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HANFORD WASTE DISPOSAL SUMMARY - 1968

By

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Radiation Standards Department
Safety and Standards Division

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HANFORD WASTE DISPOSAL SUMMARY - 1968

INTRODUCTION

This is the second summary report of Hanford waste disposal experience. The data was tabulated from reports submitted by the contractors to the Richland Office of the Atomic Energy Commission(1,2,3,4,5,6,7,8). For a detailed description of Hanford waste management practices and plans the reader is directed to Hanford Waste Management Plans(9).

SUMMARY

There were no instances where rates of release exceeded applicable release guides and generally release rates were less than 10% of RL Appendix 0510 guides. There was a general long term downward trend in releases to the atmosphere and to the river reflecting retirement of production facilities including the 100-B reactor in February 1968, and also reflecting the results of programs intended to reduce releases even further.

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SUMMARY TABLE

Radioactive Waste Disposal - 1968

Liquid Waste to Columbia River		
Chromium-51	156	KCi
Neptunium-239	98	KCi
Phosphorus-32	8.7	KCi
Arsenic-76	77	KCi
Zinc-65	8.4	KCi
Iodine-131	0.90	KCi
Tritium	0.15	KCi
Gaseous Waste to Atmosphere		
Iodine-131	5.91	Ci
Plutonium-239	9.85×10^{-3}	Ci
Uranium	7.50×10^{-4}	Ci
Beta Emitters	1.70	Ci
Tritium	1.2×10^{3}	Ci
Liquid Waste to Ground in 200 Area		
Volume	2.3×10^{10}	liters
Uranium	210	Kg
Plutonium	9,380	g
Total Beta	11,200	Ci
Cobalt-60	< 40	Ci
Strontium-90	162	Ci
Cesium-137	1,680	Ci
Ruthenium	2,580	Ci
Solid Waste Burial		
Volume	267,000	ft^3
Area Used	5.73	Acres
Total Radioactivity	76,200	Ci
Uranium	1,370	Kg
Plutonium	6,220	g

I. Liquid Wastes Discharged to the Columbia River

A. 1968 Experience

Most of the radioactivity released to the river from Hanford operations during 1968 was contained in cooling water from the 100-C, 100-KE and 100-KW reactors. Reported releases from the above reactors were less than 10% of release guides except that release of phosphorus-32 was about 20% of applicable release guides during the last half of the year.

Quantitative measurement of those radionuclides considered important were reported in Reference 1. In addition, river water measurements at Richland provided estimates of the rate of transport of those same nuclides as well as a few others. The results of the latter measurements were reported by the Environmental Studies Section, Battelle-Northwest in their monthly reports of the radiological status of the Hanford environs(10). The rate of release is compared with the rate of transport in Figure 1. Only one significant difference appears. The apparent rate of release of iodine-131 in October exceeded the rate of transport by a considerable amount. In the absence of corroborating data from environmental measurements, the anomalous point must be in error. Other differences are explainable on the basis of radioactive decay, common sampling or analytical problems, and phenomena which occur in the river. Although the tabulation of fuel element cladding failures shown in the 1967 report was considered irrelevant and omitted from this report, releases of iodine-131 and neptunium-239 from those failures that occurred in 1968 are included in the reported data.

Battelle-Northwest reported the release of about 100 Ci tritium and about 1 Ci of other radionuclides from PRTR in cooling water released to the river(2). Since these amounts were well below drinking water concentration limits in the effluent, they were not detectable in river water samples nor significant to users of river water.

The releases of chemicals to the river from facilities operated by Douglas United Nuclear were summarized in Refernce 14 for the period July 1, 1967 to June 30, 1968. Table 1 summarizes the chemicals used and released to the river. The concentration of hexavalent chromium (Cr^{+6}) in the Columbia River at Richland was routinely measured and was reported by the Environmental Studies Section, Battelle-Northwest in their monthly reports(10).

