WSRC-RP--90-386

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WESTINGHOUSE SAVANNAH RIVER COMPANY
SAVANNAH RIVER LABORATORY DIVISION

April 9, 1990

DEC 0 3 1990

TO: C.B. Shedrow, WSRC/EPS, 773-42A

FROM: W.L. Marter, WSRC/SRL, 773-42A W L Marter
L.R. Bauer, WSRC/SRL, 773-A L R Bauer

DEFENSE WASTE PROCESSING FACILITY (DWPF) ENVIRONMENTAL DOSIMETRY DATA (U)

The original Environmental Impact Statement for the DWPF was issued in 1982. Since that time, estimated releases of radioactivity to the environment have changed because of changes in the DWPF process. In addition, the methodology for calculating offsite doses from routine releases has changed. In anticipation of a potential supplement to the 1982 EIS, current dosimetry methodology has been used to estimate offsite doses from the current as-constructed estimate of radioactivity releases. Offsite doses have also been calculated for the radioactivity release data published in the 1982 EIS using current dosimetry methodology. The two data sets may therefore be used to compare the estimated original and current impacts.

This memorandum documents the results of the offsite dose calculations for routine operation of the DWPF. Also included is a brief description of methodology and parameters used in the calculations.

Questions or comments about the enclosures may be directed to W.L. Marter (803-725-5205) or to L.R. Bauer (803-725-3280).

DISTRIBUTION:

WSRC
1-10. C.B. Shedrow, 773-42A
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17. W.L. Marter, 773-42A
18. J.S. Haselow, 773-42A
19. J.B. Gladden, 773-42A
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DWPF POTENTIAL SEIS
ENVIRONMENTAL DOSIMETRY DATA SPECIFICATIONS

Source Terms

Dose estimates for the 1982 Record of Decision alternative were based on atmospheric and liquid release limits reported in the Final EIS for "Stage 1/Stage 2 coupled operation" (DOE 1982). Current ("1990") atmospheric source terms were based on FY 1988 reactor operational parameters and a radionuclide blend of 5- and 15-year-out-of-the-reactor waste for the insoluble and soluble fractions, respectively. This approach provides the best approximation of the waste the DWPF will process and is consistent with the NESHAPS permit application for the facility. The 1990 source terms do not include liquid effluent release rates because no direct-to-stream discharges from the DWPF are anticipated.

Dosimetry Methodology

Offsite radiological impacts for both generations of source terms were calculated using current i.e., ICRP 30 methodology. The codes used to generate the dose estimates, and the site- and release-specific data used as input to the codes, are identified in the attachments. A more detailed description of the operational characteristics of the dose codes can be found in Reference Du Pont 1986.

Description of Attachments

1. Identification of changes in code input between FEIS and SEIS
2. Summary of doses for 1982 and 1990 source terms
3. 1990 Release Locations
4. 1990 Source Terms - H Area
5. 1990 Source Terms - S Area
6. 1990 Source Terms - Z Area
7. Dose Data - 1990 Atmospheric releases
8. 1982 Release Locations
9. 1982 Source Terms - Atmospheric releases
10. 1982 Source Terms - Liquid releases
11. Dose Data - 1982 Atmospheric releases
12. Dose Data - 1982 Liquid releases

Prepared by:

L.R. Bauer, WSRC/SRL

Technical Review by:

W.L. Marter, WSRC/SRL

REFERENCES

DOE 1982. Final Environmental Impact Statement Defense Waste Processing Facility Savannah River Plant Aiken, SC, U.S. Department of Energy, Washington, D.C., DOE/EIS-0082, February 1982.

DOE 1988a. External Dose-Rate Conversion Factors for Calculation of Dose to the Public, U.S. Department of Energy, Washington, D.C., DOE/EH-0070, July 1988.

DOE 1988b. Internal Dose Conversion Factors for Calculation of Dose to the Public, U.S. Department of Energy, Washington, D.C., DOE/EH-0071, July 1988.

Du Pont 1981a. Environmental Information Document Defense Waste Processing Facility, E.I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC, DPST-80-249, July 1981.

