20	^{239}Np	90.

TABLE 2.
Radioactive Liquid Waste Reaching
the Columbia River From 100-N
After Discharge to the Ground - 1972

	<u>(Ci)</u>		<u>(Ci)</u>
^3H	7.0×10^3	^{99}Mo	1.1
^{51}Cr	5.3	^{131}I	1.9
^{60}Co	0.01	^{137}Cs	0.05
^{89}Sr	0.05	$^{140}\text{BaLa}$	0.5
^{90}Sr	0.95		

Non-radioactive liquid waste from the 100 Areas is tabulated in Table 3. These figures are not measurements of direct discharge to the river, but are rather total consumption figures. Although the greatest part of these materials is discharged directly to the river, an unknown fraction is retained in ground disposal sites.

TABLE 3.
Quantities of Reagent Consumed in 100 Areas and
Presumed Discharged to Columbia River in Liquid Waste Streams - 1972

[illegible]

Discharge to Ground

Most of the radioactivity discharged to the ground in liquid waste at Hanford occurs in the 200 Areas at sites remote from the river. These sites are managed by the ARHCO for disposal of all contractors' waste. However, PNL, HEDL, and UNI also made use directly or indirectly of liquid waste disposal trenches or ponds located near the Columbia River bank in the 100 Area and 300 Area. The quantities are shown in Table 4.

PNL released waste waters from animal quarters to a trench at 100-F Area. Groundwater samples indicate no discharge to the river from this source.

TABLE 4.

Liquid Waste Discharged to the Ground - 1972				Total (a)
	<u>100-F</u>	<u>200</u>	<u>300</u>	<u>All Areas</u>
Vol (ℓ)	1.4×10^8	2.11×10^{10}	4.0×10^9	2.5×10^{10}
Plutonium (Kg)		8.0		8.0
Uranium (Kg)		$<1.1 \times 10^2$	5.2×10^2	6.3×10^2
Total Beta (Ci)	0.15 ^(b)	3.8×10^3	0.5	3.8×10^3
Total Alpha (Ci)	0.01 ^(c)		0.4	0.4
⁶⁰ Co (Ci)		$<2.0 \times 10^1$		$<2.0 \times 10^1$
⁹⁰ Sr (Ci)		1.6×10^2		1.6×10^2
¹³⁷ Cs (Ci)		2.4×10^2		2.4×10^2

(a) Does not include discharges at 100-N shown in Table 2.

(b) Total beta in the 100-F waste stream is considered as ⁹⁰Sr, even though natural beta emitters may be present.

(c) Total alpha in the 100-F waste stream is considered as ²³⁹Pu, even though natural alpha emitters are known to be present.

UNI, HEDL, and PNL (via HEDL facilities) released liquid waste to ponds at the 300 Area. These ponds, used primarily for disposal of cooling water, also received discharges of chemical and low-level radioactive waste.

Concentration measurements of combined 300 Area liquid waste prior to discharge to the 300 Area pond were made by HEDL. These data appear in Tables 4 and 5.

TABLE 5.
Nonradioactive Liquid Waste Discharged to Ground
At the 300 Area - 1972

	(kg)
Chlorine	5.0×10^4
Copper	8.7×10^3
Iron	4.6×10^2
Fluoride	8.7×10^3
Nitrate (as No_3)	2.5×10^5
Sulfate (as So_4)	1.2×10^5
Chromium (as hexavalent chromium)	4.6×10^1

All liquid waste discharged to ground on the 200 Area plateau during 1972 were released to waste facilities managed by the ARHCO. Details of these releases are contained in Reference 4. The volume of liquid waste discharged to ground in the 200 Areas during 1972 (2.1×10^{10} liters) was slightly less than that discharged in 1971. The gross beta activity discharged to ground in the 200 Areas during 1972 (3,800 Ci) was also somewhat lower than that discharged during 1971 (5,700 Ci). Most of the waste resulted from activities in the 200 Areas. However, intermediate-level radioactive liquid waste generated by UNI, HEDL, and PNL at the 100-N and 300 Areas were evaporated at ARCHO facilities. The concentrate was sent to high-level waste storage tanks. The condensate was discharged to cribs, and included by ARHCO in the 200 Area data.

Active liquid waste disposal sites in the 200 Area are listed in Table 6.

No data relative to non-radioactive liquid waste discharged to ground from either the 200 Area or other 100 Areas were available. These discharges, primarily cooling water containing only small amounts of pollutants, are controlled to a pH between 7.0 and 8.0.

TABLE 6.

200 Areas Active Liquid Waste Disposal Sites - CY-1972

200 East Area

<u>Cribs</u>	<u>Ponds and Ditches</u>
216-A-8	216-A-25
216-A-10(1)	216-A-29
216-A-30(1)	216-B-2-3
216-A-36B(2)	216-B-3
216-B-10B	216-B-63
216-B-12	
216-B-50	
216-B-55	
216-B-57	
216-C-7	

200 West Area

<u>Cribs</u>	<u>Ponds and Ditches</u>
216-S-6(3)	216-S-11
216-S-20(4)	216-S-16(3)
216-S-23(3)	216-S-19
216-T-19	216-T-4
216-U-12	216-U-10
216-Z-12	216-U-14
216-Z-16	216-Z-19
216-Z-18	

-
1. Volume substantially reduced after 9/1/72
 2. No discharge after 9/1/72
 3. No discharge after 7/10/72
 4. Used 11/8 - 11/15/72 only.

