662930

DP-1349

CONTROL AND TREATMENT OF RADIOACTIVE LIQUID WASTE EFFLUENTS AT THE SAVANNAH RIVER PLANT

W. R. JACOBSEN
W. L. MARTER
D. A. ORTH
C. P. ROSS

RECORD
COPY
DO NOT RELEASE
FROM FILE

DU PONT
REG. U. S. PAT. OFF.

E. I. du Pont de Nemours & Co.
Savannah River Laboratory
Aiken, S. C. 29801

PREPARED FOR THE U. S. ATOMIC ENERGY COMMISSION UNDER CONTRACT AT(07-2)-1

NOTICE

Printed in the United States of America
Available from
National Technical Information Service
U. S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22151
Price: Printed Copy $5.45; Microfiche $1.45

662930

DP-1349
UC-70

CONTROL AND TREATMENT OF RADIOACTIVE LIQUID WASTE EFFLUENTS AT THE SAVANNAH RIVER PLANT

by

W. R. Jacobsen
W. L. Marter
D. A. Orth
C. P. Ross

Approved by

B. C. Rusche, Director
Environmental Sciences Section

Publication Date: February 1974

E. I. du Pont de Nemours & Co.
Savannah River Laboratory
Aiken, S. C. 29801

PREPARED FOR THE U. S. ATOMIC ENERGY COMMISSION UNDER CONTRACT AT(07-2)-1

ABSTRACT

Radioactive waste effluents at the Savannah River Plant are treated on the basis of potential off-site effects. Those wastes that are not stored in tanks or released directly to plant streams are either discharged to seepage basins or treated further to reduce their activity before being discharged. Administrative controls require that releases not result in harmful consequences and that they are also kept as low as practical. This document describes the controls, documents the releases of radionuclides to seepage basins, and describes other methods used to treat radioactive liquid wastes.

CONTENTS

LIST OF TABLES AND FIGURES

INTRODUCTION

In the course of the civil action concerning the Atomic Energy Commission's waste management program,[1] answers to a set of questions (interrogatories) prepared by the plaintiffs were required of the AEC. The Savannah River Plant and the National Reactor Testing Station were required to reply to 7 of the 54 interrogatories; the remaining questions focused attention on the Hanford site operations.

The interrogatories were primarily concerned with the disposition of liquid radioactive wastes to on-site disposal facilities in the ground. The Savannah River Plant replies to the interrogatories included only summaries of information for questions 1, 49, and 50. This report was prepared to document the more-detailed data and descriptive material from which those summaries were drawn.

The interrogatories directed to Savannah River presumed a definition of "intermediate-level" as waste that is stored or disposed of in open-bottom facilities or which might be so handled. For the purpose of responding to the interrogatories, liquid waste streams sent to seepage basins and streams that are treated to reduce their activity content before they are released either directly to plant streams or to seepage basins were discussed.

This report consists of four sections:

- Section I, *Technical Standard for the Release of Radioactivity from the Savannah River Plant*, is the Du Pont Company's administrative control for limiting off-site effects from releases of radioactivity. In this context, a technical standard states the value of the relevant parameter for which the probability of harmful consequences is acceptably low. Revisions are made to the standard when warranted by new information or experience.

---

[1] *Interrogatories Propounded to Defendants*, Civil Action No. 3924, in the United States District Court for the Eastern District of Washington, Natural Resources Defense Council, Inc., et al., Plantiffs, vs. Dixy Lee Ray, et al., Defendants (September 28, 1973).

- Section II, *Operating Guides for the Release of Radioactive Liquids from the Savannah River Plant,* contains the working limits for radioactivity releases. These guides state values that are achievable with good operating practice, and are based on the continuing objective of reducing radioactive effluents to the lowest practical levels. The guides are reviewed at least annually and increased or decreased as needed to reflect best current operating practice, experience, and production commitments.
- Section III, *Radioactivity Discharged to Seepage Basins and Other Unlined Basins at the Savannah River Plant,* documents the releases of radionuclides to various basins, by disposal site, on annual, cumulative, and decay-corrected cumulative bases.
- Section IV, *Treatment, Storage, and Disposal of Liquid Radioactive Wastes at the Savannah River Plant,* describes the facilities available for treatment of liquid waste streams, procedures for their operation, types and concentrations of radioactivity treated, and the costs of processing these waste streams.

ACKNOWLEDGMENT

The authors wish to express their gratitude to the Savannah River Laboratory and Plant employees who assisted in compiling the data and information included in this report, particularly the members of the Plant and Area Central Environmental Committees.

SECTION I

TECHNICAL STANDARD FOR THE RELEASE OF RADIOACTIVITY FROM THE SAVANNAH RIVER PLANT

(Revised 3/72)

APPLICABILITY

This Standard applies to the release of radioactive materials in gaseous and liquid effluents from the Savannah River Plant.

OBJECTIVE

The objective for prescribing the dose limits in this Standard is to keep exposures to the public in the vicinity of the Savannah River Plant as low as practicable.

LIMITS

The annual exposure to an individual in the off-plant population caused specifically by release of radioactivity from the Savannah River Plant shall not exceed the following limits:

Type of Exposure	Dose Limit, mrem/yr
Whole Body	10
Gonads	10
Bone Marrow	10
Gastrointestinal Tract	30
Bone	30
Thyroid	30
All Other Organs	30

BASES

The bases for this Standard are operating experience, recommendations of the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection and Measurements (NCRP), the Federal Radiation Council (FRC), and the anticipated guidelines of the Atomic Energy Commission and Environmental Protection Agency.

This Standard does not in any way modify the guides stated in AEC Manual chapter 0524 or those recommended by the ICRP, NCRP, and FRC for control of population exposure. The numerical limit recommended by these standards-setting organizations of 170 mrem per year for the average dose to the whole population remains as the basic radiation protection criterion for control of public exposure. The Technical Standard Limits indicate the Savannah River Plant's objective to keep off-site exposures as far below this criterion as practicable.

RISKS

The Technical Standard Limits are only 6% of the numerical guides recommended by the ICRP, NCRP, and FRC for population exposure. The guides were established by these authoritative organizations on the basis of conservative assumptions and were set substantially below levels where biological damage has been observed in humans. Thus the Technical Standard Limits represent no significant health risk to the population in the vicinity of the Savannah River Plant.

Another measure of the minimal risk represented by the Technical Standard Limits can be obtained by comparing them with the exposure from natural radiation background. A person living at the boundary of the Savannah River Plant receives an annual exposure of 120 mrem from natural radiation sources. The whole body exposure limit of 10 mrem per year specified in this standard is approximately 8% of the natural radiation background dose. With the maximum annual exposure of an individual restricted to 10 mrem, the average exposure to the general population in the vicinity of the Savannah River Plant would be approximately 1% of natural radiation background. It is proper to compare the 10 mrem per year limit, rather than 30 mrem per year limit, because it applies to the organs of consequence to radiation-induced leukemia and genetic damage, the important effects when assessing the impact of low radiation exposure of a large population.

REVISIONS

Revisions are made whenever new information or experience warrants. Revisions are approved by Du Pont Management with information copies to AEC-SROO.

SECTION II

OPERATING GUIDES FOR THE RELEASE OF RADIOACTIVE LIQUIDS FROM THE SAVANNAH RIVER PLANT

(Revised 5/73)

Plant Policy. The Plant will confine radioactivity as completely as practical rather than release it to the environment. Release Guides are not to be considered desirable discharge quantities.

Responsibility for Guides. Operating guides for release of radioactivity are incorporated in DPSOP 40 with the advice and concurrence of Radiological Sciences Division (RSD) and the Environmental Analysis and Planning organization. Release guides are reviewed annually, or more frequently if changes in process or equipment indicate a need for revision of specific guides. (Revisions are approved by appropriate Du Pont Operations Management.)

Administrative Controls and Reports. Each month the Environmental Monitoring group of the Health Physics Section will issue summaries of all measured releases of radioactivity. These reports will provide direct comparisons of the releases during the report period with the fractions of annual Release Guides that are appropriate to that period. Copies of these reports will be sent to the superintendents of the operating departments and technology sections having responsibility for the releases, to Plant Management, to Environmental Analysis and Planning and to Radiological Sciences Division.

Releases that exceed the appropriate fractions of the annual Release Guides will be reported, with brief explanations, by the appropriate technology section in the Works Technical Department monthly report.

Accidental releases or abnormal operations that greatly increase the likelihood of release will be investigated and reported by the department having responsibility for the operation. These investigations may be initiated by the superintendent of the operating department, by the superintendent of the technology section or by the Superintendent of Health Physics. Any of these superintendents may refer the investigation report to the Special Hazards Committee for review.

REACTOR AREAS

The quantity of each radionuclide entering the Savannah River Plant streams or basins from all reactor areas shall not exceed the following guides.

Radionuclide	Ci/yr
^{3}H	40,000
^{24}Na	0.01
^{32}P	1.0
^{35}S	3.5
^{51}Cr	2.0
^{58,60}Co, ^{59}Fe	0.3
^{65}Zn	0.1
^{89}Sr	2.0
^{90}Sr	0.5
^{91}Y	1.0
^{95}Zr-^{95}Nb	1.5
^{103}Ru, ^{106}Ru-Rh	0.15
^{124,125}Sb	0.9
^{131}I	0.9
^{134}Cs	1.2
^{137}Cs	1.3
^{140}Ba-^{140}La	0.1
^{141}Ce, ^{144}Ce	0.7
^{147}Pm	1.0
^{239}Np	0.1
All alpha emitters, total	0.05
All other beta or gamma emitters, total	0.5

SEPARATIONS AREAS

Seepage Basin

Radioactivity release to separations areas seepage basins shall not exceed the following guides.

Radionuclide	Ci/yr F Area	Ci/yr H Area
^{3}H	*a*	*a*
^{51}Cr	0.01	40.0
^{58}Co	0.01	0.6
^{60}Co	0.15	0.4
^{89}Sr	0.4	2.0
^{90}Sr	1.5	2.0
^{95}Zr	9.0	5.0
^{95}Nb	9.0	8.0
^{103}Ru	5.0	10.0
^{106}Ru	30.0	30.0
^{124,125}Sb	*b*	1.0
^{131}I	2.0	2.0
^{134}Cs	1.0	2.0
^{137}Cs	7.0	7.0
^{141}Ce	0.1	1.0
^{144}Ce	3.0	3.0
^{147}Pm	3.0	3.0
All alpha emitters, total	1.0	1.0
All other beta or gamma emitters, total	1.0	1.0

---

[a] 39,000 Ci for the total from both areas.

[b] Included in All other beta or gamma emitters guide.

Plant Streams

Radioactivity releases from the separations areas to the Savannah River Plant streams shall not exceed the following guides (total for both areas).

Radionuclide	Ci/yr
^{3}H	100
$^{89,90}Sr$	0.1
$^{134,137}Cs$	0.4
All alpha emitters, total	0.03
All other beta or gamma emitters, total	0.7

RAW MATERIALS AREA

Liquid releases to streams or basins shall not exceed the following guide.

Radionuclide	Ci/yr
$^{235,238}U$	0.8

TECHNICAL AREA

Seepage Basins

Radioactive nuclide releases to seepage basins from 700-Area Savannah River Laboratory facilities shall not exceed the following guides.

Radionuclide	Ci/yr
^{3}H	50
$^{89,90}Sr$	0.005
$^{235,238}U$	0.05
All other alpha emitters, total	0.4
All other beta or gamma emitters, total	0.14

Streams

Liquid releases to streams from technical area facilities shall not exceed the following guides.

Radionuclide	Ci/yr
All other alpha emitters, total	0.015
All other beta or gamma emitters, total	0.010

CMX-TNX Settling Basin

Radionuclide	Ci/yr
$^{235,238}U$	0.015
All other alpha emitters, total	0.001
All other beta or gamma emitters, total	0.004

HEAVY WATER PRODUCTION AREA

Liquid releases from the 400 Area facilities to streams shall not exceed the following guides.

Radionuclide	Ci/yr
^{3}H	10,500
^{35}S	0.03
$^{58,60}Co$	0.03
^{65}Zn	0.01
$^{89,90}Sr$	0.02
^{95}Zr-^{95}Nb	0.2
$^{103,106}Ru$	0.05
$^{141,144}Ce$	0.05
All alpha emitters, total	0.01
All other beta or gamma emitters, total	0.1

SECTION III

RADIOACTIVITY DISCHARGED TO SEEPAGE BASINS AND OTHER UNLINED BASINS AT THE SAVANNAH RIVER PLANT

The information contained in this section was compiled to furnish a response to Interrogatory No. 49(b),

> *"State separately for (a) the National Reactor Testing Station and (b) the Savannah River Plant: (i) the total accumulation of intermediate-level radioactive wastes by radionuclide, in curies; and (ii) the total and annual amounts of intermediate-level radioactive wastes, by radionuclide, in curies, stored or disposed of in open-bottom disposal facilities."**

Aqueous discharges of radioactivity to seepage basins, settling basins, unlined retention basins, and a disposal pit are given in Table 49-1 for cumulative quantities through 1972, in Table 49-1a for cumulative quantities decay corrected through 1972, and in Table 49-2 for calendar year 1972. Tables 49-3 through 49-10 list annual releases to the basins for the periods of time they have been in use.

Table 49-11 lists the various locations at the Savannah River Plant containing radioactivity (greater than one curie) resulting from spills, equipment failure, etc. In many cases, the accumulations at these locations result from efforts undertaken to prevent migration of radioactivity to flowing streams (such as creating temporary retention ponds, diking, backfilling, etc.); the activity given is the amount remaining after cleanup or removal operations and radioactive decay through 1972.

Explanatory material for some tables is given in brief paragraphs introducing those tables. Details concerning basin descriptions, locations, and procedures for their use are given in Section IV (material compiled for the response to Interrogatory No. 50).

The amounts of radioactive wastes stored or disposed of at the Savannah River Plant are measured by techniques that involve flow measurements, sampling, and radiochemical analyses. All of the quantities reported are judged to be within ±50% of the true value. Based on current monitoring experience, current annual quantities are judged to be within ±30% of the true value.

---

*Only radionuclides with half-lives greater than 1 year were to be included.

TABLE 49-1, TOTAL CURIES TO SEEPAGE BASINS AND OTHER UNLINED BASINS

The summation of discharges to various basins given in Table 49-1 includes both curies of specific nuclides and curies of "gross beta" (nonvolatile beta). Specific nuclide analyses began, in most cases, in 1960-1963 with the application of improved gamma spectrometry techniques to effluent sample analyses. Other analytical refinements, such as separation of uranium and plutonium analyses, distinction between ^{134}Cs and ^{137}Cs, etc. cause some variation in the reporting of several analyses. The years these refinements were adopted are shown in Tables 49-3 through 49-10. (Note: 100-R and 100-L are reactors in standby condition.)

Table 49-1a lists the total curies given in Table 49-1, after correcting for radioactive decay to 1972.

TABLE 49-2, 1972 RELEASES TO SEEPAGE BASINS AND OTHER UNLINED BASINS

The basins listed in Table 49-2 were in active use in 1972. Use of all other basins, etc. listed in Table 49-1 was discontinued at various times as shown in Tables 49-3 through 49-10. These inactive basins have not been backfilled (with the exception of five of the six 100-R Area seepage basins) and could be used in the future, if such action were considered desirable or necessary.