Du Pont 1981b. Environmental Information Document Defense Waste Processing Facility Staged Operations, E.I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC, DPST-80-249-Supplement, November 1981.

Du Pont 1986. Technical Manual Environmental Risk Assessment, E.I. du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC, DPSTM-86-700-1, April 1986.

ORNL 1986. A Methodology for Calculating Radiation Doses from Radioactivity Released to the Environment, Oak Ridge National Laboratory, Oak Ridge, TN, ORNL-4992, March 1976.

WSRC 1989. Environmental Information Document Reactor Operation Volume III, Westinghouse Savannah River Company, Savannah River Laboratory, Aiken, SC, WSRC-RP-89-817, December 1989.

DISCLAIMER

ATTACHMENTS

DWPF ENVIRONMENTAL DOSIMETRY
Code Specifications
Site and Population Characteristics

	1982 Data (a)	1990 Changes (b)
Atmospheric Releases		
Dose factors	ICRP 2	DOE/ICRP 30
Dose codes		
Maximum individual	AIRDOS-EPA	MAXIGASP
Offsite population	AIRDOS-EPA	POPGASP
80-km Population	781,000	852,000
% Adults	67.9	100
% Teens	10.8	
% Children	21.3	
Liquid Releases		
Dose factors	ICRP 2	DOE/ICRP 30
Dose codes		
Maximum individual	ORNL 1986	LADTAP II
At-risk populations	ORNL 1986	LADTAP II
River flow rate, avg cfs	10,000	
River dilution in estuary	Factor of 3	
Transit time, hr		
DWPF to river	24	
SRS to WTPs	72	
Water treatment time, hr	24	
Aquatic food harvest, kg/yr		
Fish - sport	90,700	
Fish - commercial	31,800	
Salt water invertebrates	299,000	
Shore width factor	0.2	
Population sizes		
Beaufort-Jasper	40,300	117,000
Port Wentworth	29,200	200,000
80-km radius	781,000	852,000
Age distribution, A/T/C		
Beaufort-Jasper	69/10/21	100/0/0
Port Wentworth	100/0/0	100/0/0
80-km radius	68/11/21	100/0/0

(a) Based on DPST-80-249 projected averages for years 1990-2020.
(b) Based on projected values for the Year 2000 (developed for the Continued Reactor Operation EID).

