RADIOACTIVE EFFLUENT REDUCTION
FROM 200 AREA FACILITIES

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RADIOACTIVE EFFLUENT REDUCTION
FROM 200 AREA FACILITIES

A. INTRODUCTION

A comprehensive study of radioactive wastes discharged to the environs in the 200 Areas was made in 1967⁽¹⁾. It was found that gaseous waste emission guides were being met for the discharge of ^{131}I , ^{90}Sr , mixed fission products, and ^{239}Pu . Treatment systems for reduction of NO_2 from several stacks were proposed. A prototype system is presently being tested on UO_3 Plant stack gases. Proposed treatment of liquid wastes emphasized removal of the long-lived radionuclides (^{90}Sr , ^{137}Cs , ^{239}Pu) from those streams being discharged to the environs.

Significant reductions of radioactivity to the ground have been realized during the past three to four years by changes in operating procedures and minor expenditure of funds for process and equipment improvements. Our over-all performance in this area is shown in Table 1. The radioactivity content of waste streams discharged to the environment is under continuous surveillance and continued reductions, wherever possible, will be achieved with existing funds. Further major reductions in radioactive discharges to meet the goal of less than ten grams of plutonium and less than four hundred total beta curies can only be achieved with budgeted funds. Funds have been requested for FY 1972 to provide facilities for plutonium effluent clean-up, separations effluent control, and for low-level effluent analysis. The above goal should be realized by the end of CY 1975 by installation and beneficial use of these facilities, the shutdown of the Redox waste concentrators, further refinement of the Purex process condensate recycle and/or re-evaporation systems and lower analytical detection capability.

B. GASEOUS WASTE REVIEW

1. <u>Discharges</u>	Volume ($\times 10^{11}$ Ft ³)	Total Beta (Curies)	Total* Alpha (Curies)	Total** Alpha (Curies)	^{131}I (Curies)
CY 1967	~ 4.0	1.51	0.353	7.20×10^{-4}	29.9
CY 1968	4.44	1.67	9.38×10^{-3}	7.50×10^{-4}	5.62
CY 1969	4.04	4.29	≤ 0.037	$< 8.60 \times 10^{-4}$	1.58

*Assumed source ^{239}Pu ; **Assumed source ^{238}U

(1) ARH-231 (secret), December 29, 1967, R. J. Sloat,
"Hanford Low Level Waste Management Reevaluation
Study"

2. Past Experience

Waste effluent gases are passed through one or more stages of filtration, monitored, sampled and analyzed. A wide variety of high efficiency filters is used. The plutonium processing facilities use three stages of high efficiency particle arrester (HEPA) filters; B Plant uses two stages of HEPA filters; the Purex plant uses two stages of glass fiber; and the UO₃ Plant, Redox and T Plants use sand filters. Samples are routinely analyzed for total alpha and total beta emitters. Selected stacks are analyzed for ¹³¹I. Analyses for radioisotopes, other than ¹³¹I, are performed if warranted by the total alpha or total beta level. No capability is presently installed for sampling stack waste gases to determine ³H, ¹⁴C or the noble gases.

3. Future Plans

FY 1972 funding has been requested for several projects which will assure containment of particulate matter containing radionuclides:

- a. A backup ventilation filter is planned at the Purex plant to replace the ventilation filter which has been in service since 1965.
- b. Facilities have been proposed to reduce the risk potential for releasing radionuclides by providing backup contamination barriers around highly radioactive process cells, glove boxes and work areas and primary confinement barriers for non-process areas potentially contaminated by interties with process areas.

Funding has also been requested to provide reduction of nitrogen oxides in the waste gas effluent from several plant stacks.

C. LIQUID WASTE REVIEW

Annual discharges of radionuclides to the ground in liquid wastes from 1965 through 1969 are presented in Table 1.

TABLE 1
RADIOACTIVITY IN LIQUID WASTES
DISCHARGED TO GROUND IN THE 200 AREAS

<u>Calendar Year</u>	<u>Total Beta (Curies)</u>	<u>Plutonium (Grams)</u>	<u>⁶⁰Co (Curies)</u>	<u>⁹⁰Sr (Curies)</u>	<u>¹³⁷Cs (Curies)</u>
1965	141,000	3730		2730	732
1966	101,000	2773		521	854
1967	17,430	8343(1)	<79.7	<263	290
1968	11,162	9385(1)	<40.3	162	1,685(3)
1969	3,915	6126(2)	<15.7	171	441(4)

includes a + adjustment

*ARH-1159
6270*

- (1) Increased plutonium discharge resulting from waste losses during recovery from incinerator ash leaches. *Ph adjustments in Waste Treatment caused a solids problem and a new analytical method was initiated.*
- (2) Decreased plutonium discharge resulting from centrifugation recovery of solids from incinerator ash leaches. *not detected greater amount of Pu*
- (3) Increased ¹³⁷Cs losses resulted from B Plant waste concentrator pressurizations and no process condensate recycle capability.
- (4) Decreased ¹³⁷Cs losses following installation and beneficial use of B Plant process condensate recycle.

It is readily apparent that substantial reductions in the quantity of total beta activity to the ground have been achieved.