TABLES 49-3 THROUGH 49-10, ANNUAL RELEASES

The description, procedures for use, and in most cases typical concentrations of nuclides in influent water, and costs of operation of these basins are given in Section IV. Comments on certain aspects of the history of some of the basins follow.

TABLE 49-3, 100-P AND K AREAS 50-MILLION GALLON BASINS

The 100-K Area 50-million gallon basin first received discharges of fuel and target storage basin water in 1965, in order to provide a delaying facility to permit decay of unusual amounts of ^{32}P (half-life 14 days) activity. The basin has continued in similar service since the ^{32}P problems were alleviated, and functions in much the same way as the 200-F and H seepage basins do by providing a mechanism for decay of certain nuclides and smoothing out batchwise releases. Tritium is the only activity observed to date migrating from the basin; a total of 33,000 curies of tritium migrated to Indian Grave Branch from 1969 to 1972 as indicated by routine monitoring.

The significant decrease in the quantities of activity other than tritium discharged to this facility in 1971-72 is the result of improved confinement and deionization facilities for the fuel and target storage basin water. This reduction has also been observed in 100-P and 100-C reactor discharges to effluent streams in recent years.

TABLE 49-1

Total Curies to Seepage Basins and Other Unlined Basins
(Through 1972) (Not corrected for radioactive decay)

Nuclide	200-F Seepage	200-H Seepage	700-A Seepage	CMX-TNX Settling	100-R Seepage	100-P Seepage	100-L Seepage	100-K Seepage
	F and H							
^{3}H	360,000		170		5300	8900	7000	4700
^{137}Cs and ^{134}Cs	190	110			0.8	0.3	0.02	
^{90}Sr	23	26	0.1^{a}		0.5^{a}	0.2^{a}	1.5^{a}	0.1
$^{106}Ru^{b}$	850	350					0.2	<0.01
^{147}Pm	25	17						
^{125}Sb		1.1						
^{60}Co	0.1	1.4				0.9	1.5	0.2
U, α	7.6	0.6		0.7				
Pu, α	5.4^{c} +4.4 as "U+Pu"	2.8^{c} +1.4 as "U+Pu"						
Th, α				0.2				
Gross β^{d}	280	260	10		*e*	230	49	23
Gross α			3.8^{f}					

Nuclide	100-C Seepage	100-P 50 MGB^{g}	100-K 50 MGB^{g}	100-L Oil and Chem Pit	Heat Exchanger Repair Facility Seepage	300-M Settling	Total
^{3}H	20,000	3900	200,000	34,000	470		650,000
^{137}Cs and ^{134}Cs	0.1	0.03	12	0.4			310
^{90}Sr	0.1^{a}		5.4	0.1^{a}			57
^{106}Ru	2.6		5.0	35			1,300
^{147}Pm			0.1				42
^{125}Sb			1.8				3
^{60}Co	0.4		1.2	3.3			9
U, α							9 (+6 "U+Pu")
Pu, α							8
Th, α							0.2
Gross β^{d}	190		160	62	0.02		1,300
Gross α						0.05	4

---

a. Includes ^{89}Sr (radioactive half-life is 50.6 days)

b. Includes ^{103}Ru (radioactive half-life is 40 days)

c. Includes 1.4 Ci ^{238}Pu in 200-F and 1.7 Ci ^{238}Pu in 200-H.

d. Gross β includes all nonvolatile β emitters; conversion from counts to disintegrations based on RaD and E in early years, later (where used) represents summation of individual nuclides.

e. About 2700 curies of gross beta were released to the 100-R seepage basins in 1957-1959 and contained about 900 Ci of ^{137}Cs and 200 Ci of ^{90}Sr. These basins were backfilled and this activity is inventoried in Table 49-11 "Misc. Radioactivity Disposal Sites." The tritium and the 0.8 Ci ^{137}Cs and 0.5 Ci ^{90}Sr were released between 1960 and 1964.

f. The 3.8 Ci of gross alpha released to the 700-A seepage basin was primarily ^{244}Cm in 1969-1971.

g. 50-million gallon basin for confinement.

TABLE 49-1a

Total Curies to Seepage Basins and Other Unlined Basins
(Through 1972)

Corrected for Radioactive Decay to 1972

Nuclide	F Seepage	H Seepage	700-A Seepage	CMX-TNX Settling	R Seepage	P Seepage	L Seepage	K Seepage
^{3}H	F and H 260,000		160		3000	5900	5500	3200
^{137}Cs and ^{134}Cs	160	88			0.7	0.3	0.02	
^{90}Sr	19	22	0.09		0.5	0.2	1.3	0.10
^{106}Ru	40	35					0.01	
^{147}Pm	7.6	7.0						
^{125}Sb		0.7						
^{60}Co	0.09	1.1				0.3	0.9	0.09
U, α	7.60	0.6		0.7				
Pu, α	5.2 +4.4 as U+Pu	2.8 +1.4 as U+Pu						
Th, α				0.2				
Gross β[a]	280	270	10			230	49	23
Gross α[a]			3.8					

Nuclide	C Seepage	P 50 MGB	K 50 MGB	L Oil & Chem Pit	Heat Exch. Repair Fac. Seepage	300-M Settling	Total
^{3}H	13,000	3500	170,000	22,000	300		490,000
^{137}Cs and ^{134}Cs	0.09	0.03	11	0.4			260
^{90}Sr	0.10		5.1	0.09			48
^{106}Ru	0.02		0.7	0.3			76
^{147}Pm			0.1				15
^{125}Sb			1.6				2
^{60}Co	0.2		0.8	1.3			5
U, α							9, + 6 as U+Pu
Pu, α							8
Th, α							0.2
Gross β[a]	190		160	62	0.02		1300
Gross α[a]						0.05	4

---

[a] Not decay corrected.
See also footnotes for Table 49-1.

TABLE 49-2

1972 Releases to Seepage Basins and Other Unlined Basins, Curies

Nuclide	200-F Seepage	200-H Seepage	700-A Seepage	300-M Settling	100-K 50 MGB[a]	100-L Oil and Chem Pit	1972 Total
	F and H						
^{3}H	22,000		20		24,000	920	47,000
^{137}Cs	2.7	5.6			0.5		8.8
^{134}Cs	-	0.9			0.3		1.2
^{90}Sr	0.4	0.5	0.0005		0.03		1.0
^{106}Ru	16	13			0.02	0.02	29
^{147}Pm	0.5	1.3			0.10		1.9
^{125}Sb	-	0.9			0.7		1.6
^{60}Co	-	0.03				0.01	0.04
U, α	0.23	-					0.23
^{239}Pu, α	0.21	0.03					0.24
^{238}Pu, α	0.11	0.29					0.40
Gross β			0.03				0.03
Gross α			0.07	0.003			0.07

---

a. 50-million gallon basin for confinement.

TABLE 49-3

Annual Releases, Ci

Basin - 100-K 50-Million Gallon Basin
Watershed - Indian Grave Branch - Pen Branch

Year	^{3}H	^{137}Cs	^{134}Cs	^{90}Sr	^{106}Ru[a]	^{147}Pm	^{125}Sb	^{60}Co	Gross β
1965	17,000[b]								
1966	42,000[b]								44
1967	38,000[b]								120
		$^{137}Cs+^{134}Cs$							
1968	24,000	0.01			2.0			0.4	
1969	23,000	2.7		3.6	1.3			0.7	
1970	20,000	8.1		1.6	1.7			0.08	
1971	17,000	0.6		0.2	0.02		1.1	0.03	
1972	24,000	0.54	0.3	0.02	0.02	0.1	0.7	-	
	200,000	12	0.3	5.4	5.0	0.1	1.8	1.2	160

Currently in use

Basin - 100-P 50-Million Gallon Basin
Watershed - Steel Creek

Year	^{3}H	$^{134,137}CS$
1970	3900	0.03

Not used since 1970

---

a. Includes ^{103}Ru
b. Estimated

TABLES 49-4, 5, AND 6, 100-PKC SEEPAGE BASINS

These basins are located in areas where the reactors are currently in operation, but the basins are not currently being used. Miscellaneous contaminated aqueous wastes which were previously disposed of in these basins are now sent to the 200 Area for storage or processing, or to the 100-L Area oil and chemical pit, or to the reactor area fuel storage basin.

TABLE 49-4, 100-L AREA OIL AND CHEMICAL PIT

Aqueous wastes containing radioactivity and high chemical concentrations (e.g., decontamination solutions) and other contaminated materials, such as oily wastes, etc., have been disposed of in this facility. The decrease in activity releases in recent years is the result of increased usage of the 200-Area waste management system for much of this material.

TABLE 49-5, 100-L SEEPAGE BASINS

The 100-L reactor was shut down and placed in a standby status in 1968. The 100-L seepage basin last received activity in 1969.

TABLE 49-6, 100-R SEEPAGE BASINS

These basins received about 2700 curies of gross beta activity (estimated to contain 900 Ci ^{137}Cs, 200 Ci ^{90}Sr) resulting from the failure of an experimental fuel assembly in an isolated section of the 100-R Area fuel and target storage basin in 1957. Five of the six seepage basins were backfilled, and areas where activity migration was observed were capped and diked with clay. The 100-R reactor was shut down and placed in a standby status in 1964.

TABLES 49-7 AND 8, 200-F AND H SEEPAGE BASINS

Releases to these basins have varied depending on process operations which generate the waste streams, on the waste evaporation program, and on receipts of wastes from other areas, such as regenerant solution resulting from the processing of 100-Area deionizers. About 70,000 curies of tritium and five curies of ^{90}Sr have migrated to Four Mile Creek from these basins through 1972.

TABLE 49-4

Annual Releases, Ci

Basin - 100-C Seepage
Watershed - Four Mile Creek

Year	^{3}H	^{137}Cs	^{134}Cs	^{90}Sr[a]	^{106}Ru[b]	^{60}Co	Gross β
1959							98
1960	70						64
1961	1200						20
1962	1600						4
1963	590						5
		$^{137}Cs+^{134}Cs$					
1964	12,000	0.02		0.02	1.2	0.2	
1965	1700	0.008		0.008	0.8	0.09	
1966	60			0.02	0.4	0.03	
1967	490			0.002	0.2	0.08	
1968	240			0.03	0.003	0.004	
1969	400	0.06		0.03	-	-	
1970	1700	0.01		-	-	0.001	
	20,000	0.1		0.1	2.6	0.4	190

Not used
since 1970

---

[a] Includes ^{89}Sr
[b] Includes ^{103}Ru

Basin - 100-L Oil and Chemical Pit
Watershed - Steel Creek

Year	^{3}H	^{137}Cs	^{134}Cs	^{90}Sr[a]	^{106}Ru[b]	^{60}Co	Gross β
1961	8500						26
1962	2300						21
1963	3100						15
		$^{137}Cs+^{134}Cs$					
1964	2800	0.06		0.04	3.8	1.6	
1965	6200	0.3		0.04	29	1.3	
1966	4500	0.005		0.02	1.7	0.2	
1967	2000	0 004		0.006	0.8	0.1	
1968	3200			0.001	0.01	0.04	
1969	600			0.001	0.001	0.05	
1970	190			0.001	0.001	0.002	
1971	290	0.0003		0.0003	0.001	0.01	
1972	920				0.02	0.01	
	34,000	0.4		0.1	35	3.3	62

Currently
in use

---

[a] Includes ^{89}Sr
[b] Includes ^{103}Ru

TABLE 49-5

Annual Releases, Ci

Basin - 100-L Seepage
Watershed - Steel Creek

Year	^{3}H	^{137}Cs	^{134}Cs	^{90}Sr[a]	^{106}Ru[b]	^{60}Co	Gross β
1957							31
1958							2
1959							2.2
1960							0.02
1961	32						0.03
1962	12						14
1963	90						
		$^{137}Cs+^{134}Cs$					
1964	280	0.02		1.2	0.07	0.01	
1965	72						
1966	-						
1967	910	0.004		0.2		0.04	
1968	5500			0.09	0.11	1.4	
1969	110					0.001	
	7000	0.02		1.5	0.2	1.5	49

Not used
since 1969

---

[a] Includes ^{89}Sr
[b] Includes ^{103}Ru

Basin - 100-K Seepage
Watershed - Pen Branch

Year	^{3}H	^{90}Sr[a]	^{60}Co	Gross β
1959				20
1960				3.1
1965	4700	0.12	0.22	
	4700	0.12	0.22	23

Not used
since 1965

---

[a] Includes ^{89}Sr

TABLE 49-6

Annual Releases, Ci

Basin - 100-R Seepage
Watershed - Lower Three Runs

Year	^{3}H	^{137}Cs	^{134}Cs	^{90}Sr^a	Gross β
1957					2100^b
1958					530^b
1959					35
1960	4900				0
1961	320				0
1962	1				0.8
1963	0	^{137}Cs+^{134}Cs			0.1
1964	55	0.8		0.5	
	5300	0.8		0.5	2700

Not used
since 1964

---

a. Includes ^{89}Sr

b. The 2630 curies of gross β released in late 1957, early 1958, contained about 900 curies of ^{137}Cs and 200 curies of ^{90}Sr. Five of the six basins were backfilled; Table 49-11 lists an estimate of curies remaining.

Basin - 100-P Seepage
Watershed - Steel Creek

Year	^{3}H	^{137}Cs	^{134}Cs	^{90}Sr^a	^{60}Co	Gro β
1957						3
1958						
1959						8
1960	96					6
1961	1900					3
1962	86					1
1963	72	^{137}Cs+^{134}Cs				
1964	1700	0.02		0.03	0.9	
1965	2900	0.007		0.003	0.003	
1966	84	0.001			0.003	
1967	120	-		-	0.005	
1968	1900	0.3		0.2	0.03	
	8900	0.3		0.2	0.9	23

Not used
since 1968

---

a. Includes ^{89}Sr.