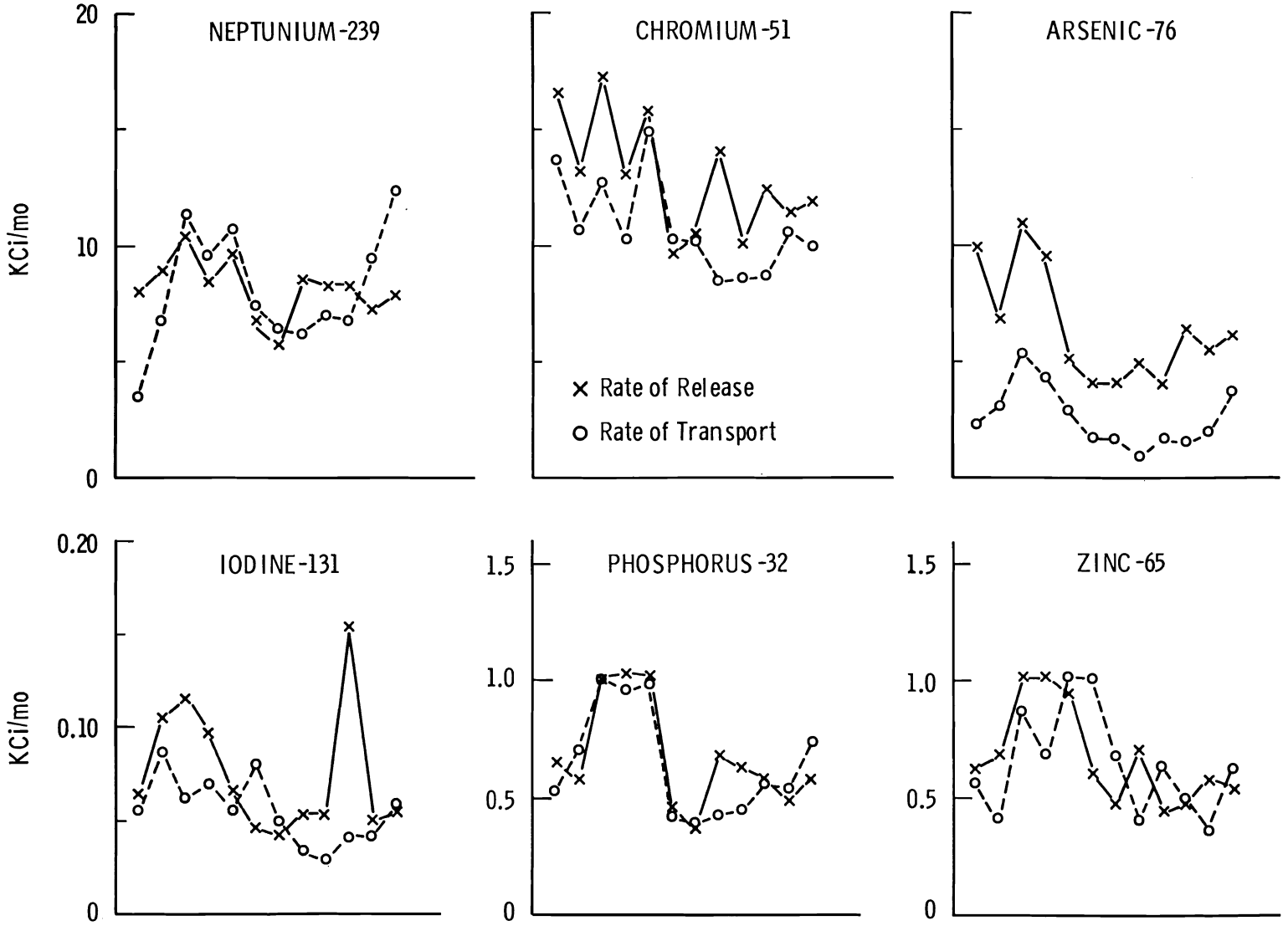

FIGURE 1
Rate of Release and Rate of Transport in River at Richland - 1968

TABLE 1

CHEMICALS DISCHARGED TO THE COLUMBIA RIVER

JULY 1967 - JUNE 1968

Chemical	Quantity Consumed (thousands of pounds) 100-B	100-C	100-D	100-KE	100-KW	100-N	Total
Aluminum Sulfate	160	60	29	1001	1185	378	2812
Bauxite	763	2131	60	3459	3222		9636
Sulfuric Acid (as 100%)	4958	11739	137	21909	21776	1309	61828
Chlorine	134	344	26	773	789	28	2093
Polyacrylamide	2.2	3.1	0.4	16.4	12.1	1.0	35
Sodium Dichromate	160	226		641	725		1752
Sodium Silicate			208		127		335
Ammonium Sulfate					10		10
Sodium Hydroxide (as 76% Na_2O)						424	424
Hydrazine (as 25% N_2H_4)						9.9	10
Morpholine						3.7	4

B. Trends

Data from routine reactor effluent measurements for the past five years shown in Figures 2, 3 and 4 was intended to illustrate long term trends[1,11]. However, the trends may be more readily seen in the following table since the change in rate of release for some nuclides has been small. The release of all nuclides was down in 1966 because of the two month outage during the strike. Only the rate of release of chromium-51 shows a steady downward trend, but all nuclides listed have decreased some during the period. Phosphorus-32 and zinc-65 showed the first significant decrease in 1968. The trend line was omitted from iodine-131 because part of the data was obtained from river water measurements which in 1964 were not consistent with reported rates of release.