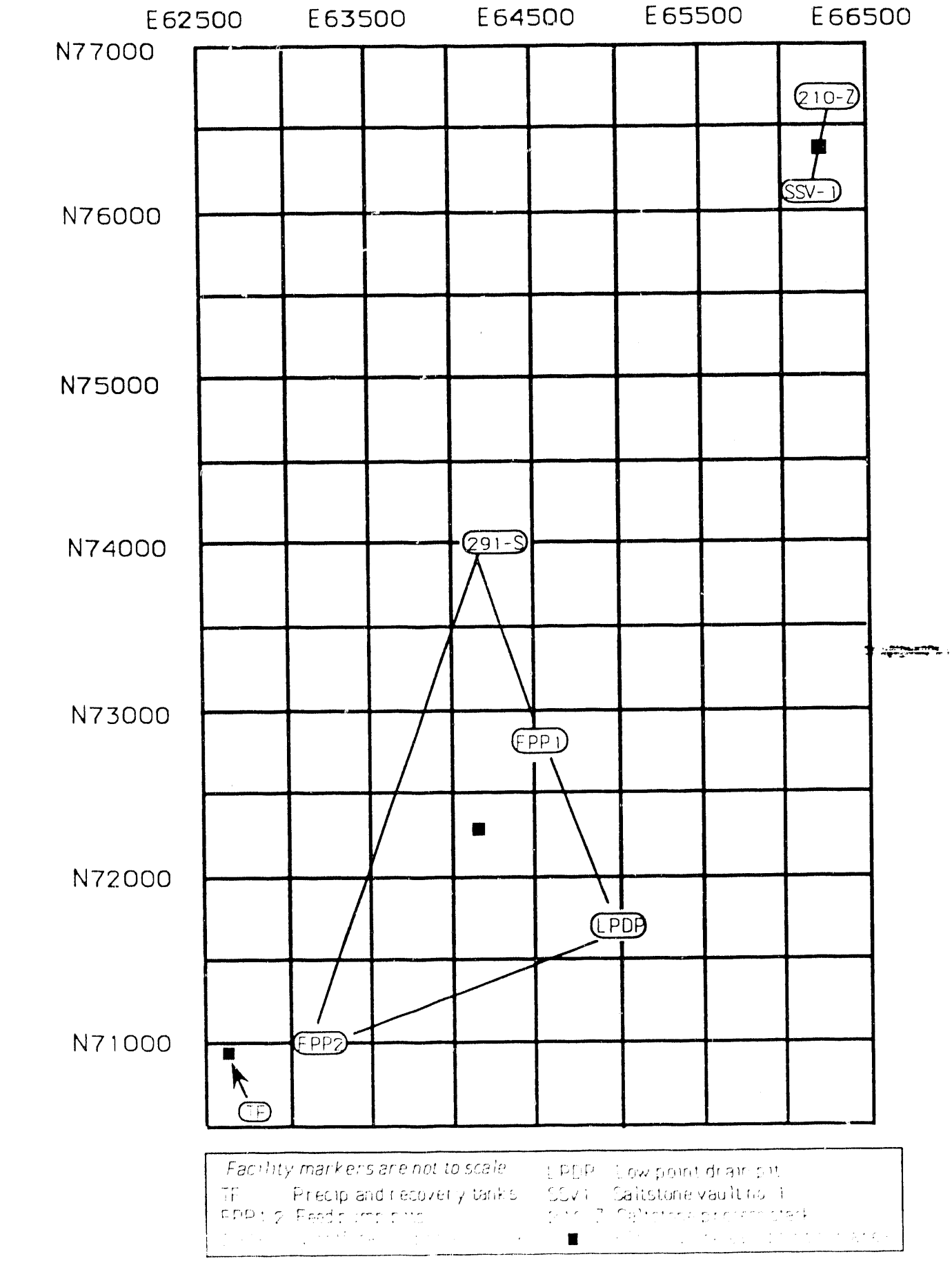
4/4/90

Dosimetric Impact of DWPF Operating Releases
Summary Data for DWPF SEIS

	1982 ROD Alternative	1990 Status	% Change
Annual EDE to the Maximum Individual, mrem			
Atmospheric releases	1.94E-03	7.82E-04	-60
Liquid releases	2.40E-03	(a)	N/A
TOTAL	4.34E-03	7.82E-04	-82
Annual EDC to the Offsite Population, person-rem			
Atmospheric releases	6.29E-02	3.80E-02	-40
Liquid releases	7.03E-01	(a)	N/A
TOTAL	7.66E-01	3.80E-02	-95

(a) No direct-to-stream effluents from routine DWPF operations.