TABLE 49-7

Annual Releases, Ci

Basin - 200-F Seepage

Watershed - Four Mile Creek

Year	^{3}H	^{137}Cs	^{134}Cs	^{90}Sr	^{106}Ru	^{147}Pm	^{60}Co	U, α	Pu, α		Gross β
								U + Pu			
1955	See										
1956	Table 49-8							1.0			58
1957	for							0.57			71
1958	Total F and H							0.80			33
1959		^{137}Cs+^{134}Cs						0.99			120
1960		6.9		4.4	140^{a}			1.0 4.4			
1961		18		1.9	36^{a}			0.25	0.17		
1962		57		2.6	81^{a}			0.57	0.28		
1963		15		3.1	70^{a}			0.66	0.28		
1964		15		1.7	200^{a}			1.80	<0.09		
1965		4.4	-	1.9	89^{a}	11		0.59	0.32		
1966		4.0	-	1.0	63^{a}	3.3		0.49	0.62		
									^{239}Pu	^{238}Pu	
1967		7.2	-	0.7	47^{a}	1.4		0.18	0.74	0.12	
1968		19	-	1.0	44^{a}	2.5		0.25	0.33	0.23	
1969		23	-	1.0	14	2.7	0.02	0.97	0.46	0.48	
1970		13	-	2.0	39	2.5	0.09	1.4	0.30	0.30	
1971		4.8	0.16	0.8	12	1.2	0.01	0.22	0.18	0.11	
1972		2.7	-	0.4	16	0.5	-	0.23	0.21	0.11	
		190	0.2	23	850	25	0.1	7.6	4.0	1.4	280
Currently in use											

---

a. Includes ^{103}Ru

TABLE 49-8

Annual Releases, Ci

Basin - 200-H Seepage
Watershed - Four Mile Creek

Year	$^{3}H^{a}$	^{137}Cs	^{134}Cs	^{90}Sr	^{106}Ru	^{147}Pm	^{125}Sb	^{60}Co	U, α	U + Pu	Pu, α		Gross β
1955	-												
1956	-									0.55			60
1957	6000									0.32			49
1958	5500									0.20			45
1959	11,500									0.23			110
		^{137}Cs+^{134}Cs											
1960	13,000	1.2		0.5	17^{b}					0.08			
										1.4			
1961	22,000	3.5		3.6	17^{b}				0.11		0.11		
1962	31,000	7.7		1.2	35^{b}				0.08		0.32		
1963	25,000	8.2		6.9	52^{b}		0.1		0.05		0.09		
1964	28,000	4.9		1.0	30^{b}		0.1		0.11		0.07		
1965	29,000	17	2.6	4.7	15^{b}	2.6			0.07		0.29		
1966	37,000	13	0.9	0.8	33^{b}	1.6			0.04		0.01		
											^{239}Pu	^{238}Pu	
1967	20,000	15	1.4	1.2	13^{b}	1.0			0.01		0.03	0.02	
1968	35,000	10	-	1.4	53^{b}	4.5			0.08		0.06	0.29	
1969	23,000	6.1	-	2.3	39	3.8		0.66	0.03		0.01	0.64	
1970	32,000	2.4	-	0.7	12	1.1		0.32	0.03		0.05	0.26	
1971	19,000	3.2	1.4	0.9	20	1.0		0.42	0.02		0.03	0.22	
1972	22,000	5.6	0.9	0.5	13	1.3	0.9	0.03	-		0.03	0.29	
	360,000	98	7.2	26	350	17	1.1	1.4	0.63		1.1	1.7	260

Currently
in use

---

a. F Basin + H Basin
b. Includes ^{103}Ru

TABLE 49-9

Annual Releases, Ci

Basin - CMX/TNX Settling
Watershed - Savannah River

Year	U nat	Th nat
1952		
1964		
1968	0.50	0.16
1969	0.16	0
1970	0	0
1971	0	0
1972	0	0
	0.66	0.16

Currently
in use

Basin - Heat Exchanger Repair
Facility Seepage
Watershed - Four Mile Creek

Year	^{3}H	Gross β
1964	19	.004
1965	450	.013
1966	-	.002
1967	3	<.001
1968	-	<.001
	470	0.02

Not used
since 1968

TABLE 49-10

Annual Releases, Ci

Basin - 700-A Seepage

Watershed - Tims Branch - Upper Three Runs

Year	^{3}H	^{90}Sr[a]	Gross α	Gross β
1954-55			0.03	0.25
1956			0.08	0.18
1957			0.04	0.25
1958			0.04	0.05
1959			0.02	0.05
1960			0.03	0.09
1961			0.03	0.07
1962			0.04	1.7
1963			0.03	0.28
1964			0.03	0.32
1965		.046	0.04	0.17
1966		.007	0.02	0.05
1967		.018	0.03	0.11
1968		.011	0.26	0.79
1969	22	.007	0.94[b]	1.40
1970	58	.008	1.1[b]	3.7
1971	72	.001	0.98[b]	0.65
1972	20	<.001	0.07	0.03
	170	0.10	3.8	10
Currently in use				

---

[a] Includes ^{89}Sr

[b] Primarily ^{244}Cm

TABLE 49-11 MISCELLANEOUS RADIOACTIVITY DISPOSAL SITES

In addition to the sites listed in Table 49-11, 37 other locations, each containing activity estimated to be less than one curie, exist on the plant site. Most of these are marked with pylons or are within posted or controlled areas. An active program is underway to mark the remaining sites or, if analyses warrant, to remove them from the list. These sites include dirt or rock covered small spills, and burial of slightly contaminated obsolete process equipment.

TABLE 49-11

Miscellaneous Radioactivity Disposal Sites
(Containing >1 Ci)

Location	Description	Source of Activity	Treatment	Date of Release	Activity	Estimated Ci[a]
200-F (281-3F)	Earthen retention basin, $2x10^4$ ft^2	Algae, etc., from cleaning delaying basin 281-5F; cooling water from equipment failure	Herbicides on sides of basin, asphalt emulsion	Startup to 1973	α,β,γ	5-10
200-F	North seepage basin, $4x10^4$ ft^2	Miscellaneous	Inactive	Startup to 1955	α,β,γ	∿1
200-H (281-3H)	Same as 281-3F, above				α,β,γ	10-30
200-H	Storm sewer, east of area, $2x10^5$ ft^2	Tank car leak	150 ft backfilled	4/58	β,γ	∿1
200-H	Temporary retention pond, ∿10^5 ft^2	Release from contaminated segregated cooling water to temporary impoundment	Pond backfilled	9/56, 5/60, 11/65	β,γ	∿5
200-H (241-H)	Soil under tank 16, ∿$3x10^4$ ft^2	Tank leak	Pumped ground water	12/60	β,γ (primarily ^{137}Cs)	10-500
200-H (241-H)	Surface soil above tank 9, ∿10^3 ft^2	Tank riser overflow	Soil excavated and replaced	5/67	β,γ (primarily ^{137}Cs)	75-100
200-H	Two temporary retention ponds, storm sewer, ∿$5x10^5$ ft^2	Tank riser overflow (same as above) and back flush line failure	Soil excavated, banks of ditch asphalted (emulsified)	5/67, 2/69	β,γ (primarily ^{137}Cs)	5-10
700-A	Ground beneath E-Wing, 773-A, ∿10^3 ft^2	Leak from high level caves separator pit to storm sewer	Storm sewer disconnected, backfilled	12/71	α,γ (^{244}Cm)	6
100-R	Seepage basins No. 1-5	Failure of experimental fuel assembly in 100-R storage basin	Backfilled, clay capped, clay diked	1957-59	β,γ	700 ^{137}Cs 150 ^{90}Sr

---

[a] Curies remaining, including correction for radioactive decay through 1972.

SECTION IV

TREATMENT, STORAGE, AND DISPOSAL OF LIQUID RADIOACTIVE WASTES AT THE SAVANNAH RIVER PLANT

The information contained in this section was compiled to furnish a response to Interrogatory No. 50(b):

> *"State and describe in detail all techniques currently employed for the treatment, storage, and disposal of intermediate-level radioactive wastes at (a) the National Reactor Testing Station, and (b) the Savannah River Plant, including information regarding: (i) the type(s) of waste, by radionuclide, managed by each technique or process; (ii) the total and annual volumes and amounts of waste, by radionuclide, so treated, stored or disposed of; (iii) the cost in current dollar values of each phase of each technique or process per gallon of waste, by radionuclide, treated, stored, or disposed of; (iv) the type, size, capacity, construction material, and construction costs, by facility, of all equipment and structures employed in each technique or process; and (v) the dates when each such storage or disposal practice began, ended, and whether each is presently in use."*

Techniques currently used for the treatment, storage, or disposal of liquid radioactive wastes are shown in Figures 2-7. Descriptions of techniques used follow the appropriate figures. For purposes of identification, each process, research, administration, and support facility has a unique identification number and letter; for example, major areas have the following numbers:

100 Areas - Production reactor areas

200 Areas - Fuel and target element chemical processing areas

300 Area - Fuel and target element fabrication area

400 Area - Heavy water production and rework area

600 Area - All areas generally outside the main areas

700 Area - Administration, support facilities, and Savannah River Laboratory research facilities

900 Area - Seepage basins and pits.

Buildings or process facilities within an area also have individual identification numbers and letters. The first number in the series of three identification numbers identifies the facility as being associated with one of the major area categories shown above; the identification numbers of a few facilities within major areas are shown for example:

105-R - Reactor building in 100-R Area

221-F - Chemical separations building (canyon) in 200-F fuel and target element chemical processing area

773-A - The main research building of the Savannah River Laboratory in the 700-A Area.

This system of identification, with a brief description of each facility, is used in answering Interrogatory 50. In some cases, the facility identification is given with an additional number or name that identifies a suboperation or piece of equipment within the facility.

Locations of major areas are shown on the map of the Savannah River Plant (Figure 1). In describing the location of a technique for treatment, storage, and disposal, locations are usually given as being in a major area, or distance and direction from a major area.

Schematic flow diagrams are given for waste water streams containing radioactive contamination (or having the potential for contamination). A flow diagram is given for each major process or research function in Figures 2-7. A diamond (◇) is shown on these diagrams for each option point where a decision is made whether to treat, store, or dispose. The significant option actions are identified with letters of the alphabet, and these letters, with the figure number, are included in the portion of the text describing a particular technique. Techniques in addition to disposal to open bottom pits are given; this is done in order to give a complete picture of liquid waste management operations at the Savannah River Plant.

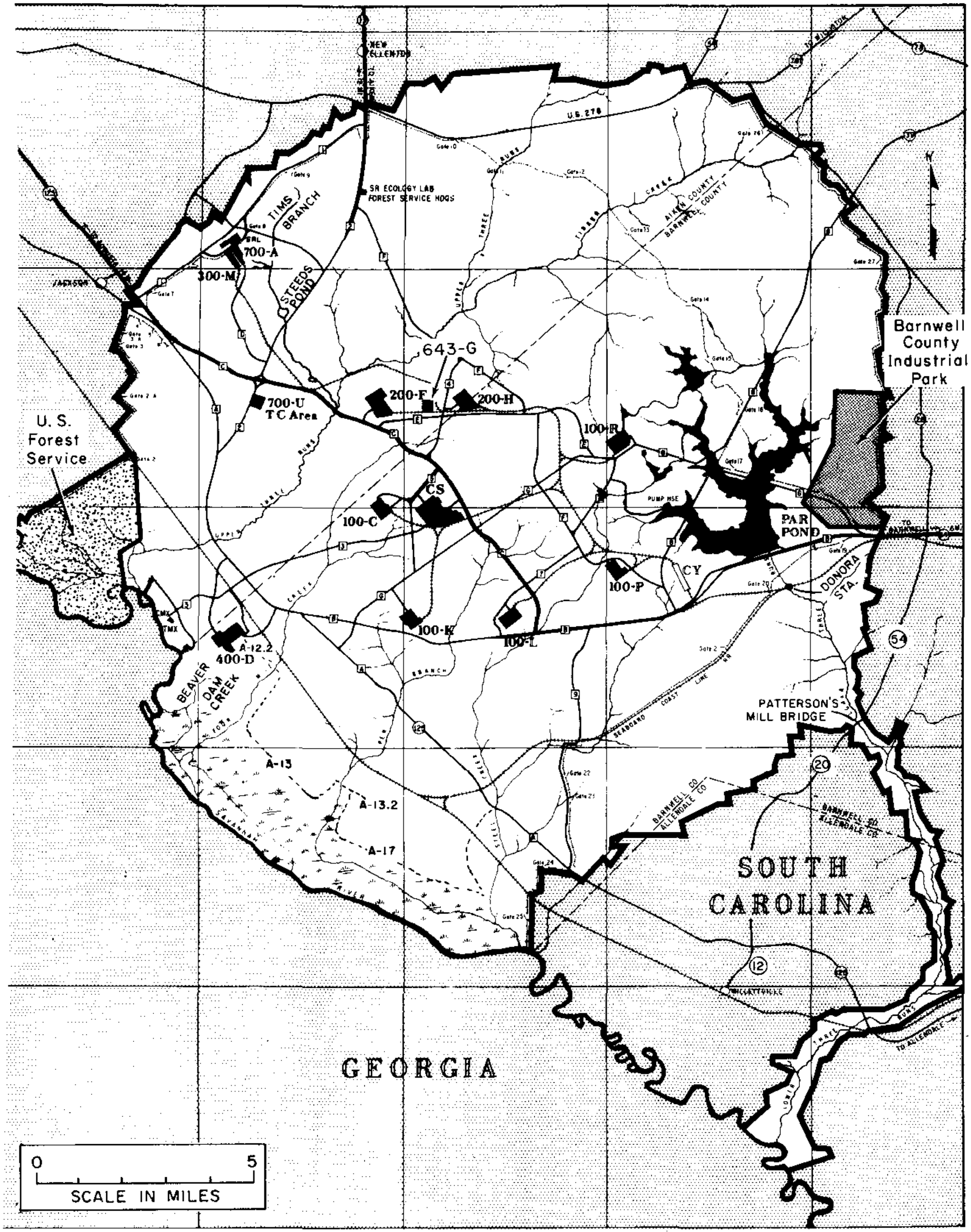
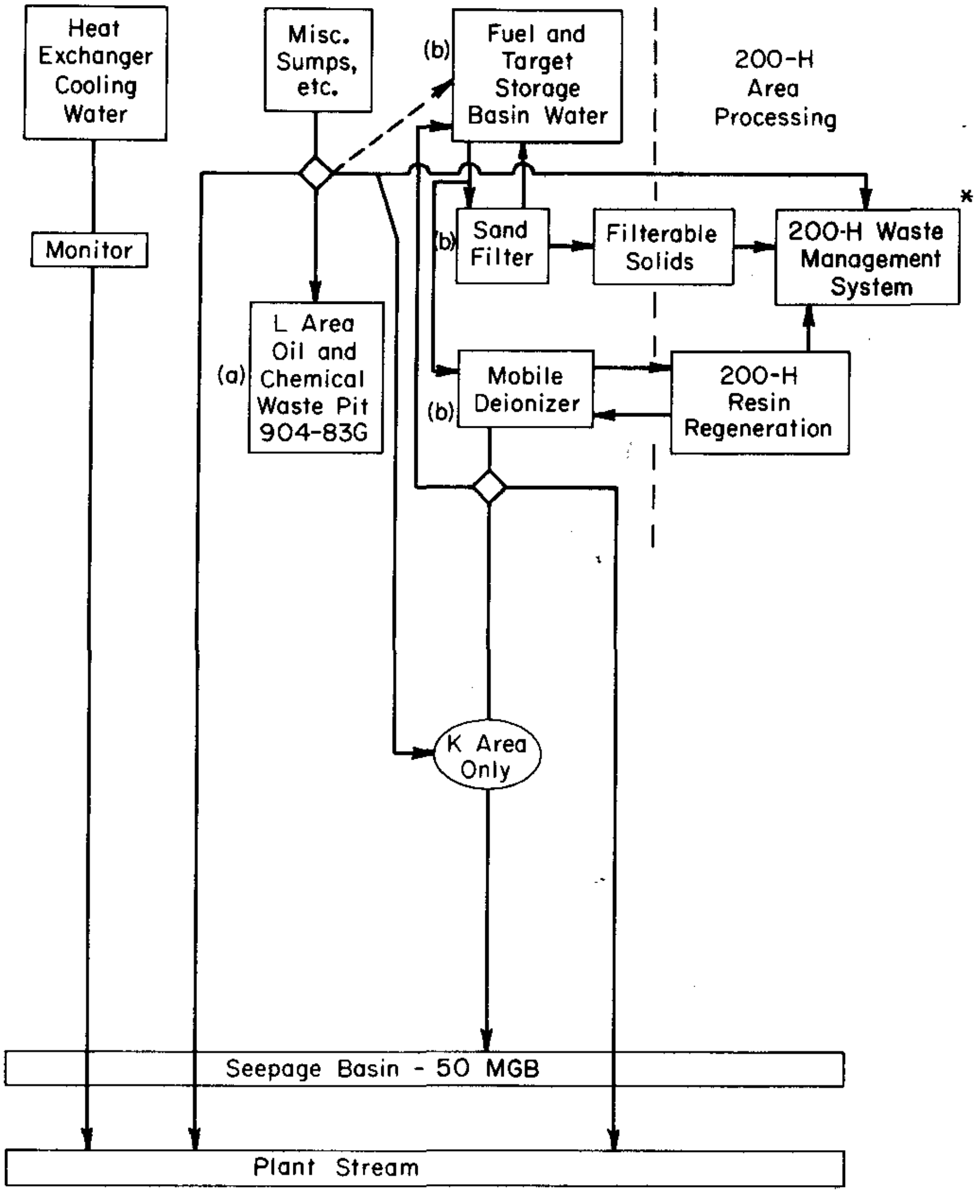


FIGURE 1 Savannah River Plant Site

The cost per gallon or per cubic meter for each technique described is based on current operating costs. Construction costs, in 1973 dollar equivalents, are given but are not used in calculating the cost per gallon or cubic meter of the technique for treatment, storage, or disposal. In some cases, the cost of a technique per curie of radionuclide is given; however, in many cases such a calculation is not practical because mixtures of radionuclides at varying concentrations and in varying total amounts (volume) of waste make such a calculation of dubious value. The operating and construction costs of discontinued techniques for treatment, storage, or disposal are generally not given. However, inventories of radioactivity in soil from discontinued practices are given in Section III.