The radioactive content of all waste streams is under continuous surveillance. Where reductions in radioactivity can be achieved by improved operation or equipment modifications within existing funds, these changes are implemented. Further major reductions will require specific funding for treatment facilities.

Individual liquid waste streams, discharged to the ground in the 200 Areas have been reviewed. Information on discharges during 1967, 1968 and 1969, past experience and future plans for each stream are presented.

It should be recognized that the indicated radioisotopic discharges on a number of high volume, normally low activity, waste

streams may be abnormally high. The capability of our laboratories to analyze specific radioisotopes at low-level concentrations, although improved, is still not definitive enough for an exact measure. Thus a less-than number must be used for the analyses in the discharge calculations, and the resultant number may be many fold higher than the actual discharge. Development of improved analytical capability is continuing.

1. Purex Ammonia Scrubber Waste
(Aluminum and Zirconium Clad Fuels)

a. <u>Discharges</u>	<u>Volume</u> <u>(nx10⁰ Gal)</u>	<u>Total</u> <u>Beta</u> <u>(Curies)</u>	<u>Pu</u> <u>(Grams)</u>	<u>⁶⁰Co</u> <u>(Curies)</u>	<u>⁹⁰Sr</u> <u>(Curies)</u>	<u>¹³⁷Cs</u> <u>(Curies)</u>
CY 1967	1.305	4996	13.9	7.0	25.0	15.0
CY 1968	1.326	928	19.4	0.8	13.7	14.8
CY 1969	4.696	1791	7.2	6.6	99.1	110.2

b. Past Experience

Ammonia scrubber wastes represent the absorber water leaving four off-gas ammonia scrubbers - one for each of the three dissolvers and one for Zirflex decladding waste neutralization. Radionuclides are routinely present in these wastes due to entrainment from the dissolution and neutralization reaction vessels. Facility modifications in the dissolver system have significantly reduced the radioactivity content of ammonia scrubber waste.

c. Future Plans

The method selected for further reduction in radioactivity discharges to the environs with this waste is decontamination by evaporation and eventual solidification and long-term storage of the concentrated waste.

Funds have been requested for FY 1972 to re-route ammonia scrubber waste to existing evaporator facilities. It now appears that the most favorable evaporator facility from a capital cost standpoint is a concentrator recently installed in Purex for thorium processing in Fll canyon position. Design work needed to implement this proposal is expected to begin soon.

2. Purex Process Condensates

a. <u>Discharges</u>	<u>Volume</u> ($\times 10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	82.49	1430	13.5	0.62	2.88	6.48
CY 1968	68.18	497	15.5	3.04	4.4	4.59
CY 1969	30.84	731	6.05	5.24	40.4	44.9

b. Past Experience

The process condensate stream consists of overheads condensates from the first and second cycle uranium concentrators, the backcycle waste concentrator, and the nitric acid absorber. The radioactivity levels in these streams result primarily from the small amounts of aqueous entrainment which are not removed by existing deentrainment equipment. The program selected for reducing radioactivity discharges via process condensates is in-process recycle of the higher activity condensate and ground discharge of any low activity condensate in excess of the amount which can be recycled. It was further planned that diversion capability would be provided to allow evaporative decontamination of the excess condensate during periods of unusually high activity discharges.

Presently about 80 percent of the nitric acid absorber condensate and all of the first cycle uranium concentrator condensate are being successfully recycled. Recycle system modifications are in progress to allow recycle of the remaining 20 percent of the nitric acid absorber condensate.

c. Future Plans

A proposed system for total recycle of the backcycle waste concentrator condensate is currently being evaluated for process compatibility; the proposed facilities are budgeted for FY 1972. The remaining process condensate stream, the overheads condensate from the second cycle uranium concentrator, would be expected to discharge less than five total beta curies per year to the environs. Process condensate diversion capability is also presently budgeted for FY 1972.

3. Purex Steam Condensate

a. Discharges	Volume ($\times 10^6$ Gal)	Total Beta (Curies)	Pu (Grams)	^{60}Co (Curies)	^{90}Sr (Curies)	^{137}Cs (Curies)
CY 1967	97.88	408	18.0	0.74	2.8	2.66
CY 1968	78.22	39	< 8.5	0.63	5.56	2.53
CY 1969	64.22	342	1.91	1.66	13.0	14.4

b. Past Experience

The steam condensate waste stream consists primarily of condensates from process vessel heating coils. This waste routing also carries small volumes of liquid wastes from railroad tunnel floor drains, the slug storage basin, etc. Also the cooling water discharges from selected "high-risk" process vessel coils have been re-routed from a surface disposal site to the steam condensate sub-surface ground disposal site to minimize the potential impact of a coil failure. The radioactivity present in this waste stream is routinely quite low; the cause of radioactive discharges to this stream is infrequent equipment failure.

c. Future Plans

The method selected to reduce such radioactivity discharges requires new facilities to monitor stream radiation levels continuously and to divert the stream automatically to interim storage to await further processing if abnormally high radioactivity is detected. Such facilities, funded for FY 1972, are quite appropriate for this stream, since radioactivity discharges are infrequent and result from abnormal operating conditions.