DWPF Release Locations
1990 Status



Facility markers are not to scale

TF Precip and recovery tanks

LPDP Low point drain pit

SSV-1 Saltstone vault no. 1

DWPF OPERATING RELEASES - 1990 ESTIMATES 3/22/90

Annual Atmospheric H-Area Releases, Ci

	Tanks 48 & 49	Tank 50	H-Area Total
Stack Ht. (ft)	25	25	25
Coord-E	62670	62605	62640
Coord-N	70960	70820	70890
Nuclide			
H-3	1.70E+00	1.36E+00	3.06E+00
C-14	3.56E-14	6.81E-13	7.17E-13
Co-60	5.90E-09	2.04E-11	5.92E-09
Se-79	6.75E-12	3.41E-11	4.09E-11
Sr-90	7.18E-06	6.81E-11	7.18E-06
Y-90	7.42E-06	6.81E-11	7.42E-06
Tc-99	1.25E-09	3.41E-09	4.66E-09
Ru-106	5.65E-10	3.41E-09	3.98E-09
Rh-106	5.67E-10	3.41E-09	3.98E-09
Sn-126	4.14E-09	1.36E-11	4.15E-09
Sb-125	2.70E-07	6.81E-10	2.71E-07
Sb-126m	4.14E-09	1.36E-11	4.15E-09
Te-125m	3.87E-12	2.04E-11	2.43E-11
I-129	2.72E-15	2.04E-11	2.04E-11
Cs-134	2.99E-06	6.81E-12	2.99E-06
Cs-135	1.51E-09	4.08E-15	1.51E-09
Cs-137	6.48E-04	2.04E-09	6.48E-04
Ba-137m	6.19E-04	2.04E-09	6.19E-04
Ce-144	9.20E-11	3.41E-13	9.23E-11
Pr-144	9.23E-11	3.41E-13	9.26E-11
Pr-144m	1.10E-12	3.41E-15	1.10E-12
Pm-147	1.18E-07	4.09E-10	1.18E-07
Sm-151	5.44E-08	2.04E-10	5.46E-08
Eu-152	2.11E-10	6.13E-13	2.12E-10
Eu-154	2.47E-08	6.81E-11	2.48E-08
Eu-155	9.97E-09	3.41E-11	1.00E-08
Pu-238	2.75E-07	4.77E-12	2.75E-07
Pu-239	2.59E-09	4.77E-14	2.59E-09
Pu-240	1.75E-09	3.41E-14	1.75E-09
Pu-241	2.09E-07	3.41E-12	2.09E-07
Am-241	4.32E-09	1.36E-11	4.33E-09
Cm-244	2.16E-08	6.81E-14	2.16E-08

DWPF OPERATING RELEASES - 1990 ESTIMATES 3/22/90

Annual Atmospheric S-Area Releases, Ci

	Feed Pump Pits				Vit BLDG	
	Routine Releases	Process Upsets	Total	Low Point Drain Pit	Process Stack (291-S)	S-Area Total
Stack Ht. (ft)			53	13	145	-
Coord-E			63850	65040	64335	64175
Coord-N			71900	71670	74000	72250
Nuclide						
H-3	2.12E-01	6.03E-05	2.12E-01	3.71E-01	5.84E+00	6.42E+00
C-14					2.12E-02	2.12E-02
Co-60	1.78E-09	2.10E-10	1.99E-09	2.73E-11	5.15E-08	5.35E-08
Se-79	2.01E-12	4.32E-13	2.44E-12	4.09E-11	6.18E-09	6.22E-09
Sr-90	1.63E-06	5.78E-08	1.69E-06	9.55E-11	1.40E-05	1.57E-05
Y-90	1.63E-06	5.94E-08	1.69E-06	9.55E-11	1.45E-05	1.62E-05
Tc-99	2.69E-10	7.95E-12	2.77E-10	4.09E-09	1.12E-07	1.16E-07
Ru-106	8.00E-09	3.32E-09	1.13E-08	4.09E-09	3.15E-05	3.15E-05
Rh-106	8.03E-09	3.33E-09	1.14E-08	4.09E-09	3.15E-05	3.15E-05
Sn-126	8.54E-10	1.17E-12	8.55E-10	2.72E-11	1.33E-10	1.02E-09
Sb-125	5.84E-08	1.08E-09	5.95E-08	1.23E-09	2.58E-07	3.19E-07
Sb-126m	8.54E-10	1.02E-12	8.55E-10	2.72E-11	1.34E-10	1.02E-09
Te-125m	1.01E-09	7.01E-10	1.71E-09	2.72E-11	1.00E-05	1.00E-05
Te-127	4.41E-13	3.05E-13	7.46E-13		4.37E-09	4.37E-09
Te-127m	4.49E-13	3.10E-13	7.59E-13		4.46E-09	4.46E-09
I-129	6.10E-16	3.73E-16	9.83E-16	2.72E-11	8.19E-05	8.19E-05
Cs-134	6.16E-07	1.69E-09	6.18E-07	1.26E-11	2.56E-05	2.62E-05
Cs-135	3.11E-10	5.72E-13	3.12E-10		7.55E-09	7.86E-09
Cs-137	1.34E-04	2.48E-07	1.34E-04	2.72E-09	3.29E-03	3.42E-03
Ba-137m	1.28E-04	2.36E-07	1.28E-04	2.72E-09	3.15E-03	3.28E-03
Ce-144	3.45E-08	1.22E-08	4.67E-08		2.99E-06	3.04E-06
Pr-144	3.45E-08	1.22E-08	4.67E-08		3.00E-06	3.05E-06
Pr-144m	4.10E-10	1.44E-10	5.54E-10		3.59E-08	3.65E-08
Pm-147	1.09E-07	2.98E-08	1.39E-07	5.46E-10	7.33E-06	7.47E-06
Sm-151	1.20E-08	3.12E-10	1.23E-08	2.72E-10	7.51E-08	8.77E-08
Eu-152	5.25E-11	4.57E-12	5.71E-11		1.12E-09	1.18E-09
Eu-154	7.24E-09	7.67E-10	8.01E-09	1.36E-10	1.88E-07	1.96E-07
Eu-155	3.71E-09	5.88E-10	4.30E-09	4.09E-11	1.44E-07	1.48E-07
Pu-238	6.19E-08	1.87E-09	6.38E-08	6.80E-12	4.50E-07	5.14E-07
Pu-239	5.79E-10	1.63E-11	5.95E-10	6.80E-14	3.91E-09	4.51E-09
Pu-240	3.89E-10	1.09E-11	4.00E-10	6.31E-13	2.63E-09	3.03E-09
Pu-241	4.86E-08	2.07E-09	5.07E-08	8.39E-11	5.06E-07	5.57E-07
Am-241	9.28E-10	1.40E-11	9.42E-10	8.81E-16	3.34E-09	4.28E-09
Cm-244	4.82E-09	1.35E-10	4.96E-09		4.95E-11	5.00E-09