REACTOR AREAS (100 Areas)

LIQUID WASTE MANAGEMENT SYSTEMS



* See Figure 4

FIGURE 2 100 Areas (Reactors P, K, and C) Liquid Wastes

50. DESCRIPTION

a. *Name*

Oil and Chemical Waste Pit

b. *Identification No.*

904-83G

c. *Location*

100-L Area

d. *Purpose*

To dispose of small volumes of oils and chemical wastes (containing radioactive contamination) that cannot be discharged to effluent streams, regular seepage basins, or 200 Area waste management system.

e. *Technique or process used*

Small volumes of waste are transported by tank truck, metal drums, etc. to 904-83G. Wastes so disposed are radiochemically analyzed before disposal.

f. *Reference to Figure No. and letter*

Figure 2 - (a)

(i) TYPES OF WASTE

a. *Source*

Primarily from the reactor areas but occasionally has been used for all production and research areas at the Savannah River Plant.

b. *Nuclides generally present*

Mixed activation and fission products and traces of actinides.

c. *Concentrations*

$$\left.\begin{array}{r} \text{Total beta-gamma } (T_{\frac{1}{2}} > 1 \text{ yr}) - 3.4\text{x}10^{-4} \text{ Ci/m}^3 \\ \text{Tritium } 10.4 \text{ Ci/m}^3 \end{array}\right\{ \begin{array}{l} 1972 \\ \text{Annual} \\ \text{Avg} \end{array}$$

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

See Table 49-2

b. *Total - by nuclide*

See Table 49-1

c. *Annual - by volume*

20,000 gallons (1972)

d. *Total - by volume*

930,000 gallons (through 1972)

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

see (iv) g.

b. *Cost per curie of nuclide*

Information concerning volume of liquids associated with each nuclide is not available.

(iv) TECHNIQUE OF PROCESS

a. *Type*

Earthen basin (unlined)

b. *Size*

100' x 60' x 7'

c. *Capacity*

250,000 gallons

d. *Construction material*

Excavated in earth

e. *Construction cost (1973 dollars)*

$5700

f. Operating cost - annual

Costs of analysis and transportation are borne by the areas in which the waste originates.

g. Operating cost - total

Costs of analysis and transportation are borne by the areas in which the waste originates.

(v) DATES

a. Date technique or process began

1961

b. Date technique or process ended

c. Is technique or process currently in use?

Yes

50. DESCRIPTION

a. Name

Fuel and Target Basin Isolation, Sandfilter, and Mobile Deionizers

b. Identification No.

c. Location

Reactor Buildings 105 PLKC

d. Purpose

To remove decay heat and radioactive contamination from reactor fuel and target storage basins and maintain clarity of the basin water, thus eliminating need for continuous purge of water to an effluent stream.

e. Technique or process used

The "Vertical Tube Storage" section of each basin is provided with isolation gates to minimize the amount of water contaminated during reactor discharge. The entire basin system is closed (no routine overflow), and decay heat is removed by heat exchangers. Sandfilters are used to maintain water clarity, and a mobile (trailer mounted) deionizer is used to remove radioactive materials from the water. Deionized water is purged to effluent streams, as required, to reduce tritium concentration in the basin.

f. Reference to Figure No. and letter

Figure 2 - (b)

(i) TYPES OF WASTE

a. Source

The major source of liquid radioactive waste in the basins is from discharge of irradiated fuel, targets, and other hardware from the reactors. The radioactivity is carried by moderator wetting during discharge, by oxide spalling off of the components, and by leakage from defective cladding on fuel and target elements. A minor source of radioactivity to basin water is a periodic purge of reactor shield cooling water.

b. Nuclides generally present

Fission products and activation products

c. Concentrations

Concentration of radionuclides in deionized water purge ranges from nil to ∿5 x 10^{-5} Ci/m^3. Concentrations of radionuclides in the Vertical Storage Basin ranges from 10^{-5} Ci/m^3 prior to reactor discharge to 10^{-3} Ci/m^3 after discharge.

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

∿450 curies (includes some nuclides with $T_{\frac{1}{2}}$ <1 yr) of nonvolatile beta-gamma is removed and transported to 200-H Area where the deionizers are regenerated, and the radioactive waste is processed in 200-H waste management system.

b. Total - by nuclide

Data not available

c. Annual - by volume

1.5 x 10^7 gallons purged (includes 9.5 x 10^6 gallons to K-Area basin for confinement)

d. Total - by volume

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

3.6 cents/gallon of water purged to effluent streams

b. Cost per curie of nuclide

∿ $1200 per beta-gamma curie (excluding tritium) prevented from reaching the effluent stream during purging of basin water

(iv) TECHNIQUE OR PROCESS

a. Type

b. Size

c. Capacity

d. Construction material

e. Construction cost (1973 dollars)
$4,443,000*

f. Operating cost - annual
$553,000*

g. Operating cost - total

(v) DATES

a. Date technique or process began
105-P, 7/63; 105-K, 8/63; 105-C, 12/63; 105-L, 10/63**

b. Date technique or process ended

c. Is technique or process currently in use?
Yes, except in 105-L which has been shut down and on standby status since 1968.

---

* See page 4-13 for details.

** On the dates shown, mobile filters were in use. Because of limited capacity, they were replaced with sandfilters on the following dates: 105-K, 12/69; 105-P, 11/71; 105-C, 4/72.

Construction Costs

Vertical Tube Storage Isolation, 105 PLKC	$2,898,000
Mobile Deionizers - 4	120,000
Sandfilters, 105 PKC	1,420,000
Total	$4,443,000

Annual Operating Costs, 105 PKC

Regeneration of resin in deionizers	$300,000
Transportation of deionizers to and from 200-H Area	30,000
Transportation of sandfilter backwashes to 200-H Area	300
Storage of dewatered sandfilter backwash and resin in 200-H Area	Not available
Resin replacement	12,000
Operating labor	116,800
Laboratory analyses	93,600
Total	$552,700

50. DESCRIPTION

a. Name

K Area Basin for Confinement (Seepage Basin)

b. Identification No.

904-88G

c. Location

100-K Area

d. Purpose

To receive contaminated cooling water in event of a reactor accident. Also serves as a seepage basin for 105-K Fuel and Target Storage Basin purges.

e. Technique or process used

Disposal into earthen basin.

f. Reference to Figure No. and letter

None

(i) TYPES OF WASTE

a. Source

Fuel and target storage basin purge water.

b. Nuclides generally present

Fission products and activation products.

c. Concentrations

Beta-gamma ($T_{\frac{1}{2}}$ > 1 yr) - $5\text{x}10^{-5}$ Ci/m^3 (annual average - 1972)

Tritium - 0.7 Ci/m^3 (annual average - 1972)

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

See Table 49-2

b. Total - by nuclide

See Table 49-1

c. Annual - by volume

9,500,000 gallons

d. Total - by volume

406,000,000 gallons

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

See (iv) g.

b. Cost per curie of nuclide

See (iv) g.

(iv) TECHNIQUE OR PROCESS

a. Type

Earthen basin excavated in earth

b. Size

c. Capacity

50 million gallons

d. Construction material

Earth

e. Construction cost (1973 dollars)

∿ $210,000

f. Operating cost - annual

Costs are included in the cost of operation of the Fuel and Target Storage Basins (Figure 2 - (b)).

g. Operating cost - total

Costs are included in the cost of operation of the Fuel and Target Storage Basins (Figure 2 - (b)).

(v) DATES

a. Date technique or process began

1965

b. Date technique or process ended

c. Is technique or process currently in use?

Yes

50. DESCRIPTION

a. *Name*

50-Million Gallon Basins for Confinement

b. *Identification No.*

904-86G, 904-87G, 904-89G

c. *Location*

100-PLC

d. *Purpose*

To retain contaminated cooling water in event of a reactor accident.

e. *Technique or process used*

Earthen basins

f. *Reference to Figure No. and letter*

None

(i) TYPES OF WASTE

a. *Source*

Cooling water from reactor accidents

b. *Nuclides generally present*

Not applicable

c. *Concentrations*

Not applicable

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

Not applicable*

---

*The basins have never been required for a reactor accident. The P-Area basin was used one time in 1970 (Section III); it is no longer in use for contaminated water disposal.

b. Total - by nuclide

Not applicable

c. Annual - by volume

None

d. Total - by volume

None

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

Not applicable

b. Cost per curie of nuclide

Not applicable

(iv) TECHNIQUE OR PROCESS

a. Type

Earthen basin

b. Size

c. Capacity

50,000,000 gallons

d. Construction material

Earth

e. Construction cost (1973 dollars)

∿ $210,000 each

f. Operating cost - annual

Nil

g. Operating cost - total

Nil

(v) DATES

a. *Date technique or process began*

Basins constructed and placed in service in late 1963 and early 1964

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes

50. DESCRIPTION

a. *Name*

100-R Area Seepage Basin - Inactive

b. *Identification No.*

904-60G

c. *Location*

R Area

d. *Purpose*

To receive contaminated H_2O wastes

e. *Technique or process used*

Pump waste streams to basin

f. *Reference to Figure No. and letter*

None

(i) TYPES OF WASTE

a. *Source*

Miscellaneous contaminated H_2O streams from R Area

b. *Nuclides generally present*

^3H, nonvolatile β emitters

c. *Concentrations*

Unknown

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

Basin no longer used

b. *Total - by nuclide*

See Table 49-1

c. *Annual - by volume*

Unknown

d. *Total - by volume*

Unknown

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

Unknown

b. *Cost per curie of nuclide*

Unknown

(iv) TECHNIQUE OR PROCESS

a. *Type*

Seepage basin

b. *Size*

500' x 40' x 9'

c. *Capacity*

970,000 gallons

d. *Construction material*

Natural soils

e. *Construction cost (1973 dollars)*

∿ $7000

f. *Operating cost - annual*

Unknown

g. *Operating cost - total*

Unknown

(v) DATES

a. *Date technique or process began*

1957

b. *Date technique or process ended*

1964

c. *Is technique or process currently in use?*

No

50. DESCRIPTION

a. Name

100-P Area Seepage Basins - Inactive

b. Identification No.

904-61G, 62G, 63G

c. Location

P Area

d. Purpose

To receive contaminated H_2O wastes

e. Technique or process used

Pump waste streams to basins

f. Reference to Figure No. and letter

None

(i) TYPES OF WASTE

a. Source

Miscellaneous contaminated H_2O streams from P Area

b. Nuclides generally present

^3H, nonvolatile β emitters

c. Concentrations

Unknown

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

Basin no longer used

b. Total - by nuclide

See Table 49-1

c. Annual - by volume

Unknown

d. Total - by volume

Unknown

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

Unknown

b. *Cost per curie of nuclide*

Unknown

(iv) TECHNIQUE OR PROCESS

a. *Type*

Seepage basin

b. *Size*

(410' x 35' x 7')
(210' x 70' x 7')
(340' x 70' x 12')

c. *Capacity*

(510,000)
(520,000)
(1,450,000) gallons

d. *Construction material*

Natural soils

e. *Construction cost (1973 dollars)*

$21,000

f. *Operating cost - annual*

Unknown

g. *Operating cost - total*

Unknown

(v) DATES

a. *Date technique or process began*

1957

b. *Date technique or process ended*

1968

c. *Is technique or process currently in use?*

No

50. DESCRIPTION

a. *Name*

100-L Area Seepage Basin - Inactive

b. *Identification No.*

904-64G

c. *Location*

L Area

d. *Purpose*

To receive contaminated H_2O wastes

e. *Technique or process used*

Pump waste streams to basin

f. *Reference to Figure No. and letter*

None

(i) TYPES OF WASTE

a. *Source*

Miscellaneous contaminated H_2O streams from L Area

b. *Nuclides generally present*

^3H, nonvolatile β emitters

c. *Concentrations*

Unknown

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

Basin no longer used

b. *Total - by nuclide*

See Table 49-1

c. *Annual - by volume*

Unknown

d. *Total - by volume*

Unknown

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

Unknown

b. *Cost per curie of nuclide*

Unknown

(iv) TECHNIQUE OR PROCESS

a. *Type*

Seepage basin

b. *Size*

365' x 35' x 7' (L-shaped)

c. *Capacity*

525,000 gallons

d. *Construction material*

Natural soils

e. *Construction cost (1973 dollars)*

∿ $7000

f. *Operating cost - annual*

Unknown

g. *Operating cost - total*

Unknown

(v) DATES

a. *Date technique or process began*

1957

b. *Date technique or process ended*

1969

c. *Is technique or process currently in use?*

No

50. DESCRIPTION

a. *Name*

100-K Area Seepage Basin - Inactive

b. *Identification No.*

904-65G

c. *Location*

K Area

d. *Purpose*

To receive contaminated H_2O wastes

e. *Technique or process used*

Pump waste streams to basin

f. *Reference to Figure No. and letter*

None

(i) TYPES OF WASTE

a. *Source*

Miscellaneous contaminated H_2O streams from K Area

b. *Nuclides generally present*

^3H, nonvolatile β emitters

c. *Concentrations*

Unknown

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

Basin no longer used

b. *Total - by nuclide*

See Table 49-1

c. *Annual - by volume*

Unknown

d. *Total - by volume*

Unknown

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*
Unknown

b. *Cost per curie of nuclide*
Unknown

(iv) TECHNIQUE OR PROCESS

a. *Type*
Seepage basin

b. *Size*
130' x 65' x 7'