4. Purex Laboratory and Miscellaneous Wastes

a. Discharges	Volume ($\times 10^6$ Gal)	Total Beta (Curies)	Pu (Grams)	^{60}Co (Curies)	^{90}Sr (Curies)	^{137}Cs (Curies)
CY 1967	1.112	502	6	0.995	5.0	7.22
CY 1968	0.496	20	< 6	0.104	4.11	0.99
CY 1969	0.342	8.5	< 2.03	0.026	0.232	0.263

b. Past Experience

Selected laboratory wastes, miscellaneous wastes from canyon ventilation stack drainage and flushes, and various floor drains from potentially radioactive areas were formerly routed to a sub-surface disposal site. Substantial radioactivity discharges via this stream may result from infrequent high-activity batches collected from stack or ventilation filter drainage. Thus, the method selected for significant reduction of this radioactivity discharge requires capability for occasionally routing a high-radioactivity waste batch to an underground storage tank for eventual solidification and long-term storage.

c. Future Plans

The re-routing of this liquid waste to an underground storage tank was recently accomplished. However, due to lack of adequate funding the re-routing method destroyed the capability to discharge this stream to the sub-surface disposal site previously used. Although the normally low radioactivity levels on this waste may not justify the expense of additional evaporative decontamination, capability to discharge selected waste batches to ground disposal should be established only if the additional liquid volume will hinder waste solidification goals.

5. Purex Cooling Water

a. <u>Discharges</u>	<u>Volume</u> <u>($\times 10^6$ Gal)</u>	<u>Total</u> <u>Beta</u> <u>(Curies)</u>	<u>Pu</u> <u>(Grams)</u>	<u>^{60}Co</u> <u>(Curies)</u>	<u>^{90}Sr</u> <u>(Curies)</u>	<u>^{137}Cs</u> <u>(Curies)</u>
CY 1967	2947	368	18.4	< 18	47.2	10.5
CY 1968	2917	754	19.5	24.7	39.0	40.0
CY 1969	1933	< 11.1	< 2.16	< 0.13	< 0.324	8.9

b. Past Experience

The cooling water effluent from the Purex plant consists primarily of condenser and cooling coil discharges, which normally contain relatively small quantities of fission products. The discharges reported above are known to be high because of the inability of laboratory analysis to measure at the low concentrations known to exist. During CY 1969 samples were analyzed by a laboratory having improved control of cross-contamination and improved measurement at low

concentrations, which resulted in a substantial reduction of radioactivity measured in the effluent stream. The amount of radioactivity added to the cooling water stream is essentially nil. A continuous radiation monitor has been installed on the cooling water stream which will alarm if a detectable radioactivity release were to occur. In such an instance rapid plant shutdown, followed immediately by identification and removal of the activity source, will minimize the radioactivity released.

c. Future Plans

The FY 1972 budget contains an item for cooling water diversion capability to allow collection and subsequent further processing if the cooling water were to become radioactively contaminated.

6. Purex Chemical Sewer

a. Discharges	Volume ($\times 10^6$ Gal)	Total Beta (Curies)	Pu (Grams)	^{60}Co (Curies)	^{90}Sr (Curies)	^{137}Cs (Curies)
CY 1967	219.8	47	< 6.5	< 1.32	0.88	7.29
CY 1968	130.3	63	< 6.0	1.12	2.8	3.0
CY 1969	162.6	26	< 2.56	1.36	1.15	1.28

b. Past Experience

The major portion of the chemical sewer flow during plant operation consists of condenser cooling water from the nitric acid fractionator. Other inputs include acid fractionator steam and process condensates, building heater condensates, water demineralizer regeneration wastes, and miscellaneous tank and floor drains. The only routine source of radioactive input to the chemical sewer is the overheads condensate from the nitric acid absorber. Recently emergency diversion capability was installed for the floor drains from the building pipe and operating gallery, which could potentially receive large amounts of radioactivity under serious accident conditions.

c. Future Plans

Equipment modifications are planned for this calendar year which will allow in-process recycle of a large portion of the acid fractionator condensate and disposal of the excess to a sub-surface disposal site rather than the surface pond used for

chemical sewer disposal. Facilities for diverting, accumulating, sampling and appropriate disposal of chemical sewer effluent to preclude discharging radionuclides and significant quantities of toxic chemicals to the ground have been proposed.

7. 241-A and AX Tank Farm Condensate

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	6.692	84	0.064	< 0.2	< 33	49.3
CY 1968	7.047	963	< 0.072	< 1.40	< 21	377
CY 1969	6.370	276	< 0.081	0.058	2.14	53.5

b. Past Experience

Sluicing of solids from the 241-A Farm tanks with resulting entrainment to the tank farm condensate stream is believed to be responsible for the increased radioactivity released in CY 1968. The beneficial use of improved deentrainment and ventilation facilities on the 241-A and AX Tank Farm facilities during the second quarter of CY 1969 provided a substantial reduction in the radioactivity discharged.

c. Future Plans

Funding for ion-exchange treatment of this waste effluent stream has not been requested for FY 1972. Currently a prototype ion exchange column is being used to remove ^{137}Cs from this waste stream. The average ^{137}Cs concentration has been reduced to 3×10^{-4} $\mu\text{Ci/gallon}$ (< 1% of AECM 0524 Standards).