DWPF OPERATING RELEASES - 1990 ESTIMATES 3/22/90

Annual Atmospheric Z-Area Releases, Ci

	Saltstone Process Stack (210-Z)	Saltstone Vault No. 1	Z-Area Total
Stack Ht. (ft)	41	15	GL (a)
Coord-E	66310	66200	66255
Coord-N	76620	76052	76340
Nuclide			
H-3	4.60E-01	2.10E+01	2.15E+01
Co-60	1.73E-09		1.73E-09
Se-79	2.58E-09		2.58E-09
Sr-90	6.04E-09		6.04E-09
Y-90	6.04E-09		6.04E-09
Tc-99	2.58E-07		2.58E-07
Ru-106	2.58E-07		2.58E-07
Rh-106	2.58E-07		2.58E-07
Sn-126	1.72E-09		1.72E-09
Sb-125	7.75E-08		7.75E-08
Sb-126m	1.72E-09		1.72E-09
Te-125m	1.72E-09		1.72E-09
I-129	1.72E-09		1.72E-09
Cs-134	7.97E-10		7.97E-10
Cs-137	1.72E-07		1.72E-07
Ba-137m	1.72E-07		1.72E-07
Pm-147	3.44E-08		3.44E-08
Sm-151	1.72E-08		1.72E-08
Eu-154	8.62E-09		8.62E-09
Eu-155	2.58E-09		2.58E-09
Pu-238	4.31E-10		4.31E-10
Pu-239	4.31E-12		4.31E-12
Pu-240	3.99E-11		3.99E-11
Pu-241	5.30E-09		5.30E-09
Am-241	5.56E-14		5.56E-14

(a) GL = Treated as a ground-level release.