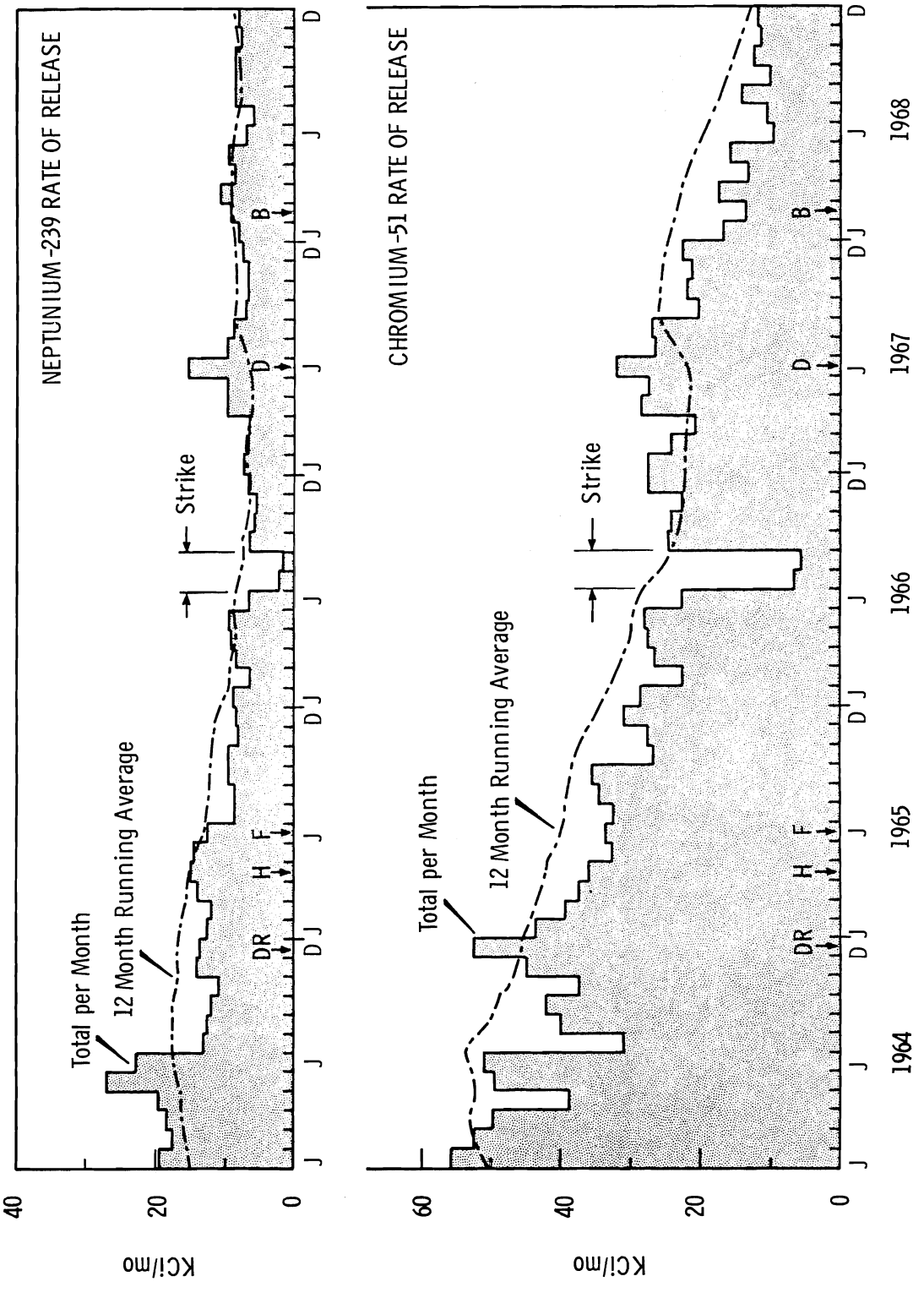
NEPTUNIUM-239 RATE OF RELEASE
Total per Month
12 Month Running Average
Strike
DR
H
F
B
D
J
KCi/mo
0
20
40
CHROMIUM-51 RATE OF RELEASE
Total per Month
12 Month Running Average
Strike
0
20
40
60
1964
1965
1966
1967
1968