c. *Capacity*
380,000 gallons

d. *Construction material*
Natural soils

e. *Construction cost (1973 dollars)*
$2400

f. *Operating cost - annual*
Unknown

g. *Operating cost - total*
Unknown

(v) DATES

a. *Date technique or process began*
1959

b. *Date technique or process ended*
1965

c. *Is technique or process currently in use?*
No

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

Unknown

b. *Cost per curie of nuclide*

Unknown

(iv) TECHNIQUE OR PROCESS

a. *Type*

Seepage basin

b. *Size*

130' x 65' x 7'

c. *Capacity*

380,000 gallons

d. *Construction material*

Natural soils

e. *Construction cost (1973 dollars)*

$2400

f. *Operating cost - annual*

Unknown

g. *Operating cost - total*

Unknown

(v) DATES

a. *Date technique or process began*

1959

b. *Date technique or process ended*

1965

c. *Is technique or process currently in use?*

No

50. DESCRIPTION

a. *Name*

100-C Area Seepage Basin - Inactive

b. *Identification No.*

904-66G, 67G, 68G

c. *Location*

C Area

d. *Purpose*

To receive contaminated H_2O wastes

e. *Technique or process used*

Pump waste streams to basins

f. *Reference to Figure No. and letter*

None

(i) TYPES OF WASTE

a. *Source*

Miscellaneous contaminated H_2O streams from C Area

b. *Nuclides generally present*

^3H, nonvolatile β emitters

c. *Concentrations*

Unknown

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

Basin no longer used

b. *Total - by nuclide*

See Table 49-1

c. *Annual - by volume*

Unknown

d. *Total - by volume*

Unknown

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

Unknown

b. *Cost per curie of nuclide*

Unknown

(iv) TECHNIQUE OR PROCESS

a. *Type*

Seepage basin

b. *Size*

(360' x 35' x 7')
(300' x 55' x 11')
(150' x 80' x 12')

c. *Capacity*

(460,000)
(930,000)
(695,000) gallons

d. *Construction material*

Natural soils

e. *Construction cost (1973 dollars)*

$18,000

f. *Operating cost - annual*

Unknown

g. *Operating cost - total*

Unknown

(v) DATES

a. *Date technique or process began*

1959

b. *Date technique or process ended*

1970

c. *Is technique or process currently in use?*

No

50. DESCRIPTION

a. Name

Seepage Basin for Heat Exchanger Repair Facility - Inactive

b. Identification No.

904-91G

c. Location

Central Shops ("CS" on Figure 1)

d. Purpose

To receive aqueous wastes from heat exchanger decontamination

e. Technique or process used

Pump or drain wastes to basin

f. Reference to Figure No. and letter

None

(i) TYPES OF WASTE

a. Source

Aqueous waste from decontamination of heat exchangers

b. Nuclides generally present

^{3}H

c. Concentrations

Unknown

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

Basin no longer used

b. Total - by nuclide

See Table 49-1

c. Annual - by volume

Unknown

d. Total - by volume

Unknown

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*
Unknown

b. *Cost per curie of nuclide*
Unknown

(iv) TECHNIQUE OR PROCESS

a. *Type*
Seepage basin

b. *Size*
80' x 40' x 10'

c. *Capacity*
150,000 gallons

d. *Construction material*
Natural soils

e. *Construction cost (1973 dollars)*
∿ $7000

f. *Operating cost - annual*
Unknown

g. *Operating cost - total*
Unknown

(v) DATES

a. *Date technique or process began*
1964

b. *Date technique or process ended*
1968

c. *Is technique or process currently in use?*
No

FUEL AND TARGET ELEMENT
CHEMICAL PROCESSING AREAS
LIQUID WASTE MANAGEMENT SYSTEMS

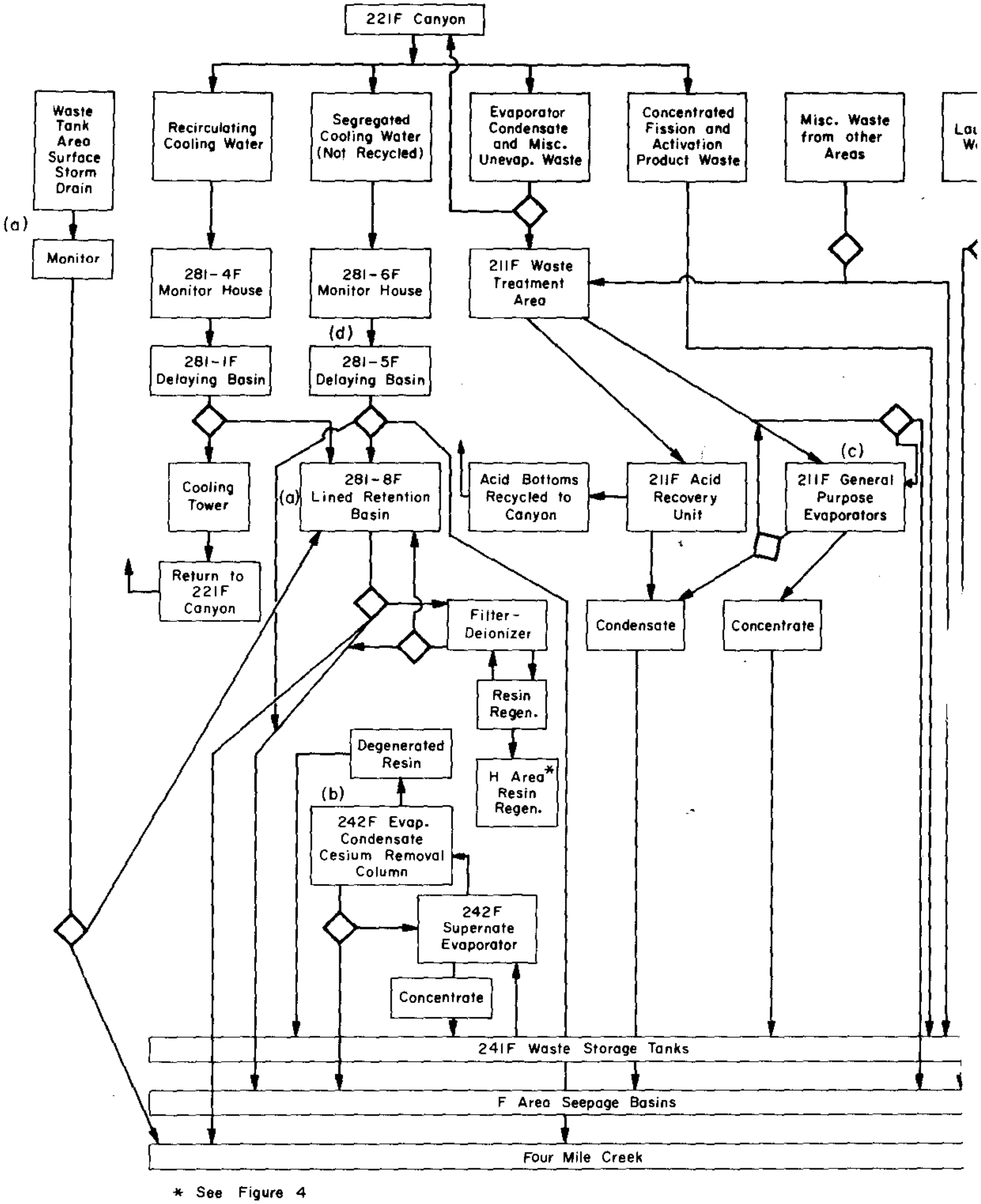


FIGURE 3 200-F Area (Chemical Separations) Liquid Wastes

50. DESCRIPTION

a. *Name*

Retention Basin (4-million gallon, lined) - Contaminated Water Control System

b. *Identification No.*

281-8F

c. *Location*

South side of 200-F Area

d. *Purpose*

To retain contaminated cooling water and surface storm drainage water to allow analysis and any necessary treatment before discard.

e. *Technique or process used*

The lined impermeable retention basin is provided to hold contaminated water from unusual incidents. After analysis, the water may be discarded to the effluent stream or to seepage basins, or may be decontaminated with a portable filter-deionizer unit before discard.

f. *Reference to Figure No. and letter*

Figure 3 - (a)

(i) TYPES OF WASTE

a. *Source*

1) Segregated and recirculating cooling water, if contaminated as a result of leaks in cooling coils.
2) Storm drain water from waste tank area if contaminated as a result of accidents.

b. *Nuclides generally present*

1) Mixed fission products and actinides if coils in process vessels leak.
2) Primarily cesium if neutralized waste solution escapes in waste tank area.

c. Concentrations

Cooling water is diverted to retention when concentratio are greater than 4.5x10^{-5} Ci/m^{3} alpha and 4.5x10^{-4} Ci/m^{3} beta-gamma. Storm drains are diverted to retention when the concentration is greater than 4.4x10^{-4} Ci/m^{3}.

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

The system has been used only once since completion. Total volume through basin was about 4 million gallons with less than 0.6 Ci of mixed fission products (^{103,106}Ru, ^{95}Zr-^{95}Nb, ^{141,144}Ce).

b. Total - by nuclide

Less than 0.6 Ci mixed fission products (see above)

c. Annual - by volume

See ii, a

d. Total - by volume

See ii, a

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

Not established

b. Cost per curie of nuclide

Not applicable

(iv) TECHNIQUE OR PROCESS

a. Type

Lined storage basin with diversion systems (piping, pumps, controls)

b. Size

c. Capacity

4 million gallons

d. *Construction material*

Earthen basin with impermeable lining

e. *Construction cost (1973 dollars)*

$667,000

f. *Operating cost - annual*

Not established

g. *Operating cost - total*

Not established

(v) DATES

a. *Date technique or process began*

Basin built 1972

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes

50. DESCRIPTION

a. *Name*

Cesium Removal Column

b. *Identification No.*

c. *Location*

Near 242-F evaporator

d. *Purpose*

To absorb cesium contamination that is present in the condensate from the evaporation of neutralized waste solutions to reduce levels of cesium sent to seepage basins.

e. *Technique or process used*

Absorption on ion exchange materials with a specific high affinity for cesium in the condensate solution. Synthetic alumino-silicate zeolites are in use at present.

f. *Reference to Figure No. and letter*

Figure 3 - (b)

(i) TYPES OF WASTE

a. *Source*

Generally, condensates from the evaporation of aged, neutralized waste.

b. *Nuclides generally present*

Predominantly ^{137}Cs with small amounts of other fissic products.

c. *Concentrations*

Feed - >4.5x10^{-2} Ci/m^3

Output - 2x10^{-4} to 5x10^{-4} Ci/m^3

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

Input - estimated as 250 to 400 Ci ^{137}Cs, 1972 (from data reported daily to check performance, but not recorded accumulatively). Output to seepage basin - 2.4 Ci ^{137}Cs, 1972 (upper limit, from analyses that would include some other fission products with the cesium).

b. Total - by nuclide

Included in total to 200-F Seepage Basins - See Table 49-1

c. Annual - by volume

1972, 2.06 million gallons

d. Total - by volume

21 million gallons

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

0.84 cent per gallon (1972)

b. Cost per curie of nuclide

Estimated $43 to $70 per curie of activity removed from feed

(iv) TECHNIQUE OR PROCESS

a. Type

Absorption column system

b. Size

Column dimensions, 22-inch diameter, 5 feet high

c. Capacity

Nominal throughput 5 gallons per minute

d. *Construction material*

304L stainless steel column, zeolite "Linde"* AW-500 or similar

e. *Construction cost (1973 dollars)*

$55,000

f. *Operating cost - annual*

$17,400 total ($6,600 exchanger medium + $10,800 personnel and other expenses)

g. *Operating cost - total*

Since 1964, 9 x $17,400 = $157,000

(v) DATES

a. *Date technique or process began*

1964

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes

---

*Trademark of Union Carbide Corporation

50. DESCRIPTION

a. Name

General Purpose Evaporator System

b. Identification No.

c. Location

211-F (East side of 221-F Canyon Building)

d. Purpose

Concentrate miscellaneous sump, catch tank, and interarea wastes, and provide additional decontamination when the wastes are too high in activity to discard to seepage basins.

e. Technique or process used

Evaporation: condensate to seepage basins and concentrated fraction to waste tanks.

f. Reference to Figure No. and letter

Figure 3 - (c)

(i) TYPES OF WASTE

a. Source

Transfers in waste trailer from other areas, sumps, and catch tanks; condensates from other evaporators.

b. Nuclides generally present

Mixed fission products.

c. Concentrations

Feed - up to $4.5\text{x}10^{-4}$ Ci/m^3 alpha
up to 0.45 Ci/m^3 gamma

Output limits for discard to seepage basins

less than $4.5\text{x}10^{-5}$ Ci/m^3 alpha
less than $5.4\text{x}10^{-2}$ Ci/m^3 gross gamma (mixed short-lived fission products)

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

Records of activity processed, released to seepage, and sent to waste tanks are not kept accumulatively. The amount sent to waste tank storage is estimated to be 100 to 1000 Ci per year. The contribution to the F-Area seepage basins is included in the total shown in Table 49-2.

b. *Total - by nuclide*

Included in total to F-Area seepage basins - see Table 49-

c. *Annual - by volume*

Approximately 3.6×10^6 gallons of condensate sent to seepag and 8.5×10^4 gallons of concentrates sent to waste tank in 1972.

d. *Total - by volume*

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

3.1 cents per gallon

b. *Cost per curie of nuclide*

(iv) TECHNIQUE OR PROCESS

a. *Type*

Evaporators (2), feed and condensate systems

b. *Size*

c. *Capacity*

20 gallons per minute boiloff rate, total

d. *Construction material*

stainless steel

e. *Construction cost (1973 dollars)*

$2,000,000

f. *Operating cost - annual*
$110,000

g. *Operating cost - total*

(v) DATES

a. *Date technique or process began*
1954

b. *Date technique or process ended*

c. *Is technique or process currently in use?*
Yes

50. DESCRIPTION

a. Name

Segregated Cooling Water Control System

b. Identification No.

281-5F, 281-6F (and auxiliaries)

c. Location

South of 221-F

d. Purpose

To limit activity discharged to Four Mile Creek and to seepage basins

e. Technique or process used

The effluent cooling water is monitored and diverted from Four Mile Creek if activity exceeds permissible limits (1.4x10^{-6} Ci/m^3 alpha, 4.5x10^{-6} Ci/m^3 beta-gamma). The water is diverted to seepage basins if permissible (up to 4.5x10^{-5} Ci/m^3 alpha, and 4.5x10^{-4} Ci/m^3 beta-gamma). The water is sent to an impermeabl basin (281-8F) for treatment if the seepage basin limi is exceeded.

f. Reference to Figure No. and letter

Figure 3 - (d)

(i) TYPES OF WASTE

a. Source

Activity may reach the cooling water by leaks in cooling coils of process vessels.

b. Nuclides generally present

Mixed radionuclides typical of nuclear fuels; primary activity is short-lived fission products.

c. Concentrations

Normally negligible, maximum observed not available.