GASEOUS WASTE DISCHARGED TO THE ATMOSPHERE

For the past several years, releases of ^{131}I at Hanford have been decreasing. Releases of this and all other radionuclides from 200-Area facilities⁽⁵⁾ were well below 10% of the release guides in 1972. There were no releases of ^{131}I from 300 Area stacks⁽⁶⁾ which exceeded 10% of the Release Guide of 200 mCi/wk given in RL Appendix 0510. Results of the 1972 stack sampling programs are listed in Table 7.

TABLE 7.
Radioactive Waste Discharged
to the Atmosphere - 1972

	<u>100</u>	<u>200</u>	<u>300</u>	<u>Total</u> <u>All Areas</u>
Total Alpha (as uranium) (a)		1.1×10^{-4}	$<6.0 \times 10^{-5}$	1.7×10^{-4}
Total Alpha (as plutonium) (a)	$<3.7 \times 10^{-7}$	5.2×10^{-3}	$<5.6 \times 10^{-6}$	5.2×10^{-3}
Total Beta (as Strontium) (b)	$<4.5 \times 10^{-6}$	0.87	3.4×10^{-3}	0.88
^3H	27.			27.
^{41}Ar	1.0×10^5			1.0×10^5
^{131}I	1.3×10^{-2}	0.21	$<1.3 \times 10^{-2}$	0.24
^{133}I	0.5			0.5
^{137}Cs		~15.		~15.

(a) Total alpha is attributed to ^{239}Pu if both plutonium and uranium are present and facility inventory of plutonium is large enough to exceed administrative guides for release to the atmosphere.

(b) Total beta is attributed to ^{90}Sr if the facility inventory of ^{90}Sr is large enough to exceed administrative guides for release to the atmosphere.

Data for non-radioactive waste discharged to the atmosphere⁽⁶⁾ was calculated from a knowledge of the type of fossil fuel consumed and the type of equipment used. Results were calculated using the methods presented in the EPA document, Compilation of Air Pollutant Emission Factors.⁽⁷⁾ These results are listed in Table 8.

TABLE 8.
Nonradioactive Waste^(a)
Discharged to Atmosphere - 1972

	100	200	300	Total All Areas
Sulfur Oxides	9.2×10^5	9.5×10^5	3.5×10^4	1.9×10^6
Nitrogen Oxides	1.7×10^5	6.3×10^5	2.0×10^5	1.0×10^6
Aldehydes	4.7×10^3	2.3×10^2	2.0×10^3	6.9×10^3
Particulates	9.7×10^4	4.9×10^6	6.2×10^5	5.6×10^6

(a) Calculated from fuel consumption and EPA guidelines

SOLID WASTE BURIAL⁽⁹⁾

Reported solid radioactive waste disposal experience for 1972 is shown in Table 9. The requirements outlined in USAEC IAD-0511-21⁽⁸⁾ were applied throughout the year. This directive required that all transuranic-bearing material^(a) be segregated for burial in containers which could be retrieved within 20 years.

The only non-radioactive solid waste burial reported was the residue from waste burning in the 100 Areas. This amounted to 13,800 Kg as reported by UNI⁽⁶⁾

(a) As used here transuranic material is uranium-233, all plutonium isotopes except Pu-241 and Pu-238, and all isotopes with atomic number greater than 93. For retrievable storage, the estimated content of each package is 10 Ci/g or more.

TABLE 9.
Radioactive Solid Waste Buried - 1972

	<u>100</u>	<u>200</u>	<u>300</u>	<u>Total All Areas</u>
Vol (M ³)	950	4930	160	6040
U (g)		4.3×10^5	160	4.3×10^5
Pu (g)		5.2×10^3		5.2×10^3
Th (g)		2.5×10^4		2.5×10^4
Am (g)		65.		65.
³ H (Ci)		1.3×10^5		1.3×10^5
⁶⁰ Co (Ci)		7.0×10^3		7.0×10^3
⁹⁰ Sr (Ci)	0.2			0.2
¹⁴⁴ Cs (Ci)		17.		17.
²³⁷ Np (Ci)		1.5×10^{-2}		1.5×10^{-2}
MFP (Ci)		5.2×10^4		5.2×10^4

ENVIRONMENTAL IMPACT

The 1972 Hanford environmental surveillance program showed continued compliance of the Hanford contractors and their operations with applicable environmental standards.⁽³⁾ The shutdown of the last of the single-pass production reactors (KE) in January 1971, eliminated the major remaining source of Hanford radioactivity released off-site. No unusual releases caused Concentration Guides as given in AEC Manual Chapter 0524, Appendix, Table II, to be exceeded outside processing areas. All measurements of radioactivity outside the plant boundaries were much less than 10% of the applicable Concentration Guides. Radiation dose estimates for population groups in the plant environs for 1972 were all less than 1% of applicable standards for plant operations.⁽³⁾ Off-site measurements of non-radioactive air and water quality parameters were also well within applicable criteria and showed no significant evidence of plant operations.⁽³⁾

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