3/26/90

DWPF Operating Releases to the Atmosphere
SEIS Data for the 1990 Source Terms

Maximum Individual Dose, mrem

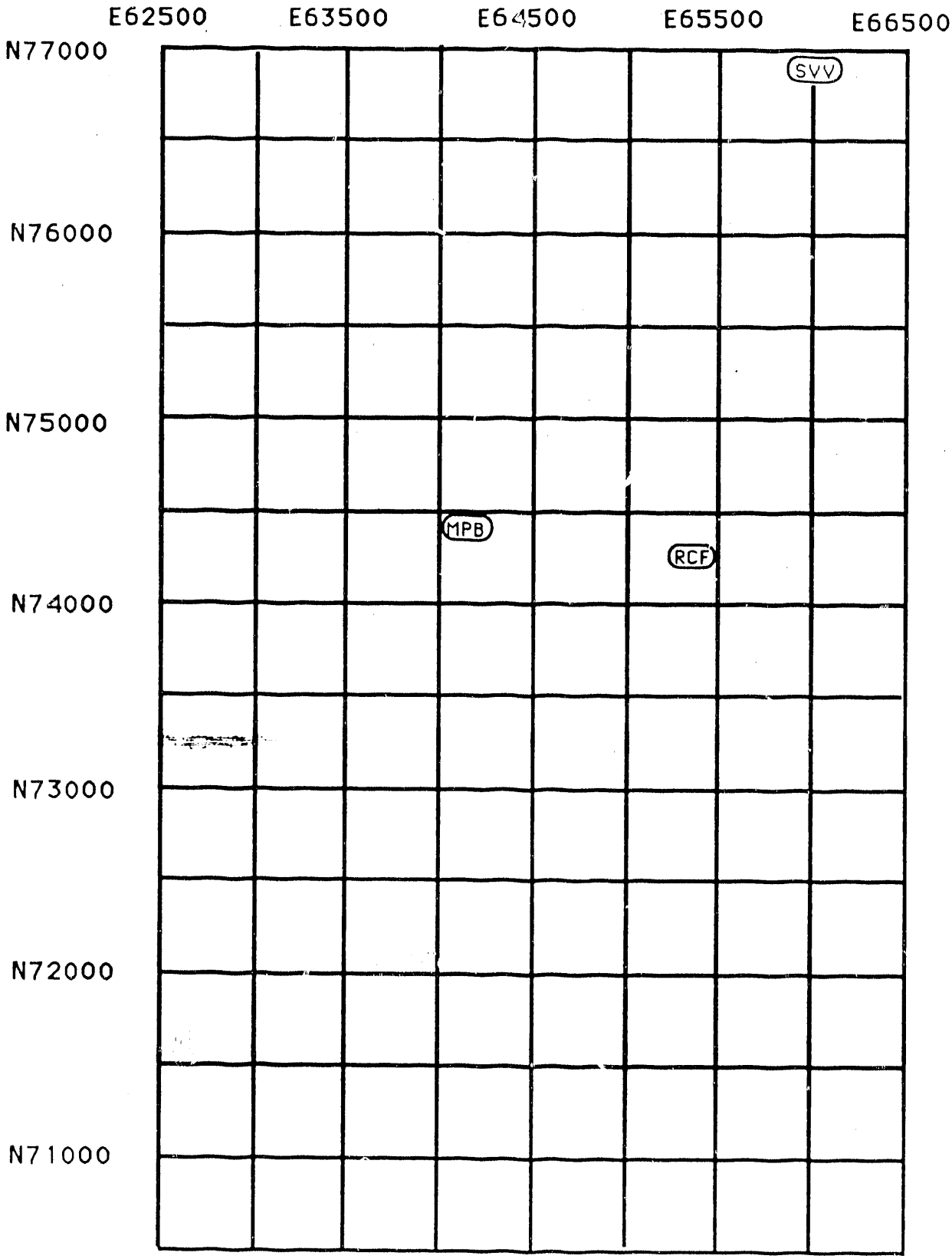
Release Location	EDE	GI-LLI	BONE MARROW	LIVER	BONE SURFACE	THYROID	LUNG	SKIN
H-Area Tanks	8.59E-05	8.45E-05	8.94E-05	4.67E-05	1.32E-04	8.08E-05	8.15E-05	4.22E-05
S Area	6.07E-04	5.06E-04	4.58E-04	1.88E-04	5.33E-04	5.30E-03	4.42E-04	2.21E-04
Z Area	8.95E-05	8.98E-05	8.94E-05	8.95E-05	8.95E-05	8.96E-05	8.94E-05	8.94E-05
Total	7.82E-04	6.80E-04	6.37E-04	3.24E-04	7.55E-04	5.47E-03	6.13E-04	3.53E-04