FIGURE 2

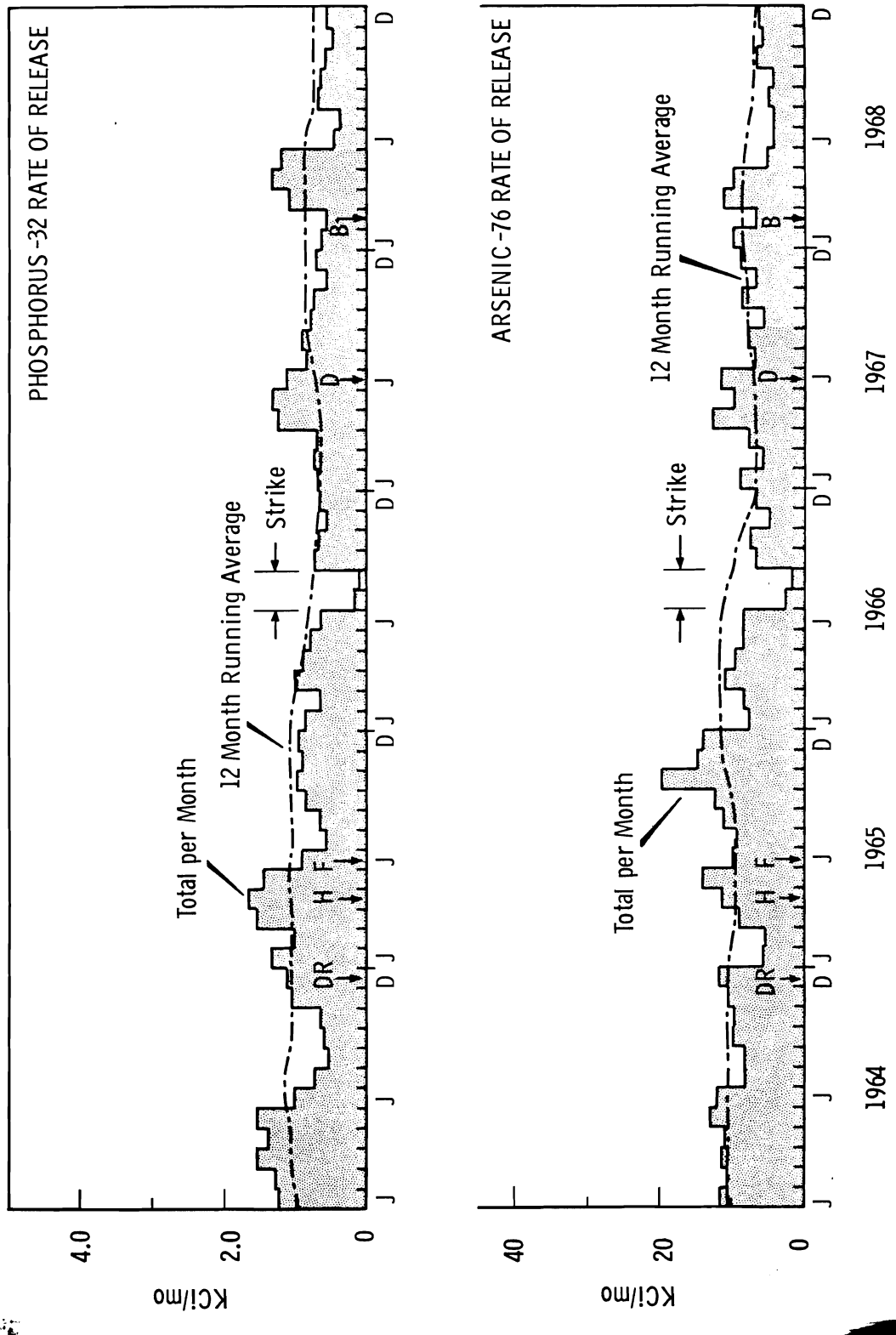
PHOSPHORUS -32 RATE OF RELEASE
Total per Month
12 Month Running Average
Strike
DR
H
F
B
D
J
1964
1965
1966
1967
1968
4.0
2.0
0
KCi/mo
ARSENIC-76 RATE OF RELEASE
Total per Month
12 Month Running Average
Strike
40
20
0
KCi/mo