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

All activity diverted to seepage basins is included in inventory of activity listed for F-Area seepage basins in Table 49-1. Complete identification of amounts from diversion is impractical.

b. *Total - by nuclide*

c. *Annual - by volume*

Average segregated cooling water flow is 800-1000 gallons per minute to effluent streams. Individual diversions ranged from thousands to hundreds of thousands of gallons.

d. *Total - by volume*

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

No adequate basis for a unit price.

b. *Cost per curie of nuclide*

(iv) TECHNIQUE OR PROCESS

a. *Type*

Activity detectors, monitoring points, delaying basin, diversion system

b. *Size*

c. *Capacity*

800-1000 gallons per minute throughput

d. *Construction material*

e. *Construction cost (1973 dollars)*

$480,000

f. *Operating cost - annual*

Estimated $37,500

g. *Operating cost - total*

(v) DATES

a. *Date technique or process began*

1954

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes

50. DESCRIPTION

a. *Name*

200-F Area Seepage Basins

b. *Identification No.*

904-41G, 904-42G, 904-43G

c. *Location*

∿ 1/3 mile south of 200-F Area

d. *Purpose*

To receive miscellaneous streams of contaminated water (See Figure 3) to permit decay of short-lived radionuclides and prevent surges in concentrations of long-lived radionuclides to effluent streams.

e. *Technique or process used*

Earthen basins (unlined)

f. *Reference to Figure No. and letter*

Figure 3

(i) TYPES OF WASTE

a. *Source*

Miscellaneous sources in 200-F Area - See Figure 3

b. *Nuclides generally present*

Mixed fission products, activation products, and actinides

c. *Concentrations*

Alpha - 3.6×10^{-6} Ci/m^3 (1972 average)

Beta-gamma - 1.3×10^{-4} Ci/m^3 (1972 average)

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

See Table 49-2

b. *Total - by nuclide*

See Table 49-1

c. *Annual - by volume*

40,400,000 gallons (1972)

d. Total - by volume

597,000,000 gallons

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

0.27 cent per gallon

b. Cost per curie of nuclide

Information concerning volumes of liquids associated with each nuclide is not available.

(iv) TECHNIQUE OR PROCESS

a. Type

3 earthen basins (unlined) in series

b. Size

c. Capacity

13,700,000 gallons total for three basins

d. Construction material

Earth

e. Construction cost (1973 dollars)

$659,000

f. Operating cost - annual

$108,000 (1972) for labor, materials, and services

g. Operating cost - total

Not available

(v) DATES

a. Date technique or process began

Mid-1955

b. Date technique or process ended

c. Is technique or process currently in use?

Yes

200-H FUEL AND TARGET ELEMENT
CHEMICAL PROCESSING AREA
LIQUID WASTES

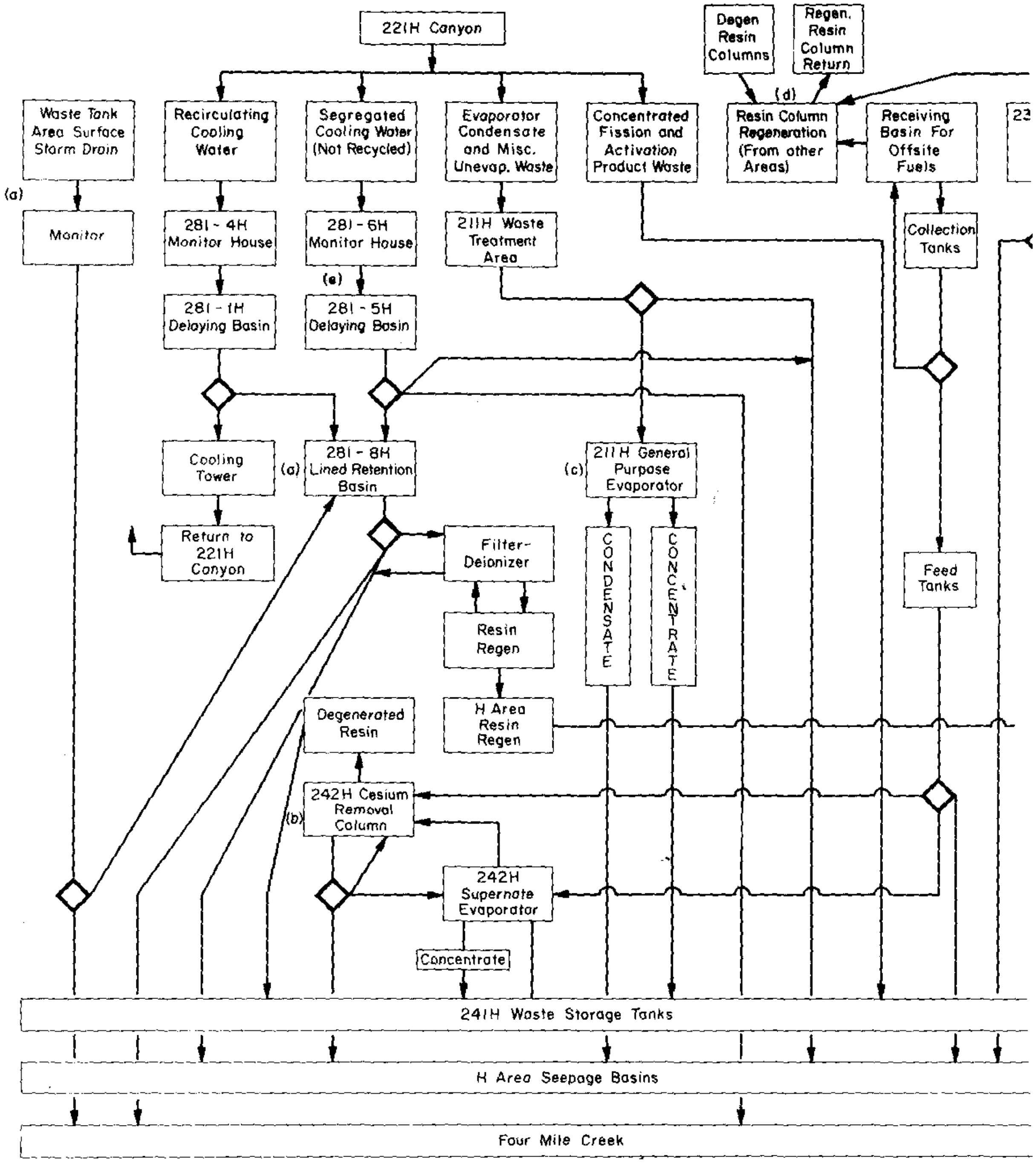


FIGURE 4 200-H Area (Chemical Separations) Liquid Wastes

50. DESCRIPTION

a. *Name*

Retention Basin (4-million gallon, lined) - Contaminated Water Control System

b. *Identification No.*

281-8H

c. *Location*

South of 200-H Area

d. *Purpose*

To retain contaminated cooling water and surface storm drainage water to allow analysis and any necessary treatment before discard.

e. *Technique or process used*

The lined impermeable retention basin is provided to retain contaminated water from unusual incidents. After analysis, the water may be discarded to the effluent stream or to seepage basins, or may be decontaminated with a portable filter-deionizer unit before discard.

f. *Reference to Figure No. and letter*

Figure 4 - (a)

(i) TYPES OF WASTE

a. *Source*

1) Segregated and recirculating cooling, if contaminated as a result of leaks in cooling coils.
2) Storm drain water from waste tank area if contaminated as a result of accidents.

b. *Nuclides generally present*

1) Mixed fission products and actinides if coils in process vessels leak.
2) Primarily cesium if neutralized waste solution escapes in waste tank area.

c. *Concentrations (ranges)*

Cooling water is diverted to retention if concentrations are greater than $4.5\text{x}10^{-5}$ Ci/m^3 alpha and greater than $4.5\text{x}10^{-4}$ beta-gamma. Storm drains are diverted to retention if the concentration is greater than $4.5\text{x}10^{-4}$ Ci/m^3.

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

(no use since completion)

b. *Total - by nuclide*

c. *Annual - by volume*

d. *Total - by volume*

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

b. *Cost per curie of nuclide*

(iv) TECHNIQUE OR PROCESS

a. *Type*

Lined storage basin with diversion systems (piping, pumps, controls)

b. *Size*

c. *Capacity*

4 million gallons

d. *Construction material*

Earthen basin with impermeable lining

e. *Construction cost (1973 dollars)*

$655,000

f. *Operating cost - annual*

Not established

g. *Operating cost - total*

Not established

(v) DATES

a. *Date technique or process began*

Basin built in 1972

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes

50. DESCRIPTION

a. *Name*

Cesium Removal Column

b. *Identification No.*

c. *Location*

Near 242-H waste evaporator

d. *Purpose*

To absorb cesium contamination that is present in the condensate from the evaporation of neutralized waste and in solutions resulting from regeneration of deionizer resins, and so to reduce levels of cesium sent to seepage basins.

e. *Technique or process used*

Absorption on ion exchange materials with a specific high affinity for cesium in the solutions to be treate Synthetic alumino-silicate zeolite is in use at presen

f. *Reference to Figure No. and letter*

Figure 4 - (b)

(i) TYPES OF WASTE

a. *Source*

Condensates from the evaporation of aged neutralized waste.

Resin regeneration solutions.

Occasionally condensates from evaporation of fresh, neutralized waste.

b. *Nuclides generally present*

^{137}Cs in aged condensate

Mixed fission products and activation products in resin regeneration solutions (primarily short-lived activity)

c. Concentrations

Feed: to >4.5×10^{-2} Ci/m^3 ^{137}Cs; 5×10^{-2} Ci/m^3 mixed fission and activation products (annual average)

Output: 1×10^{-4} to 3×10^{-2} Ci/m^3 ^{137}Cs; 5×10^{-2} Ci/m^3 mixed fission and activation products (annual average)

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

Input - Estimated as 300 to 450 Ci ^{137}Cs (1972) from 242-H evaporator and resin regeneration facility (from daily input data not recorded accumulatively). Estimated 200 Ci mixed fission and activation products from resin regeneration operations (primarily short-lived).

Output to seepage basins - Upper limit of 3.9 Ci ^{137}Cs, by an analysis technique that would include some mixed fission product contribution. Actual amounts are included in H-Area seepage basin input data (see Table 49-2).

b. Total by nuclide

Included in totals to H-Area seepage basins, see Table 49-1.

c. Annual - by volume

4.94 million gallons (1972)

d. Total - by volume

33 million gallons

(iii) COST OF TECHNIQUE OR PROCESS

a. Operating cost per gallon

0.87 cent per gallon (1972)

b. Cost per curie of nuclide

Estimated \$95 to \$140 per curie of ^{137}Cs diverted from the seepage basin.

(iv) TECHNIQUE OR PROCESS

a. *Type*

Absorption column system

b. *Size*

c. *Capacity*

Adequate performance at up to 20 gallons per minute

d. *Construction material*

304L Stainless Steel

e. *Construction cost (1973 dollars)*

$60,000

f. *Operating cost - annual*

$43,200 ($32,400 exchanger medium + $10,800 personnel and other expenses)

g. *Operating cost - total*

Not presently available

(v) DATES

a. *Date technique or process began*

1965

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes

50. DESCRIPTION

a. *Name*

General Purpose Evaporator System

b. *Identification No.*

c. *Location*

211-H (East side of 221-H Canyon Building)

d. *Purpose*

Concentrate miscellaneous wastes from sumps, drains, equipment decontamination, and provide decontamination when wastes are above release limits to seepage basins.

e. *Technique or process used*

Evaporation: condensates to seepage basins and concentrated fraction to waste tanks.

f. *Reference to Figure No. and letter*

Figure 4 - (c)

(i) TYPES OF WASTE

a. *Source*

Sumps, catch tanks, condensates from other evaporators

b. *Nuclides generally present*

Mixed fission products

c. *Concentrations*

Output Limits for discard to seepage:	Less than $4.5\text{x}10^{-5}$ Ci/m^3 alpha
	Less than $3.5\text{x}10^{-2}$ Ci/m^3 gross gamma (mixed short-lived fission products)

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

Records of activity processed, released to seepage, and sent to waste tanks are not kept accumulatively. The amount sent to waste tank storage is estimated to be 60 to 1000 Ci per year. The contribution to the H-Area seepage basins is included in the total shown in Table 49-2.

b. Total - by nuclide

Included in total to H-Area seepage basins - See Table 49-1.

c. Annual - by volume

Approximately 1.2×10^6 gallons of condensate sent to seepage and 6×10^4 gallons of concentrate sent to waste tanks, in 1972.

d. Total - by volume

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

3.3 cents per gallon

b. Cost per curie of nuclide

(iv) TECHNIQUE OR PROCESS

a. Type

Evaporator, feed, condensate, and transfer systems

b. Size

c. Capacity

10 gallons per minute boiloff rate

d. Construction material

304L Stainless Steel

e. Construction cost (1973 dollars)

$2,000,000

f. *Operating cost - annual*

$40,000

g. *Operating cost - total*

(v) DATES

a. *Date technique or process began*

1955

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes

50. DESCRIPTION

a. *Name*

Resin Regeneration System

b. *Identification No.*

245-H

c. *Location*

Adjacent to the Receiving Basin for Off-Site Fuels, west side of 200-H Area

d. *Purpose*

To regenerate resins from filter-deionizer systems, which in turn are utilized to reduce activity that otherwise would go to plant streams. In effect, activity is directed from plant streams with some going to the waste tanks and some to the H-Area seepage basins.

e. *Technique or process used*

Chemical regeneration of the resins, with resulting removal of activity.

f. *Reference to Figure No. and letter*

Figure 4 - (d)

(i) TYPES OF WASTE

a. *Source*

Portable Reactor Basin Deionizers and resin from Receivin Basin for Off-Site Fuels deionizer.

b. *Nuclides generally present*

Mixed fission products, activation products ($^{134,137}Cs$, ^{51}Cr, ^{95}Zr, ^{95}Nb, $^{103,106}Ru$, $^{141,144}Ce$, ^{131}I, $^{89,90}Sr$) 1 Ci per deionizer unit (normally 60 ft^3 of resin per unit)

c. *Concentrations*

Annual averages, total activity including short-lived radionuclides:

$2x10^{-2}$ Ci/m^3 to seepage
$5x10^{-2}$ Ci/m^3 to cesium removal columns
0.4 Ci/m^3 to waste tank storage

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

For activities with $T_{\frac{1}{2}} > 1$ yr the estimated amounts sent to seepage basins directly are 2.4 Ci ^{106}Ru, upper limit of 2.5 Ci ^{137}Cs (from control analyses on batch transfers, not recorded accumulatively). Actual amounts are included in H-Area seepage basin input data. See Table 49-2.

b. *Total - by nuclide*

Included in H-Area seepage basin data. See Table 49-1.

c. *Annual - by volume*

160 deionizer batches (1972) generating 2,700,000 gallons of waste. Projected 1973 - 300 deionizer batches, 5,000,000 gallons of waste.

d. *Total - by volume*

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per deionizer batch*

$1000 (based on 1972 operating costs).

b. *Cost per curie of nuclide*

Estimated cost of $470 per curie of mixed fission and activation products removed.

(iv). TECHNIQUE OR PROCESS

a. *Type*

Resin classification and chemical treatment system

b. *Size*

c. *Capacity*

1 regeneration per day

d. *Construction material*

Stainless steel

e. *Construction cost (1973 dollars)*

$1,380,000

f. Operating cost - annual

$211,000 (1972)

g. Operating cost - total

(v) DATES

a. Date technique or process began

1963

b. Date technique or process ended

c. Is technique or process currently in use?