8. 241-A and AX Tank Farm Cooling Water

a. Discharges

Cooling water from the Purex plant is collected in a 750,000-gallon tank and re-used in the 241-A and AX Tank Farm condensers. No increase in radioactivity has been noted. Radioactivity is reported on the Purex cooling water stream.

b. Past Experience

241-A and AX Tank Farm condenser cooling water is sampled and discharged to a surface pond. The cooling water discharge

has a gamma radiation monitor and an alarm.

c. Future Plans

No revisions to this low risk system are currently planned.

9. B Plant Process Condensate

a. <u>Discharges</u>	<u>Volume</u> ($\times 10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	1.527	887	1.15	< 0.135	17	11
CY 1968	3.833	6921	1.93	< 0.175	31	910
CY 1969	5.582	540	< 0.310	< 0.117	13	164

b. Past Experience

High level wastes resulting from B Plant operations are concentrated in the Cell 23 waste evaporator. Bottoms are routed to underground tanks for storage and the overheads condensed and routed to a crib. Pressure surges in the waste evaporators, which have occurred intermittently since startup, permit concentrator bottoms to be entrained to the condensate receiver tank. Process condensate recycle was not provided until August 1968. At this time an isolation valve, between the condensate receiver tank and the crib, was also provided. Monitoring and recycle of this stream provided a substantial reduction of the radioactivity discharged with this effluent during CY 1969. Operating procedures have incorporated periodic acid flushing of the waste concentrator during CY 1970 and pressure surges have been infrequent. The radioactivity discharged during CY 1970 will again be substantially reduced.

c. Future Plans

Improved sampling and monitoring of this waste stream is currently being installed. Funding has been requested in FY 1972 to provide diversion of high level condensate to underground tank storage and routine ion exchange processing of all B Plant process condensate for ^{137}Cs , ^{90}Sr , and $^{144}\text{CePr}$ removal.

10. B Plant Steam Condensate

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	2.904	1.51	<0.018	<0.08	<0.49	0.26
CY 1968	7.587	7.66	<0.193	<0.178	<2.39	6.63
CY 1969	22.99	16.8	<0.163	<0.011	0.246	4.61

b. Past Experience

Steam condensates from process vessel heating coils and cooling waters from "high risk" process vessel coils are discharged to a crib. Recycle of steam condensate from the Cell 5 strontium product concentrator and the Cell 20 cesium product concentrator was provided at startup and is routinely used during the first half hour following startup of a concentrator. In the event that one of these coils had failed since previously operated, the major portion of concentrated ^{90}Sr or ^{137}Cs , leaking into the coil, would be recycled vice discharged to the crib. This recycle system has recently been upgraded to provide segregated recycle from these two vessel coils.

c. Future Plans

Improved sampling and radiation monitoring are currently being installed. FY 1972 funding has been requested to permit diversion of high level condensate to underground tank storage. Diversion to the process condensate ion exchange treatment facilities may also be provided.

11. B Plant Cooling Water

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	180.5	24.3	<4.54	<9.00	<7.32	<17.3
CY 1968	616	12.8	<4.42	3.65	<1.66	<3.82
CY 1969	621.8	1.62	<3.37	<0.10	<0.14	1.71

b. Past Experience

Cooling waters from B Plant condensers and selected process vessel coils are collected via six sub-header system, which can be valved to either the 24-inch or 15-inch sewer. Waters from "high risk" service are normally routed via the

15-inch sewer, which provides continuous scintillation gamma monitoring upstream of a diversion station. The diversion station contains a dump valve, activated by the gamma monitoring system, which routes any contaminated water to an emergency disposal trench. During the four years this system has been in operation, one cooling coil has failed and the 15-inch sewer was automatically dumped to the emergency disposal trench as designed. Normally the water overflows from the diversion station into the 24-inch sewer and to retention basins, for sampling and monitoring, before discharge to a surface pond. Contaminated water can also be manually routed from the two 500,000-gallon retention basins to another emergency disposal trench.

c. Future Plans

FY 1972 funding has been requested to provide improved monitoring and diversion of contaminated waters to an underground storage tank vice the emergency disposal trench.

12. B Plant Chemical Sewer

a. <u>Discharges</u>	<u>Volume</u> ($\times 10^6$ Gal)	<u>Total</u> <u>Beta</u> (<u>Curies</u>)	<u>Pu</u> (<u>Grams</u>)	<u>^{60}Co</u> (<u>Curies</u>)	<u>^{90}Sr</u> (<u>Curies</u>)	<u>^{137}Cs</u> (<u>Curies</u>)
CY 1967	*	-	-	-	-	-
CY 1968	*	-	-	-	-	-
CY 1969	34.8	<0.429	<0.111	<0.005	<0.038	<0.226

* Volume not measured

b. Past Experience

Flow to the B Plant chemical sewer consists of compressor cooling water, chemical spills and tank flushes, gallery floor drainage, etc. Samples taken prior to an accidental release of strontium in March 1970 were below laboratory detection limits. Continuous sampling was provided in April 1970, using a portable sampler. The portable sampler was replaced by an improved continuous sampler in October 1970. Chemical sewer effluent, previously routed to a surface pond, has been routed to a separate trench since May 7, 1970.

c. Future Plans

FY 1972 funding has been requested to provide facilities for diverting, accumulating, sampling and appropriate disposal of chemical sewer effluent to preclude discharging radionuclides and significant quantities of toxic chemicals to the ground.