FIGURE 3

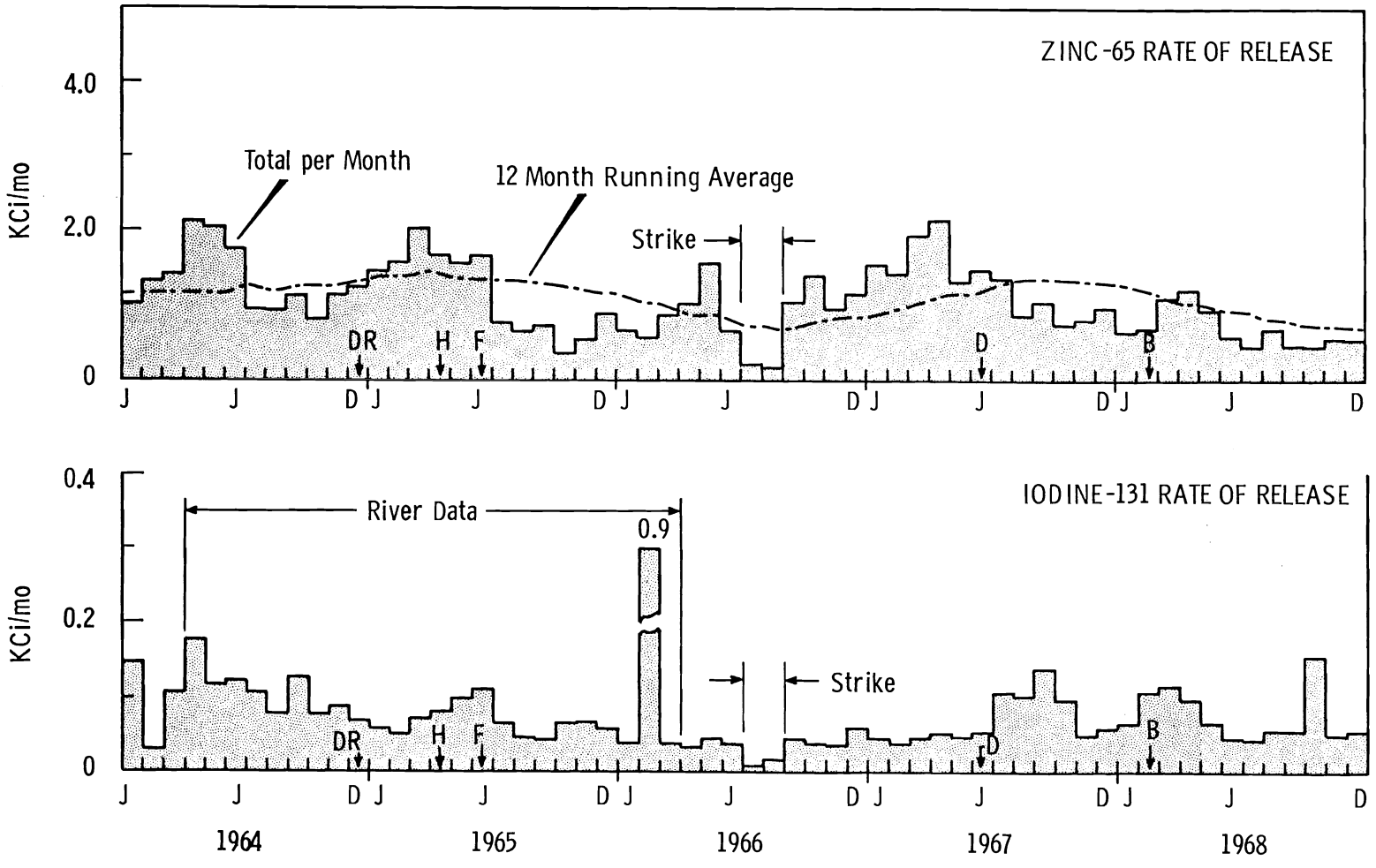

FIGURE 4

BNWL-1081

TABLE 2

Annual Average Release Rates
Single Pass Reactor Coolant
(KCi/Mo)

	1964	1965	1966	1967	1968
Phosphorus-32	1.0	1.0	0.6	0.9	0.7
Chromium-51	45	34	22	25	13
Zinc-65	1.3	1.2	0.9	1.3	0.7
Arsenic-76	11	11	7	8	6
Iodine-131	0.10	0.07	0.11	0.07	0.07
Neptunium-239	17	11	6	8	8

II. Radionuclides in Liquid Wastes Discharged to Ground in the 200 Areas

All liquid wastes discharged to the ground on the 200 Area plateau during 1968 were controlled by the Atlantic Richfield Hanford Company. A detailed report on those releases is contained in Reference 3. Most of the wastes resulted from the operation of separations plants. However, liquid waste was also disposed of as a service to Battelle-Northwest and Douglas United Nuclear. Most of that waste was evaporated at Redox and only the condensate was discharged to cribs. That condensate was reported with ARHCO releases and was not broken out according to the original contribution of waste water to Redox for evaporation. The concentrate was stored in tanks for eventual disposal by programs which are not covered in this document. Table 3 is the summary table from Reference 4 and Table 4 breaks down the 1968 releases by disposing contractor. No significant changes were apparent between 1967 and 1968.

Five disposal sites were placed in service in 1968 and the use of two was discontinued.