Yes

50. DESCRIPTION

a. Name

Segregated Cooling Water Control System

b. Identification No.

281-5H, 281-6H (and auxiliaries)

c. Location

South of 221-H

d. Purpose

To limit activity discharged to Four Mile Creek and to seepage basins.

e. Technique or process used

The effluent cooling water is monitored and diverted from Four Mile Creek if activity exceeds permissible limits (1.4 x 10^{-6} Ci/m^3 alpha, 4.5 x 10^{-6} Ci/m^3 beta-gamma). The water is diverted to seepage basins if permissible (up to 4.5 x 10^{-5} Ci/m^3 alpha, and 4.5 x 10^{-4} Ci/m^3 beta-gamma). The water is sent to an impermeable basin (281-8F) for temporary storage if the seepage basin limit is exceeded.

f. Reference to Figure No. and letter

Figure 4 - (e)

(i) TYPES OF WASTE

a. Source

Activity may reach the cooling water by leaks in cooling coils of process vessels.

b. Nuclides generally present

Mixed radionuclides typical of nuclear fuels; primary activity is short-lived fission products.

c. Concentrations

Normally negligible, maximum observed not available.

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

Water has been diverted to seepage basins less than once per year since startup (10 times in 18 years).

b. *Total - by nuclide*

All activity diverted to seepage basins is included in inventory of activity listed for H-Area seepage basins. Complete identification of amounts from diversion is impractical.

c. *Annual - by volume*

Average segregated water flow is 750 gallons per minute to effluent stream. Individual diversions have been thousands to hundreds of thousands of gallons.

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

No adequate basis for unit price.

b. *Cost per curie of nuclide*

No adequate basis for unit price.

(iv) TECHNIQUE OR PROCESS

a. *Type*

Activity detectors, monitoring points, delaying basin, diversion system

b. *Size*

c. *Capacity*

750 gallons per minute throughput

d. *Construction material*

e. *Construction cost (1973 dollars)*

$650,000

f. *Operating cost - annual*

Estimated $37,500

g. Operating cost - total

(v) DATES

a. Date technique or process began

1955

b. Date technique or process ended

-

c. Is technique or process currently in use?

Yes

50. DESCRIPTION

a. *Name*

200-H Area Seepage Basins

b. *Identification No.*

904-44G, 904-45G, 904-56G (904-46G not in use)*

c. *Location*

∿1/2 mile southwest of 200-H Area

d. *Purpose*

To receive miscellaneous streams of contaminated water (See Figure 4) to permit decay of short-lived radionucl and prevent surges in concentrations of long-lived radi nuclides to effluent streams.

e. *Technique or process used*

Earthen basins (unlined)

f. *Reference to Figure No. and letter*

Figure 4

(i) TYPES OF WASTE

a. *Source*

Miscellaneous sources in 200-H Area - See Figure 4

b. *Nuclides generally present*

Mixed fission products, activation products, and actinid

c. *Concentrations (ranges)*

Alpha - 1.3×10^{-6} Ci/m^3 (1972 average)
Beta-gamma- 9.2×10^{-5} Ci/m^3 (1972 average)

---

* 904-46G basin was in use until 1963, at which time it was retired from service and replaced with 904-56G.

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

See Table 49-2

b. Total - by nuclide

See Table 49-1

c. Annual - by volume

63,500,000 gallons (1972)

d. Total - by volume

837,000,000 gallons

iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

0.16 cent per gallon

b. Cost per curie of nuclide

Information concerning volumes of liquids associated with each nuclide is not available.

(iv) TECHNIQUE OR PROCESS

a. Type

3 earthen basins (unlined) in series

b. Size

c. Capacity

39,500,000 gallons for the 3 basins in use

d. Construction material

Earth

e. Construction cost (1973 dollars)

$755,000

f. Operating cost - annual

$102,000 (1972) for labor, materials, and services

g. Operating cost - total

Not available

(v) DATES

a. *Date technique or process began*

Mid-1955

b. *Date technique or process ended*

-

c. *Is technique or process currently in use?*

Yes

FUEL AND TARGET ELEMENT FABRICATION AREA

LIQUID WASTES

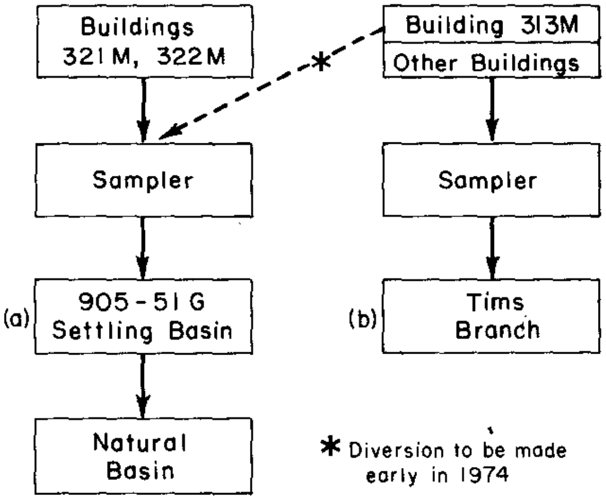


FIGURE 5 300-M Area (Fuel and Target Fabrication) Liquid Waste

50. DESCRIPTION

a. Name

300-M Area Settling Basin

b. Identification No.

904-51G

c. Location

1/4 mile south of 300-M Fuel and Target Fabrication Area

d. Purpose

To receive liquid waste streams containing waste chemicals with low concentrations of enriched uranium

e. Technique or process used

Liquid seeps into the soil; some liquid evaporates. Uranium residue is retained in the soil. The settling basin overflows to a natural basin which has no surface outlet.

f. Reference to Figure No. and letter

Figure 5 - (a)

(i) TYPES OF WASTE

a. Source

Liquid wastes containing uranium are generated in the 321-M Building from cleaning and etching of uranium-aluminum fuel components.

b. Nuclides generally present

Enriched uranium

c. Concentrations

3×10^{-8} Ci/m^3 (average)

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

3.3×10^{-3} Ci

b. Total - by nuclide

0.05 alpha curie

c. Annual - by volume

26 million gallons

d. Total - by volume

390 million gallons

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

0.04 cent per gallon

b. Cost per curie of nuclide

Not applicable

(iv) TECHNIQUE OR PROCESS

a. Type

Earthen basin

b. Size

330' x 280' x 20'

c. Capacity

∿14 million gallons

d. Construction material

Excavated in earth

e. Construction cost (1973 dollars)

$75,000

f. Operating cost - annual

$10,000 (primarily for sampling and analysis)

g. Operating cost - total

$150,000

(v) DATES

a. *Date technique or process began*

1958

b. *Date technique or process ended*

In use

c. *Is technique or process currently in use?*

Yes

Note: Early in 1974, the 904-51G basin will receive a liquid effluent stream from Building 313-M, containing nonrecoverable natural or depleted uranium. This is shown by the dashed line in Figure 5. The low concentration stream currently is discharged to an effluent stream (Tims Branch), a tributary of Upper Three Runs Creek.

50. DESCRIPTION

a. Name

300-M Area Effluent Stream (Tims Branch, a tributary of Upper Three Runs Creek)

b. Identification No.

None

c. Location

1/8 mile south of 300-M Fuel and Target Fabrication Area

d. Purpose

To dispose liquid waste containing low concentrations of uranium.

e. Technique or process used

Discharged to effluent stream. A continuous proportional sampler and flow recorder provides the method of determining the amount of uranium discharged.

f. Reference to Figure No. and letter

Figure 5 - (b)

(i) TYPES OF WASTE

a. Source

Building 313-M operates a recovery facility to collect uranium waste generated during fabrication and testing (autoclave test) of fuel elements. The small fraction of uranium not recovered is discharged to the effluent stream.

b. Nuclides generally present

^{238}U

c. Concentrations (ranges)

Gross alpha 8.6×10^{-7} Ci/m^3 (1972 annual avg)

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

1972: 0.39 Ci depleted U (2100 lb)

b. *Total - by nuclide*

22.7 Ci natural and depleted U (79,000 lb)

c. *Annual - by volume*

89,000,000 gallons

d. *Total - by volume*

- -

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

0.01 cent per gallon

b. *Cost per curie of nuclide*

(iv) TECHNIQUE OR PROCESS

a. *Type*

Effluent stream, continuously sampled

b. *Size*

-

c. *Capacity*

-

d. *Construction material*

Natural stream

e. *Construction cost (1973 dollars)*

$20,000 (primarily for continuous samples)

f. *Operating cost - annual*

$10,000 (primarily for sampling and analysis)

g. *Operating cost - total*

$200,000

(V) DATES

a. *Date technique or process began*

1953 - intermittent sampling was used until 1955, when a continuous sampler was installed.

b. *Date technique or process ended*

In use

c. *Is technique or process currently in use?*

Yes

Note: Early in 1974, the 905-51G basin will receive the liquid effluent from Building 313-M containing nonrecoverable uranium. This is shown by the dashed line in Figure 5.

SAVANNAH RIVER LABORATORY

LIQUID WASTES

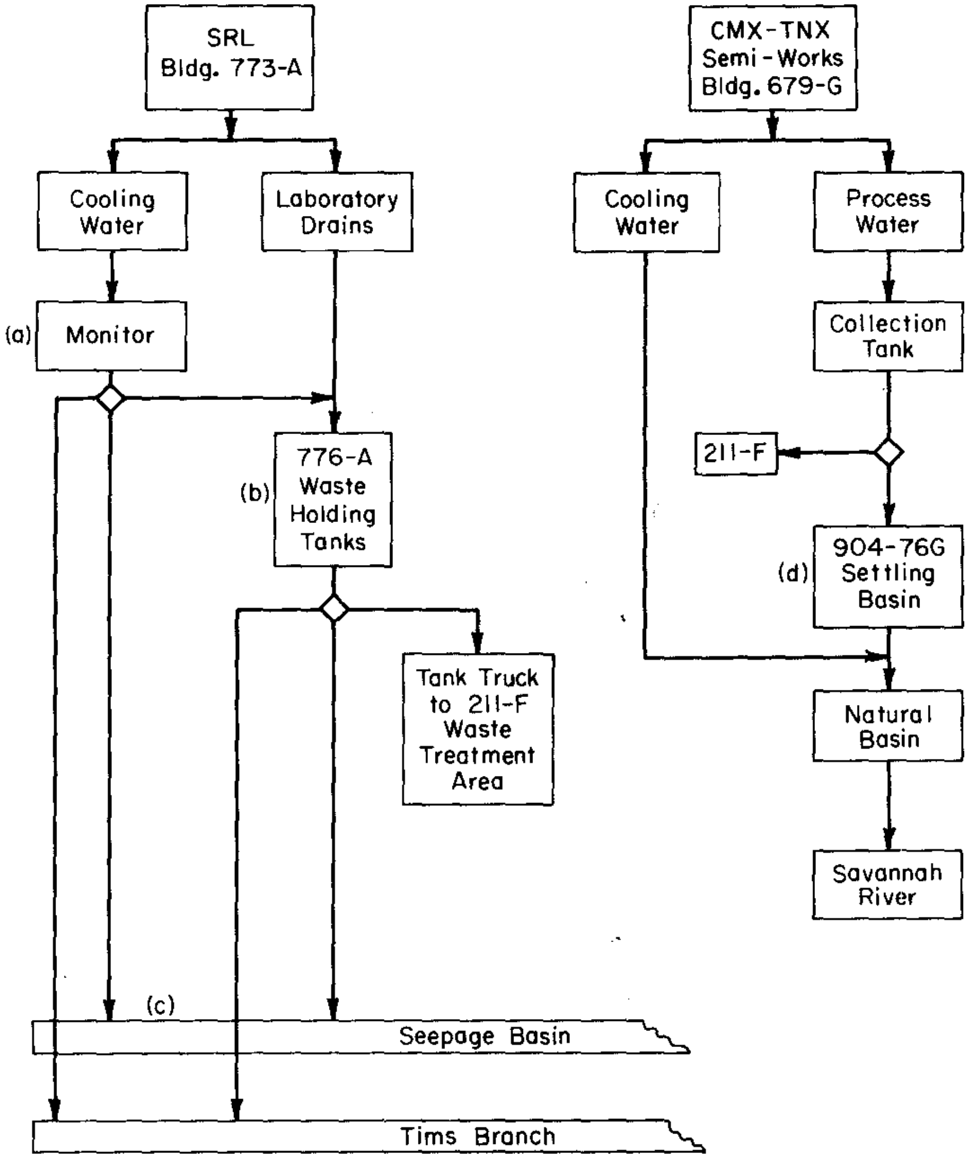


FIGURE 6 Savannah River Laboratory Liquid Wastes

50. DESCRIPTION

a. Name

Savannah River Laboratory Cooling Water Monitor

b. Identification No.

c. Location

773-A

d. Purpose

To detect any contamination of cooling water, which may be diverted from the effluent stream.

e. Technique or process used

Continuous beta-gamma and alpha water monitors are used in those research programs in which cooling water is used and the potential for serious contamination exists.

f. Reference to Figure No. and letter

Figure 6 - (a)

(i) TYPES OF WASTE

a. Source

Research programs in Building 773-A in support of Savannah River Plant operations.

b. Nuclides generally present

None

c. Concentrations

Concentrations are normally nil. This system provides an alert to an unusual incident.

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

Not applicable

b. *Total - by nuclide*

Not applicable

c. *Annual - by volume*

Varies with changing research programs

d. *Total - by volume*

No record

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

Data not available

b. *Cost per curie of nuclide*

Data not available

(iv) TECHNIQUE OR PROCESS

a. *Type*

Continuous swirl cell detectors with amplifiers, recorders, and alarm system.

b. *Size*

c. *Capacity*

d. *Construction material*

e. *Construction cost (1973 dollars)*

$1000 per monitor unit

f. *Operating cost - annual*

∿$500 per monitor unit

g. *Operating cost - total*

(v) DATES

a. Date technique or process began

1969*

b. Date technique or process ended

c. Is technique or process currently in use?

Monitors are used intermittently as research programs require.

---

*Prior to 1969 and in most current operations, because of low volumes of cooling water and/or low potential for contamination, water was sampled periodically and diverted to 776-A storage tanks or seepage basins when necessary.

50. DESCRIPTION

a. *Name*

Savannah River Laboratory Waste Holding Tanks

b. *Identification No.*

776-A

c. *Location*

200 yards northeast of Building 773-A

d. *Purpose*

To hold contaminated water until analysis can be made for disposition.

e. *Technique or process used*

Underground gravity-fed holding tanks

f. *Reference to Figure No. and letter*

Figure 6 - (b)

(i) TYPES OF WASTE

a. *Source*

Drains from "hot" sinks, shielded cells, etc.

All liquid waste from this source is routinely transported by a tank truck to 200-F Area for processing.

b. *Nuclides generally present*

Depending on research programs in progress, a wide spectrum of activation products, fission products, and actinides will be present.

c. *Concentrations*

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

Not applicable

b. *Total - by nuclide*

Not applicable

50. DESCRIPTION

a. Name

Savannah River Laboratory Waste Holding Tanks

b. Identification No.

776-A

c. Location

200 yards northeast of Building 773-A

d. Purpose

To hold contaminated water until analysis can be made for disposition.

e. Technique or process used

Underground gravity-fed holding tanks

f. Reference to Figure No. and letter

Figure 6 - (b)

(i) TYPES OF WASTE

a. Source

Drains from "hot" sinks, shielded cells, etc.