13. 244-AR Vault Waste Waters

a. Discharges	Volume ($\text{nx}10^6$ Gal)	Total Beta (Curies)	Pu (Grams)	^{60}Co (Curies)	^{90}Sr (Curies)	^{137}Cs (Curies)
CY 1967	None	-	-	-	-	-
CY 1968	5.2*	-	-	-	-	-
CY 1969	137.44	< 0.157	< 0.450	< 0.039	< 0.049	< 0.087

* No samples analyzed

b. Past Experience

The 244-AR Vault facility was first operated in 1968. Cooling waters and steam condensates from process vessel coils are continuously monitored by a gamma scintillation monitor upstream of a diversion station. The diversion station contains a dump valve, activated by the gamma monitoring system, which routes contaminated water to an emergency disposal trench. During the three years this system has been in operation no coil failures have occurred. All waste waters have been disposed to a surface pond.

c. Future Plans

FY 1972 funding has been requested to provide improved monitoring and diversion of contaminated waters to an underground storage tank vice the emergency disposal trench.

14. ITS-1 Process Condensate

a. Discharges	Volume ($\text{nx}10^6$ Gal)	Total Beta (Curies)	Pu (Grams)	^{60}Co (Curies)	^{90}Sr (Curies)	^{137}Cs (Curies)
CY 1967	2.369	22.4	0.04	< 0.2	< 5.8	13.1
CY 1968	1.891	4.0	< 0.06	< 0.023	< 0.052	2.38
CY 1969	2.378	21.4	< 0.035	< 0.01	0.01	13.2

b. Past Experience

The In-Tank Solidification unit No. 1 (ITS-1) uses an existing 750,000-gallon tank as the process vessel. Waste concentration is provided by introducing electrically heated air to an air circulator. Overheads from the boiling waste tank are deentrained, condensed, sampled and discharged to a crib. Condensates may be recycled to the underground storage tanks. A prototype ion exchange system for removal of ^{137}Cs was successfully operated in CY 1968.

c. Future Plans

Reactivation of the prototype ion exchange system for ^{137}Cs removal is being investigated.

15. ITS-1 Cooling Water

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^0$ gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	*	-	-	-	-	-
CY 1968	95**	-	-	-	-	-
CY 1969	85.47	<0.331	<0.469	<0.016	<0.027	<0.028

* Cooling water flow not measured
or sampled

** Cooling water not sampled

b. Past Experience

Cooling water from the ITS-1 condenser is discharged to a surface pond. This low risk stream is currently sampled and analyzed on a weekly basis. Radioactivity is present at less than laboratory detection limits.

c. Future Plans

A radiation monitor and alarm may be provided on this stream with FY 1972 funding.

16. ITS-2 Process Condensate

a. <u>Discharges</u>	<u>Volume</u> ($\times 10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	None	-	-	-	-	-
CY 1968	3.314	501	0.08	0.1	3	283
CY 1969	5.292	29.3	<0.096	<0.01	0.020	16.5

b. Past Experience

The In-Tank Solidification unit No. 2 (ITS-2) uses an existing 750,000-gallon tank as the process vessel. Waste concentration is provided by four banks of electrically heated elements. Overheads from the boiling waste tank are deentrained, condensed, sampled and discharged to a crib. Condensates may be recycled to the underground waste storage tanks. Deentrainer operating problems resulted in a large release of radioactivity in May 1968 (468 Ci total beta, 261 Ci ^{137}Cs). Operating procedures, changed to provide for periodic deentrainer flushing, have decreased the radioactivity content of the process condensates discharged to the crib.

c. Future Plans

FY 1972 funding has been requested to provide ion exchange treatment of the process condensate for ^{137}Cs removal. Re-activation of the ITS-1 prototype ion exchange system for removal of ^{137}Cs from all or part of this stream is being investigated.

17. ITS-2 Cooling Water

a. <u>Discharges</u>	<u>Volume</u> ($\times 10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	None	-	-	-	-	-
CY 1968	88*	-	-	-	-	-
CY 1969	133.6	<1.10	<0.789	<0.018	<0.056	<0.813

* Cooling water not sampled

b. Past Experience

Cooling water from the ITS-2 condenser is discharged to a surface pond. This low risk stream is currently sampled and

analyzed on a weekly basis. Radioactivity is present at less than laboratory detection limits.

c. Future Plans

A radiation monitor and alarm will be provided on this stream with FY 1972 funding.