216-A-39 Trench for 244-AR cooling water (new)

216-B-57 Crib for in-tank solidification No. 2 condensate (new)

216-B-59 Trench for B Plant cooling water (new)

216-Z-1 Crib for plutonium reclamation process tests (reactivated)

216-Z-16 Crib for 231-Z laboratory waste (BNW) (new)

TABLE 3

200 Area Liquid Waste

The radioactive liquid wastes discharged to ground in 1968 and through 1968 were:

In 1968	To Ponds And Ditches	To Cribs	To Specific Retention Sites	Total
Volume (n x 10^6 liters)	22,300[1]	806	2.43	23,100
Uranium (Kg)	64	146	---	210
Plutonium (g)	< 53.4	1,736	7,596	9,385
Total Beta Emitters (Ci)	891	10,268	3	11,162
^{60}Co (Ci)	< 33	7.32	---	< 40.3
^{90}Sr (Ci)	53.1	109	.05	162
^{137}Cs (Ci)	58.8	1,626	.02	1,685
^{106}Ru (Ci)	226	2,357	---	2,583

Through 1968 (from startup)

Volume (n x 10^6 liters)	410,000[1]	25,400	138	435,500
Uranium (Kg)	6,200	58,600	51,500	116,000
Plutonium (g)	9,014	199,669	59,027	267,710
Total Beta Emitters (Ci)	114,174	2,153,104	921,858	3,189,136
^{60}Co (Ci)	< 72.6[2]	478	144	< 695
^{90}Sr (Ci)	764	31,063	11,802	43,629
^{137}Cs (Ci)	606	16,528	32,208	49,342
^{106}Ru (Ci)	3,729	246,108	301,409	551,246

(1) Includes waste water from all sources

(2) Total since 1-1-67

TABLE 4

Liquid Wastes Discharged to Ground
in the 200 Areas in 1968

Generating Contractor	Volume ($n \times 10^6$ gal)	U Lb	Pu g	Total Beta Ci	^{60}Co Ci	^{90}Sr Ci	^{137}Cs Ci	^{106}Ru Ci
To Ponds and Ditches								
ARHCO	5,877	141	< 53	891	< 33	53	59	226
To Cribs								
BNW	6	0.01	2.5	84	0.03	10	0.4	2
ARHCO	207	322	1733	10,184	7.29	100	1626	2357
To Specific Retention								
ARHCO	0.64	--	7596	3	--	.05	.02	--

216-Z-17 Ditch for 231-Z laboratory waste (BNW) (terminated)

216-C-10 Crib for Semiworks process condensate (standby)

Evaluation of the migration of radionuclides discharged to ground to mid-1968 is contained in Reference 12. Only minor changes were noted from earlier reports.

III. Radionuclides Released to the Atmosphere

A. 1968 Experience

Historically iodine-131 has been the most significant nuclide released to the atmosphere from facilities at Hanford. Releases of this and other nuclides during 1968 were much less than 10% of applicable release guides except for two weeks when releases from the 327 Building stack reached 20% and 12% of release guides. Figure 5 shows the iodine-131 releases from 200 Area stacks (only Purex released significant amounts) and 300 Area stacks. A detailed report of releases from 200 Area stacks is contained in Reference 4 and Battelle-Northwest releases were reported in Reference 2. Environmental surveillance detected amounts of iodine-131 slightly over background on only a few occasions(10).

Battelle-Northwest reported an average release of 20 Ci tritium per week or a total release of a little more than 1000 Ci from PRTR. Although the number seems large, exposure to persons in the neighborhood was slight because of the low radiotoxicity of the nuclide.

B. Trends

It is apparent from Figure 6 that releases of iodine-131 from 200 Area facilities have been greatly reduced, reflecting the results of specific control efforts in addition to the effects of production curtailment. Laboratory experience in the 300 Area fluctuates unpredictably with the amount of work being performed on irradiated fuels and the amount of decay such fuels receive before examination and testing.

IV. Solid Radioactive Materials to Burial Grounds

Data from the solid radioactive waste disposal reports are tabulated below (2,5,6,7,8). One burial ground, 300 Wye, was reported by Battelle-Northwest as being permanently closed on December 31, 1967.