All liquid waste from this source is routinely transported by a tank truck to 200-F Area for processing.

b. Nuclides generally present

Depending on research programs in progress, a wide spectru of activation products, fission products, and actinides will be present.

c. Concentrations

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

Not applicable

b. Total - by nuclide

Not applicable

c. Annual - by volume

∿70,000 gallons (1972)

d. Total - by volume

∿340,000 gallons (1969-1973)

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

1.3 cents per gallon. This is a lumped cost for 776-A, the seepage basins, and transportation of wastes to 200-F Area based on operating costs of $23,000 and total volume of about 1,800,000 gallons.

b. Cost per curie of nuclide

Data not available.

(iv) TECHNIQUE OR PROCESS

a. Type

Four underground holding tanks

b. Size

c. Capacity

∿5900 gallons each

d. Construction material

Stainless steel

e. Construction cost (1973 dollars)

$2,320,000 (776-A facility plus waste tank trailer)

f. Operating costs - Annual and Total

Operating costs are included in the operating costs shown for Savannah River Laboratory Seepage Basins, 904-53G, 904-54G, and 904-55G.

(v) DATES

a. *Date technique or process began*

776-A tanks have been in use since 1954.

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes

50. DESCRIPTION

a. *Name*

Savannah River Laboratory Seepage Basins (4)

b. *Identification No.*

904-53G (Basins 1 and 2)
904-54G (Basin 3)
904-55G (Basin 4)

c. *Location*

¼ mile northeast of Savannah River Laboratory Building 773-A

d. *Purpose*

To dispose of contaminated water.

e. *Technique or process used*

Contaminated water is discharged to 4 earthen seepage basins, in series, having no surface outlet.

f. *Reference to Figure No. and letter*

Figure 6 - (c)

(i) TYPES OF WASTE

a. *Source*

773-A Laboratory sink and floor drains and miscellaneous sumps

b. *Nuclides generally present*

Depending on research program in progress, a wide spectrum of activation products, fission products, and actinides could be present.

c. *Concentrations*

Gross alpha	1.1×10^{-5} Ci/m^3	1972 annual average
Gross beta	0.5×10^{-5} Ci/m^3	
^{89,90}Sr	0.01×10^{-5} Ci/m^3	
^{3}H	2.9×10^{-3} Ci/m^3	

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*

1972 - See Table 49-2

b. *Total - by nuclide*

See Table 49-1

c. *Annual - by volume*

1,800,000 gallons (1972)

d. *Total - by volume*

26,000,000 gallons

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

See pages 50-70

b. *Cost per curie of nuclide*

Information concerning volume of liquid associated with each nuclide is not available.

(iv) TECHNIQUE OR PROCESS

a. *Type*

Unlined earthen seepage basins

b. *Size*

No. 1 - 129' x 62' x 6.5'
No. 2 - 129' x 129' x 6.5'
No. 3 - 175' x 125' x 8'
No. 4 - 300' x 150' x 11'

c. *Capacity*

No. 1 - 214,000 gallons
No. 2 - 1,000,000 gallons
No. 3 - 1,630,000 gallons
No. 4 - 4,320,000 gallons

d. *Construction material*

Excavated in earth

e. Construction cost (1973 dollars)

$50,000

f. Operating cost - annual

$23,000 to analyze and transfer liquids and to maintain seepage basin area

g. Operating cost - total

$380,000

(v) DATES

a. Date technique or process began

Basins 1 and 2 - 1954
Basin 3 - 1958
Basin 4 - 1960

b. Date technique or process ended

c. Is technique or process currently in use?

Yes

50. DESCRIPTION

a. Name

CMX-TNX Semiworks Settling Basin

b. Identification No.

904-76G

c. Location

About 1 mile west of 400-D Area and about ¼ mile east of the Savannah River

d. Purpose

To receive discarded process water occasionally containing natural uranium and thorium.

e. Technique or process used

Process waste is collected in a 3500-gallon underground tank. After analysis the waste is pumped to an earthen settling basin. Overflow from the settling basin joins a flow of 300 to 600 gallons per minute of uncontaminated cooling water before entering a natural basin or depression near the river. The natural basin overflows to the Savannah River.

f. Reference to Figure No. and letter

Figure 6 - (d)

(i) TYPES OF WASTE

a. Source

CMX-TNX serves as a pilot plant for the Fuel and Target Processing areas. Natural uranium and thorium are used in the pilot plant operations. Process rinses, flushes, etc., carrying these materials are discharged to the settling basin.

b. Nuclides generally present

Natural uranium and thorium

c. Concentrations

Concentration may range from nil to no greater than 1×10^{-4} Ci/m^3.

(ii) AMOUNTS OF WASTE

a. *Annual - by nuclide*
   See Table 49-2

b. *Total - by nuclide*
   See Table 49-1

c. *Annual - by volume*
   750,000 gallons (1952-1969)

d. *Total - by volume*
   13,500,000 gallons (1952-1969)

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*
   0.7 cent per gallon

b. *Cost per curie of nuclide*

(iv) TECHNIQUE OR PROCESS

a. *Type*
   Earthen settling basin

b. *Size*
   150' x 50' x 3.5'

c. *Capacity*
   200,000 gallons

d. *Construction material*
   Excavated in earth

e. *Construction cost (1973 dollars)*
   $12,500

f. *Operating cost - annual*
   ∿ $5000 (primarily for sampling and analysis)

g. *Operating cost - total*
   ∿ $90,000

(v) DATES

a. *Date technique or process began*

Discharge to natural basin began in 1952. The intermediate settling basin was constructed and put into use in 1955.

b. *Date technique or process ended*

April 1969

c. *Is technique or process currently in use?*

Not currently receiving thorium or uranium contaminated wastes.

HEAVY WATER PRODUCTION AND REWORK AREA

LIQUID WASTES

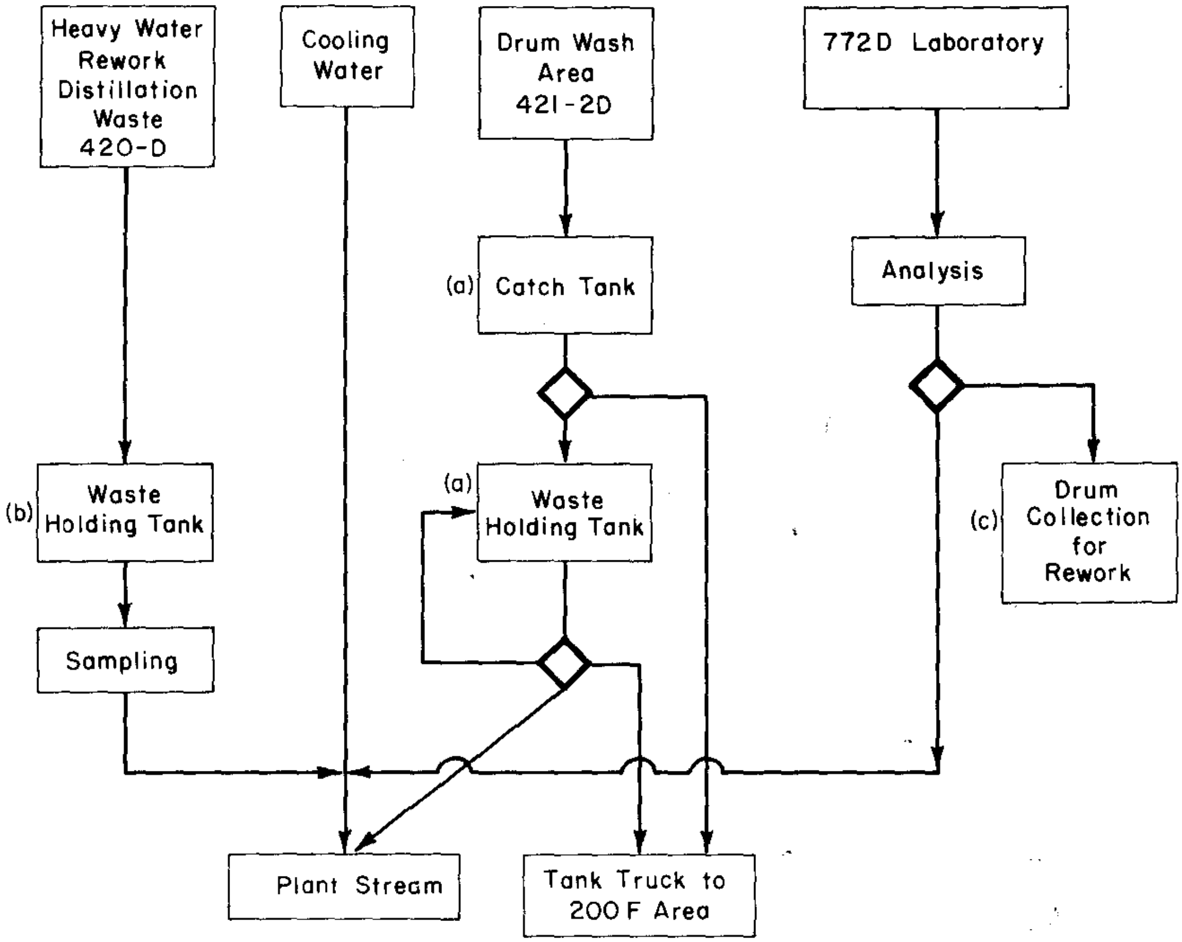


FIGURE 7 400-D Heavy Water Area Liquid Wastes

50. DESCRIPTION

a. Name

Heavy Water Area - Liquid Waste Disposal System

b. Identification No.

421-2D

c. Location

400-D Area

d. Purpose

To dispose of wash and rinse water drains from area used for cleaning heavy water drums. The drums are used for transporting degraded (and contaminated) heavy water from the reactors and off-plant sites to the heavy water rework area.

e. Technique or process used

Drains flow to a 250-gallon catch tank and then to a holding tank. Water can be sampled at either tank and is either discharged to an effluent stream or transported by tank truck to the 211-F Waste Treatment Area in 200-F Area.

f. Reference to Figure No. and letter

Figure 7 - (a)

(i) TYPES OF WASTE

a. Source

Contaminated heavy water residue in drums used to transport degraded moderator from the reactor areas and off-plant sites to the 400-D Area Heavy Water rework area.

b. Nuclides generally present

Primarily tritium (^3H) but also small amounts of activation and fission products.

c. Concentrations

Concentrations above the limits below are either transported to 211-F Waste Treatment Area or released in controlled amounts to the effluent stream.

Tritium - 50 Ci/m^3
Beta-gamma - 4 x 10^{-4} Ci/m^3
Alpha - 5 x 10^{-5} Ci/m^3

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

421-2D only - 5,400 Ci ^{3}H
Others (all 400-D sources): 0.001 Ci ^{60}Co; 0.04 Ci ^{106}Ru; Gross alpha 0.01 Ci

b. Total - by nuclide

1964-1972, all 400-D sources: 99,600 Ci ^{3}H; 0.40 Ci ^{60}Co; 0.39 Ci ^{106}Ru (includes ^{103}Ru); 0.05 Ci ^{90}Sr (includes ^{89}Sr); Gross beta 0.53 Ci; Gross alpha 0.01 Ci

c. Annual - by volume

375,000 gallons to effluent stream

d. Total - by volume

∿3,000,000 gallons to the effluent and 3000 gallons to 211-F Waste Treatment Area

(iii) COST OF TECHNIQUE OR PROCESS

a. Cost per gallon

42 cents per gallon diverted to effluent stream

b. Cost per curie of nuclide

Not applicable

(iv) TECHNIQUE OR PROCESS

a. Type

One catch tank and one hold tank with sampling, pumping, and diversion capabilities *b.* *Size*

One 250-gallon catch tank and one 23,750-gallon hold tank

c. *Capacity*

-

d. *Construction material*

Carbon steel tanks

e. *Construction cost (1973 dollars)*

$82,000

f. *Operating cost - annual*

$160,000 (labor, materials, and services)

g. *Operating cost - total*

Not available

(v) DATES

a. *Date technique or process began*

1964

b. *Date technique or process ended*

-

c. *Is technique or process currently in use?*

Yes

50. DESCRIPTION

a. Name

Heavy Water Rework Distillation Waste

b. Identification No.

420-D

c. Location

400-D

d. Purpose

To control rate of discharge of distillation waste so that concentrations of tritium (^3H) in the effluent stream do not exceed controlled area concentration guides.

e. Technique or process used

Hold, analyze, and meter into an uncontaminated cooling water stream discharged to the effluent stream.

f. Reference to Figure No. and letter

Figure 7 - (b)

(i) TYPES OF WASTE

a. Source

Distillate from the Heavy Water Rework Distillation process

b. Nuclides generally present

Tritium (^3H)

c. Concentrations

Tritium concentration varies but does not exceed 0.1 Ci/m^3 after dilution with cooling water.

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

1972 - (420-D only): 6140 Ci ^3H

b. *Total - by nuclide*
See page 50-78

c. *Annual - by volume*
12,400 average

d. *Total - by volume*
186,000 gallons

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*
Not applicable (see note at (iv))

b. *Cost per curie of nuclide*
Not applicable (see note at (iv))

(iv) TECHNIQUE OR PROCESS

a. *Type*

b. *Size*

c. *Capacity*

d. *Construction material*

e. *Construction cost (1973 dollars)*

f. *Operating cost - annual*
$10,000 for analysis of samples

g. *Operating cost - total*

These questions are not applicable as the rework facilities are operated for process considerations.

(v) DATES

a. *Date technique or process began*
December 1957

b. *Date technique or process ended*

c. *Is technique or process currently in use?*
Yes

50. DESCRIPTION

a. Name

772-D Laboratory Waste Solutions

b. Identification No.

772-D

c. Location

400-D Area

d. Purpose

To collect laboratory samples containing greater than 2% heavy water for processing in the heavy water rework distillation area.

e. Technique or process used

Laboratory samples are segregated by heavy water and chemical content and stored in drums for rework. Samples with heavy water concentrations that cannot be economicallly reprocessed are poured into sink drains which discharge into the effluent stream with uncontaminated cooling water as a diluent.

f. Reference to Figure No. and letter

Figure 7 - (c)

(i) TYPES OF WASTE

a. Source

Analytical laboratory samples

b. Nuclides generally present

Tritium (^3H) and trace of activation and fission products.

c. Concentrations

(ii) AMOUNTS OF WASTE

a. Annual - by nuclide

1972 (772-D only): 930 Ci ^3H

Other activities - see 420-D

b. *Total - by nuclide*

See 420-D

c. *Annual - by volume*

Not available

d. *Total - by volume*

Not available

(iii) COST OF TECHNIQUE OR PROCESS

a. *Cost per gallon*

nil

b. *Cost per curie of nuclide*

nil

(iv) TECHNIQUE OR PROCESS

a. *Type*

b. *Size*

c. *Capacity*

d. *Construction material*

e. *Construction cost (1973 dollars)*

f. *Operating cost - annual*

g. *Operating cost - total*

These questions are not applicable as the segregation of samples is for process considerations.

(v) DATES

a. *Date technique or process began*

1952

b. *Date technique or process ended*

c. *Is technique or process currently in use?*

Yes