18. 242-T Steam and Process Condensates

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}So</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	12.95	5.66	<0.2	<0.04	<0.3	3.32
CY 1968	17.09	8.11	0.098	<0.019	<0.85	4.48
CY 1969	17.90	8.00	<0.026	<0.002	<0.02	3.32

b. Past Experience

Non-boiling high level wastes are concentrated in the 242-T waste evaporator. Overheads are condensed, collected, sampled and discharged to a crib on a batch basis. Approximately 4×10^6 gallons of process condensate are discharged annually. Individual batches, which do not meet standards for crib discharge, are recycled. The major fission product contained in this waste stream is ^{137}Cs . Steam condensates and cooling waters from the waste evaporator tube bundles are continuously discharged to the crib. A third stream, aspirator jet water, previously discharged to the crib was discontinued in December 1969.

c. Future Plans

FY 1972 funding has been requested to provide ion exchange treatment of the process condensate for ^{137}Cs removal.

19. 242-T Cooling Water

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
1967	85.073	5.09	<1.2	<2.2	<2.8	4.20
1968	91.5	9.12	1.72	<1.16	<2.33	4.99
1969	89.0	0.54	<0.574	<0.013	0.044	0.24

b. Past Experience

Cooling water from the 242-T condenser is routed to a retention basin for batch collection, sampling and discharge to a surface pond.

c. Future Plans

A radiation monitor and alarm will be provided on this stream with FY 1972 funding.

20. 241-SX Tank Farm Process Condensate

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	1.659	59.1	0.069	<0.37	<16.9	11.8
CY 1968	0.003	2.8	0.0024	0.001	0.015	0.15
CY 1969	0.185	0.87	<0.0073	<9.2x10 ⁻⁵	0.03	0.33

b. Past Experience

Overheads from the boiling waste tanks were deentrained, condensed, sampled and discharged to a crib. Condensates have been recycled to the underground waste storage tanks since February 1968 except for January and February of 1969.

c. Future Plans

All future 241-SX Tank Farm condensate should continue to be recycled.

21. 241-SX Tank Farm Cooling Water

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	46.12	6.8	<0.42	<3.3	<3.24	<3.24
CY 1968	52.715	3.7	1.25	<0.35	<0.35	0.71
CY 1969	46.96	<0.911	<0.388	<0.011	<0.15	<0.47

b. Past Experience

241-SX Tank Farm condenser cooling water is discharged to a surface pond. This low risk stream is currently sampled and analyzed on a weekly basis.

c. Future Plans

No capital expenditures for upgrading sampling or radiation monitoring of this stream are planned.

22. 222-S Laboratory Wastesa. Waste Waters

1) <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	9.3	0.47	0.101	<0.492	<1.44	<0.273
CY 1968	9.1	0.30	0.178	0.070	0.044	0.052
CY 1969	9.1	1.20	<0.185	<0.001	<0.012	0.941

2) Past Experience

Waste waters from operation of the 222-S Laboratory are routed to a two-compartment retention basin and discharged batch-wise. Capability is installed to permit routing of the retention basins to the Redox plant for evaporation or transfer to underground storage.

3) Future Plans

When the Redox waste evaporators are shut down a routing to underground storage tanks will be provided for batches above surface disposal limits.

b. Other Liquid Waste

1) <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	0.030	0.409	0.482	<0.008	<0.050	<0.045
CY 1968	0.014	0.036	0.046	<0.0005	0.0026	0.0013
CY 1969	0.002*	0.083	0.01	1×10^{-5}	0.0047	0.0029

* This stream routed to Redox plant
for evaporation in January 1969

2) Past Experience

This low-volume, low-level waste stream from selected laboratory sinks was batch-collected and discharged to a crib until January 1969, when the crib was removed from service. Since then this waste stream has been routed to the Redox Plant for evaporation.

3) Future Plans

When the Redox waste evaporators are shut down a routing to underground storage tanks will be provided.

23. UO₃ Plant Process Condensate

a. <u>Discharges</u>	<u>Volume</u> (<u>nx10⁶ Gal</u>)	<u>Total</u> <u>Beta</u> (<u>Curies</u>)	<u>U</u> (<u>Pounds</u>)
CY 1967	2.622	0.044	151.9
CY 1968	2.342	0.026	16.68
CY 1969	1.901	0.035	13.32

b. Past Experience

Overheads from the UO₃ Plant UNH concentrators are condensed, collected, and pumped to a crib. A continuous sample is taken of the pump discharge stream. Uranium is the major contaminant present in this waste stream.

c. Future Plans

Currently this waste stream meets AECM-0524 standards for surface discharge. The present method of handling this stream appears to be satisfactory.

24. UO₃ Plant Waste Waters

a. <u>Discharges</u>	<u>Volume</u> (<u>nx10⁶ Gal</u>)	<u>Total</u> <u>Beta</u> (<u>Curies</u>)	<u>U</u> (<u>Pounds</u>)
CY 1967	201.85	1.76	90.63
CY 1968	208	3.41	31.51
CY 1969	197.56	2.58	51.87

b. Past Experience

Cooling waters from the UO₃ Plant do not have the potential for containing measurable plutonium or long-lived specific fission products since the UNH processed has low fission product activity.

c. Future Plans

This waste water stream meets the AECM-0524 standards for surface discharge. If funds are available improved sampling and radiation monitoring may be installed.