80-km Population Dose, person-rem

Release Location	EDE	GI-LLI	BONE MARROW	LIVER	BONE SURFACE	THYROID	LUNG	SKIN
H-Area Tanks	5.26E-03	5.19E-03	5.37E-03	4.38E-03	7.03E-03	5.10E-03	5.13E-03	4.63E-03
S Area	3.10E-02	2.87E-02	2.74E-02	2.12E-02	3.05E-02	1.45E-01	2.70E-02	2.45E-02
Z Area	1.76E-03	1.77E-03	1.76E-03	1.76E-03	1.76E-03	1.76E-03	1.76E-03	1.76E-03
Total	3.80E-02	3.57E-02	3.45E-02	2.73E-02	3.93E-02	1.52E-01	3.39E-02	3.09E-02

SRS North

DWPF Release Locations
1982 Status



Facility markers are not to scale.

RCF Regulated Chemical Facility vent

MPB Main Process Bldg stacks

SVV Saltcrete vessel vent

DWPF OPERATING RELEASES - FINAL EIS (FEB 1982) 3/29/90

Annual Atmospheric Releases, Ci

Stage 1 / Stage 2 Coupled Alternative (a)

	Sand Filter Stack	Regulated Chemical Facility	Saltcrete Plant	Total
Stack Ht. (ft)	140	Ground Level	Ground Level	-
Coord-E	64020	65395	66000	-
Coord-N	74440	74270	76295	-
Nuclide				
H-3	5.4E+00	2.3E+00	2.3E+00	1.0E+01
Co-60	1.2E-05	2.7E-10	3.5E-10	1.2E-05
Sr-90	2.1E-03	3.5E-10	3.8E-10	2.1E-03
Y-90	2.1E-03	3.5E-10	3.8E-10	4.2E-03
Tc-99	3.6E-07	1.4E-08	1.9E-08	3.9E-07
Ru-106	3.0E-04	9.2E-09	1.2E-08	3.0E-04
Rh-106	3.0E-04	9.2E-09	1.2E-08	3.0E-04
Sb-125	5.9E-05	3.9E-09	5.1E-09	5.9E-05
Te-125m	2.8E-05	4.8E-09	6.2E-09	2.8E-05
I-129	4.2E-04	4.4E-11	5.7E-11	4.2E-04
Cs-134	1.0E-05	7.4E-11	9.7E-11	1.0E-05
Cs-137	2.1E-03	1.6E-08	2.0E-08	2.1E-03
Ce-144	6.9E-04	9.3E-11	1.2E-10	6.9E-04
Pr-144	6.9E-04	9.3E-11	1.2E-10	6.9E-04
Pm-147	1.7E-03	1.0E-07	1.3E-07	1.7E-03
Sm-151	1.7E-05	1.3E-08	1.7E-08	1.7E-05
Eu-154	4.4E-05	1.6E-09	2.1E-09	4.4E-05
Eu-155	3.5E-05	6.8E-10	9.0E-10	3.5E-05
Pu-238	5.3E-05	2.6E-11	3.4E-11	5.3E-05
Pu-241	5.9E-05	2.0E-11	2.6E-11	5.9E-05

(a) Location and source term data based on DPST-80-249 (Jul 1981), a supplement to that EID (Nov 1982), and the Final EIS DOE/EIS-0082 (Feb 1982).

DWPF OPERATING RELEASES - FINAL EIS (FEB 1982) 3/28/90

Annual Liquid Releases, Ci

Stage 1 / Stage 2 Coupled Alternative

Nuclide	Waste Tank Farm Evaporator Releases to the Savannah River
H-3	8.5E+02
Sr-90	2.3E-05
Y-90	2.3E-05
Tc-99	4.6E-09
Ru-106	3.0E-09
Rh-106	3.0E-09
Sb-125	1.3E-09
Te-125m	1.5E-09
I-129	1.4E-11
Cs-134	2.4E-11
Cs-137	5.1E-09
Ba-137m	4.8E-09
Ce-144	3.0E-11
Pr-144	3.0E-11
Pm-147	3.3E-08
Sm-151	4.1E-09

Max discharge rate = 11 L/min.