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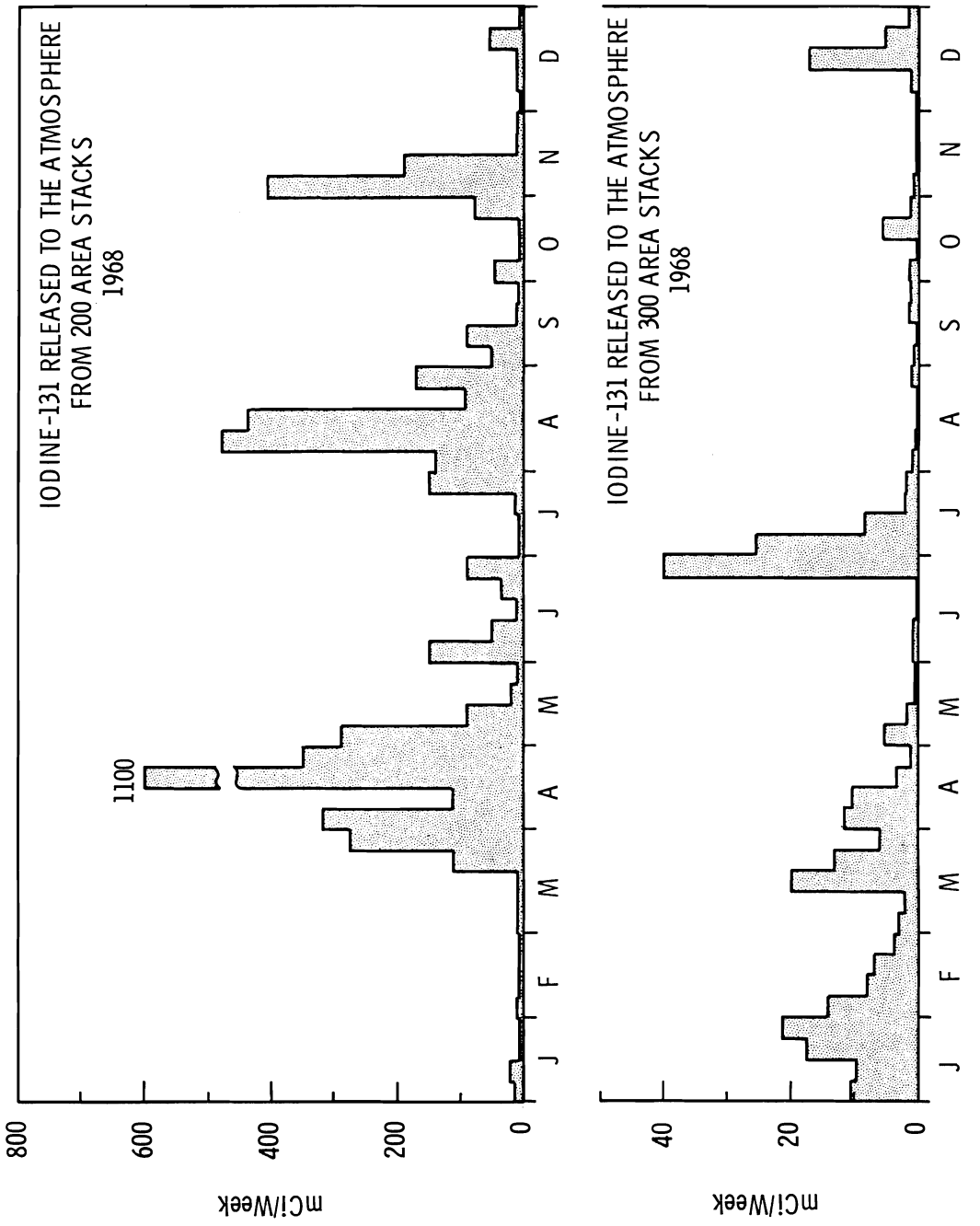
IODINE-131 RELEASED TO THE ATMOSPHERE
FROM 200 AREA STACKS
1968
1100
mCi/Week
800
600
400
200
0
J F M A M J J A S O N D
IODINE-131 RELEASED TO THE ATMOSPHERE
FROM 300 AREA STACKS
1968
mCi/Week
40
20
0
J F M A M J J A S O N D