25. T Plant Decontamination Wastes

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	0.098	92.2	2.45	0.20	7.61	4.42
CY 1968	0.013	1.0	0.031	<0.31	0.10	1.90
CY 1969	0.013	0.28	0.001	7.2×10^{-6}	<0.003	0.10

b. Past Experience

Wastes from the decontamination of failed equipment in the T Plant facilities were routinely discharged to a crib prior to 1967. Since 1967 the major volume has been routed to underground storage tanks.

c. Future Plans

All wastes from the decontamination of failed equipment were routed to underground storage during CY 1970. It is expected that this practice will be continued.

26. Plutonium Reclamation Facility Wastes

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Pu</u> (Grams)
CY 1967	0.316	7040
CY 1968	0.265	7596
CY 1969	0.208	5560

b. Past Experience

Solvent extraction wastes from the Plutonium Reclamation Facility, containing a high concentration of salts and significant quantities of organic (TBP and DBBP in CCl_4) are collected, sampled and analyzed. These wastes are discharged to an underground tile field (Z-18). The disposal of these wastes is on a specific retention basis (i.e., volume is limited to that which can be held in the soil column above ground water). Plutonium losses have been reduced over the past year by operation of a centrifuge which removes undissolved plutonium-bearing solids for further processing.

c. Future Plans

A major program has been planned to reduce the plutonium discharged to the Z-12 and Z-18 tile fields to a goal figure of less than 10 grams per year. Part of this program was initiated in December 1970 and included a major revision to the Waste Treatment Facility, at a cost of approximately \$300,000, to reduce both soluble plutonium and americium losses. Funds have been requested for FY 1972 to provide facilities which will complete the program. The program includes equipment changes to reduce the volume of waste, facilities for carbon tetrachloride recovery, and collection facilities for degraded organic waste from all ARHCO plants. The major change involves installation of fluidized bed equipment for in-bed calcination of high salt waste and organic wastes to result in a granular solid waste which can be safely stored. A summary of the budgeted plans may be found in ARH-1756 SUP1 (unclassified), August 19, 1970, L. W. Finch, "Chemical Processing Division Plant and Capital Equipment Budget for FY 1972."

27. 234-5, 236 and Laboratory Wastes

a. <u>Discharges</u>	<u>Volume</u> <u>($\times 10^6$ Gal)</u>	<u>Pu</u> <u>(Grams)</u>
CY 1967	3.088	1035
CY 1968	1.551	680
CY 1969	1.699	517

b. Past Experience

A variety of contaminated process and laboratory wastes are routed to a collection tank each day. These are very low salt waste streams, and samples of each batch collected are taken for analyses. The wastes are then neutralized and routed to an underground tile field designated as Z-12. Plutonium solids settle out in an intermediate settling tank or are filtered out in the first few inches of the soil. Facilities are available for reprocessing batches of waste which exceed discard limits.

c. Future Plans

See Item c., Plutonium Reclamation Facility Wastes.

28. 234-5 and 231-Z Cooling Water

a. <u>Discharges</u>	<u>Volume</u> ($\times 10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)
CY 1967	*	-	-
CY 1968	164.4	**	19.1
CY 1969	151.2	<2.2	<9.16

* Not measured or sampled during 1967

** Not analyzed

b. Past Experience

Water used for cooling purposes, operation of vacuum pumps, etc., is discharged to a surface pond. This water is periodically sampled and analyzed.

c. Future Plans

It is doubtful that plutonium has been discharged in the quantities reported. Laboratory low-level detection capability will be improved and improved sampling and monitoring capability will be provided as possible.

29. 231-Z Laboratory Waste

a. <u>Discharges</u>	<u>Volume</u> ($\times 10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)
CY 1967	8.095	0.80	49.2
CY 1968	5.676	0.44	2.15
CY 1969	5.649	0.14	5.18

b. Past Experience

Hood, sink and floor drain waste waters from the 231-Z Building are routed to a crib. A continuous sample is collected and analyzed weekly.

c. Future Plans

Installation of improved sampling and plutonium monitoring is planned. Diversion of a plutonium release to underground storage was previously proposed in ARH-231, via a line

installed to also handle Plutonium Reclamation waste. Since Plutonium Reclamation waste will be calcined, an alternate plan for handling a plutonium release from 231-Z must be provided.

30. Redox Process Condensate

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	2.395	4129	45.12	<20.1	<32.8	51.6
CY 1968	3.157	247	10.92	0.347	2.28	4.79
CY 1969	3.37	98.8	<0.414	<0.121	0.50	0.74

b. Past Experience

During Redox Plant processing of irradiated fuels this stream consisted of overheads condensates from first and second cycle uranium concentrators, the co-decontamination cycle feed concentrator, the backcycle waste concentrator, and the waste concentrator. Irradiated fuels processing was discontinued during early 1967. Since August 1967 this stream has consisted of overhead condensates from concentration of 222-S Laboratory wastes, T Plant decontamination wastes, Douglas United Nuclear reactor decontamination wastes, and Battelle and WADCO 300 Area Laboratory wastes. Condensates are batch collected, sampled and discharged to a crib. Modification of the Redox Plant waste concentration facilities to permit recycle of process condensates above normal discharge limits and revised operating procedures have significantly decreased the radioactivity present in this waste stream.

c. Future Plans

No capital expenditures for upgrading sampling, monitoring or waste concentration facilities are planned. It is expected that waste concentration in the Redox Plant will cease when alternate capacity is available.