3/29/90

DWPF Operating Releases to the Atmosphere
SEIS Data for the 1982 Staged Operations Alternative (Coupled Source Terms)

Maximum Individual Dose, mrem

Release Location	EDE	GI-LLI	BONE MARROW	LIVER	BONE SURFACE	THYROID	LUNG	SKIN
Sand Filter Building	1.92E-03	9.54E-04	2.68E-03	1.78E-03	1.15E-02	2.73E-02	4.71E-04	1.46E-04
Regulated Chemical Facility	8.70E-06	8.71E-06	8.70E-06	8.70E-06	8.70E-06	8.70E-06	8.70E-06	8.70E-06
Saltcrete Plant	9.77E-06	9.79E-06	9.77E-06	9.77E-06	9.77E-06	9.77E-06	9.77E-06	9.77E-06
Total	1.94E-03	9.73E-04	2.70E-03	1.80E-03	1.15E-02	2.73E-02	4.89E-04	1.64E-04

80-km Population Dose, person-rem

Release Location	EDE	GI-LLI	BONE MARROW	LIVER	BONE SURFACE	THYROID	LUNG	SKIN
Sand Filter Building	6.25E-02	3.42E-02	8.30E-02	8.20E-02	4.02E-01	6.23E-01	2.94E-02	1.61E-02
Regulated Chemical Facility	1.88E-04	1.89E-04	1.88E-04	1.88E-04	1.88E-04	1.88E-04	1.88E-04	1.88E-04
Saltcrete Plant	1.88E-04	1.89E-04	1.88E-04	1.88E-04	1.88E-04	1.88E-04	1.88E-04	1.80E-04
Total	6.29E-02	3.46E-02	8.34E-02	8.24E-02	4.02E-01	6.23E-01	2.98E-02	1.65E-02

3/30/90

DWPF Operating Releases to the Savannah River
SEIS Data for the 1982 Source Terms (Coupled Stage 1 / 2 Alternative)

Maximum Individual Dose, mrem

Exposure Pathway	SKIN	BONE MARROW	LIVER	EDE	THYROID	BONE SURFACE	LUNG	GI-LLI
Fish		1.85E-04	1.84E-04	1.84E-04	1.84E-04	1.84E-04	1.84E-04	1.84E-04
Drinking water		2.22E-03	2.22E-03	2.22E-03	2.22E-03	2.22E-03	2.22E-03	2.22E-03
Shoreline activities	3.97E-12	3.32E-12	3.32E-12	3.32E-12	3.32E-12	3.32E-12	3.32E-12	3.32E-12
Swimming		2.80E-13	2.80E-13	2.80E-13	2.80E-13	2.80E-13	2.80E-13	2.80E-13
Boating	0.00E+00	8.41E-13	8.41E-13	8.41E-13	8.41E-13	8.41E-13	8.41E-13	8.41E-13
Total	3.97E-12	2.41E-03	2.40E-03	2.40E-03	2.40E-03	2.40E-03	2.40E-03	2.40E-03

Downstream Population Doses, person-rem

Exposure Pathway	SKIN	BONE MARROW	LIVER	EDE	THYROID	BONE SURFACE	LUNG	GI-LLI
80-km Population								
Sport fish		4.85E-04	4.80E-04	4.81E-04	4.80E-04	4.91E-04	4.80E-04	4.80E-04
Commercial fish		3.71E-05	3.68E-05	3.68E-05	3.68E-05	3.76E-05	3.68E-05	3.68E-05
Recreational activity	2.15E-11			2.15E-11	2.15E-11			
Beaufort-Jasper		2.59E-01	2.59E-01	2.59E-01	2.59E-01	2.59E-01	2.59E-01	2.59E-01
Port Wentworth		4.43E-01	4.43E-01	4.43E-01	4.43E-01	4.43E-01	4.43E-01	4.43E-01
Salt water invertebrates		1.14E-06	1.13E-06	1.14E-06	1.13E-06	1.15E-06	1.13E-06	1.14E-06
Total	2.15E-11	7.03E-01	7.03E-01	7.03E-01	7.03E-01	7.03E-01	7.03E-01	7.03E-01

END

DATE FILMED

01/03/91