FIGURE 5

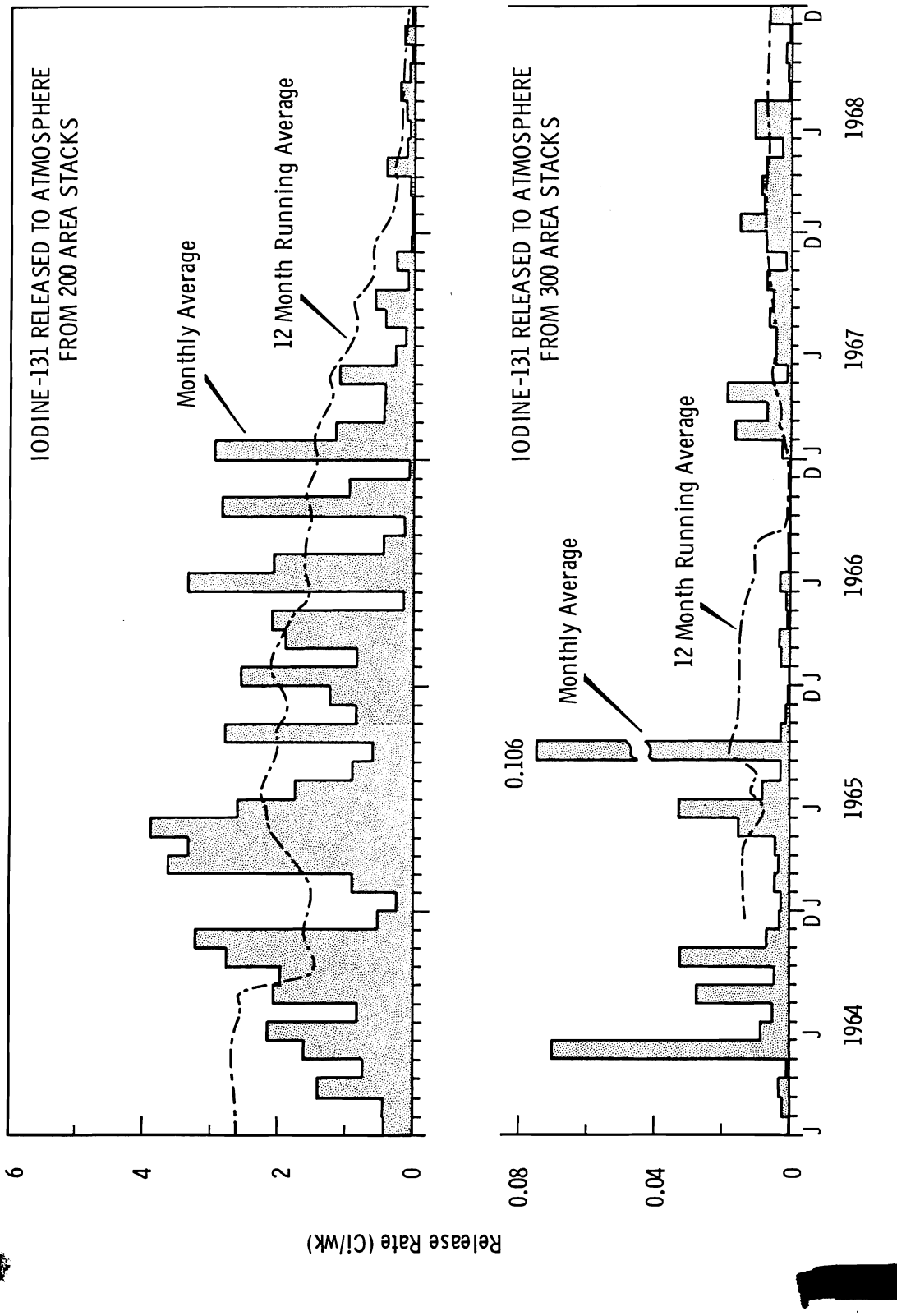
IODINE-131 RELEASED TO ATMOSPHERE
FROM 200 AREA STACKS
Monthly Average
12 Month Running Average
6
4
2
0
IODINE-131 RELEASED TO ATMOSPHERE
FROM 300 AREA STACKS
Monthly Average
12 Month Running Average
0.106
0.08
0.04
0
J
D
J
D
J
D
J
D
J
1964
1965
1966
1967
1968
Release Rate (Ci/wk)

FIGURE 6

TABLE 5

Radioactive Solid Waste Burial

Disposer	Disposal Site	Volume (ft^3)	Area (Acres)	Radioactivity U (Kg)	Pu (g)	Total (Ci)
DUN	100B	5,270	0.09			
DUN	100D	13,750	0.06			
DUN	100K	9,680	0.20			25
BNW	100F	8,900	0.19			1
ARHCO	200E(12B)	30,090	0.83		596	1,660
BNW	200E(12B)	27	0.001			
JAJ	200E(12B)	8,500	0.24			30
ARHCO	200E(10)	29,500	0.73			71,200
ARHCO	200W(4B)	48,000	1.20	5	4,600	1,720
BNW	200W(4B)	47,900	1.20	18.5	1,020	1,590
ITT/FSS	200W(4B)	4,890	0.12			
DUN	200W(4B)	413	0.01	14.7		*
JAJ	200W(4B)	2,120	0.05			25
Offsite	200W(4B)	4,820	0.21	1,329		**
DUN	300W	53,000	0.60			

* Includes 6.7 g tritium

** Includes 34 Kg thorium

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