31. Redox Plant Steam Condensate

a. <u>Discharges</u>	<u>Volume</u> ($\text{nx}10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	12.404	244	2.64	<2.64	8	7.95
CY 1968	8.76	44	0.557	<0.153	<10.9	12.0
CY 1969	4.63	0.283	<0.014	<0.0014	0.073	0.042

b. Past Experience

Steam condensates and cooling waters from selected Redox process vessel coils and tube bundles are discharged to a crib. Although irradiated fuel processing was discontinued in early 1967, radioactivity persisted in samples as a result of prior coil failures. Waste concentrators and associated vessels have been operated for decontamination of ARHCO, Battelle Northwest and Douglas United Nuclear wastes since August 1967. A gamma monitor and alarm are installed on this waste stream.

c. Future Plans

No capital expenditures for upgrading sampling or monitoring of this stream are planned.

32. Redox Plant Cooling Water

a. <u>Discharges</u>	<u>Volume</u> ($\times 10^6$ Gal)	<u>Total</u> <u>Beta</u> (Curies)	<u>Pu</u> (Grams)	<u>^{60}Co</u> (Curies)	<u>^{90}Sr</u> (Curies)	<u>^{137}Cs</u> (Curies)
CY 1967	228.51	31.1	0.42	<4.12	<9.30	<1.66
CY 1968	280.9	40.3	0.75	1.68	6.85	6.21
CY 1969	353.4	2.65	<4.68	<0.081	<0.287	0.433

b. Past Experience

Condenser cooling waters and selected process vessel coil cooling waters are discharged to a surface pond. The effluent stream is monitored with an installed gamma monitor and alarm, and is continuously sampled. Although irradiated fuel processing was discontinued in early 1967, radioactivity persisted in samples as a result of prior coil failures.

c. Future Plans

No capital expenditures for upgrading sampling or monitoring of this stream are planned.

33. Redox Plant Chemical Sewer

a. Discharges	Volume ($\text{nx}10^6$ Gal)	Total Beta (Curies)	Pu (Grams)	60Co (Curies)	90Sr (Curies)	137Cs (Curies)
CY 1967	12.724	0.415	0.076	<0.132	<0.105	0.108
CY 1968	0.047	<0.009	<0.008	0.001	0.001	0.001
CY 1969	0.82	<0.003	<0.002	1.42×10^{-4}	2.23×10^{-4}	4.98×10^{-4}

b. Past Experience

Flow to the Redox Plant chemical sewer consists of compressor cooling water, gallery floor drains, chemical spills and tank flushes, etc. However, chemicals have not been a part of this stream since mid 1967. This low risk stream is periodically sampled and analyzed. Flow is estimated.

c. Future Plans

No capital expenditures for upgrading sampling or monitoring of this stream are planned.

34. 300 Area Laboratory Wastes

a. Discharges	Volume ($\text{nx}10^6$ Gal)	Total Beta (Curies)	Pu (Grams)	60Co (Curies)	90Sr (Curies)	137Cs (Curies)
CY 1967	2.356	2087	68	5.7	13.4	24.5
CY 1968	0.03	83	0.3	0.03	<9.5	0.41
CY 1960	None	-	-	-	-	-

b. Past Experience

Miscellaneous 300 Area laboratory wastes have been discharged to cribs in the 200 Areas since 1953. Radioactivity concentration limits for crib discharge of these wastes were substantially reduced in early 1967 and a large volume of wastes, which previously would have been cribbed, were routed to underground storage tanks. Since August 1967, all but a few thousand gallons of these wastes have been decontaminated by evaporation in the Redox Plant waste concentrators. An unloading station was provided for transfer of the liquid wastes from rail tank cars or truck trailers to a 50,000-gallon storage tank. Wastes are transferred to the concentrator via existing underground lines.

c. Future Plans

When alternate waste concentration capacity is installed these wastes will be unloaded at the Redox unloading station and routed via existing underground lines.

35. 100 N Reactor Decontamination Wastes

a. Discharges

During 1966 and 1967, 530,000 gallons of waste from decontamination of the 100 N Reactor and steam generator loops, containing 0.14 Ci ^{60}Co ; 0.16 Ci ^{90}Sr ; and 0.05 Ci ^{137}Cs were discharged to a 200 Area crib.

b. Past Experience

Although the wastes discharged to a crib from the initial reactor decontamination contained only small quantities of radioactivity, it was recognized that subsequent decontamination flushes could contain significant quantities of ^{60}Co . All reactor waste, subsequent to June 1967, has been transferred to the Redox Plant for decontamination by evaporation.

c. Future Plans

When alternative waste concentration capacity is installed these wastes will be unloaded at the Redox unloading station and routed via existing underground lines.

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