Surface Water Modeling Using an EPA Computer Code for Tritiated Waste Water Discharge from the heavy Water Facility

by

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DOE Contract No. **DE-AC09-96SR18500**

WSRC-TR-98-00230 (U)

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Publication Date: June 1998

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This document was prepared in connection with work done under Contract No. DE-AC09-96SR18500 with the U. S. Department of Energy

DISCLAIMER

DOCUMENT: WSRC-TR-98-00230

TITLE: Surface Water Modeling Using an EPA Computer Code for Tritiated Waste Water Discharges from the Heavy Water Facility (U)

TASK:

TECHNICAL REVIEW

[redacted]

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ABSTRACT

Tritium releases from the D-Area Heavy Water Facilities to the Savannah River have been analyzed. The U.S. EPA WASP5 computer code was used to simulate surface water transport for tritium releases from the D-Area Drum Wash, Rework, and DW facilities. The WASP5 model was qualified with the 1993 tritium measurements at U.S. Highway 301. At the maximum tritiated waste water concentrations, the calculated tritium concentration in the Savannah River at U.S. Highway 301 due to concurrent releases from D-Area Heavy Water Facilities varies from 5.9 to 18.0 pCi/ml as a function of the operation conditions of these facilities. The calculated concentration becomes the lowest when the batch releases method for the Drum Wash Waste Tanks is adopted.

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1. SUMMARY

Tritium releases from the D-Area Heavy Water Facilities to the Savannah River have been analyzed. The U.S. EPA WASP5 computer code was used to simulate surface water transport for tritium releases from the D-Area Drum Wash, Rework, and DW facilities. The WASP5 model was qualified with the 1993 tritium measurements at U.S. Highway 301.

At the maximum tritiated waste water concentrations, the calculated tritium concentration in the Savannah River at U.S. Highway 301 due to concurrent releases from D-Area Heavy Water Facilities varies from 5.9 to 18.0 pCi/ml as a function of the operation conditions of these facilities. The calculated concentration becomes the lowest when the batch releases method for the Drum Wash Waste Tanks is adopted.

2. INTRODUCTION

The limits for tritiated waste water batch releases from D-Area Heavy Water facilities are based on predicted tritium concentrations in Savannah River at the U.S. Highway 301 bridge [1,2]. The bases for these limits need to be re-evaluated for the following reasons:

i. The assumptions for aqueous release periods and tritium concentrations used to develop the limits are inconsistent with actual conditions.

ii. Identification of release points is inconsistent within Reference [2].

iii. The limits are based on a single worst-case release scenario from four SRS facilities. There are total curie limits for individual releases but there was no evaluation for locations that have frequent releases nor are there explicit limits placed on discharge intervals.

The existing limits, as they are currently applied, could prevent concurrent operation of the Heavy Water Rework (RW), DuPont Water (DW) and Drum Washing facilities. The Environmental Compliance group of EXFAC & RFS Division has requested ETS/SRTC to reevaluate the limits bases using validated modeling techniques [3]. Table 1 [3] lists the specified input conditions for this evaluation.

3. WASP5 MODEL

River Geometry

WASP5 [4] was used to model both the Savannah River and Beaver Dam Creek systems.

WASP5 is a computer code developed by the EPA to model stream/river systems and to provide predictions of pollutant concentrations and water qualities in surface water systems.

Figure 1 shows the computer model for the Savannah River. This model extends from River Mile 168 (about 16.2 river miles upstream from the confluence with Beaver Dam Creek) to River Mile 16 (about 13 river miles downstream from Port Wentworth). To provide adequate detail for prediction of transient releases, the river was divided into 489 segments with a segment length of 500 m (0.31 mile). An average cross-section of 139 m^2 (1500 ft^2) was used for the river model.

Figure 2 shows the model for Beaver Dam Creek. This model covers a distance of 5.54 km (3.44 miles), starting above the D-Area outfall and extending to the Savannah River. Beaver Dam Creek was divided into 11 segments with a segment length of 500 m (0.31 mile) and an average cross section of 5.94 m^2 (63.94 ft^2).

4. MODEL QUALIFICATION

The WASP5 model was qualified by comparing predicted tritium concentrations to measured tritium concentrations at U.S. Highway 301, about 20 miles down river from SRS. Tritium concentration measurements were obtained from Reference 5, as described in the following section.

Tritium Concentration Data

The average measured tritium concentration at the U.S. Highway 301 bridge for 1993 was 1.24±0.46 pCi/ml [Table 24 of Reference 5]. The measured tritium concentrations at U.S. Highway 301 include contributions from all upstream tritium releases. This section presents the method used to estimate the tritium concentration that would be measured at U.S. Highway 301 if only the tritium released from D-Area was considered.

Sources of tritium releases in SRS streams and the Savannah River are documented in Reference 5 and listed in Table 2. Table 2 shows that the tritium released from D-Area for 1993 accounted for 499 Ci. The total tritium released to Savannah River including direct releases and migration for 1993 was 12,700 Ci. Thus, D-Area contributed about 3.9% of the total tritium released to Savannah River and detected at U.S. Highway 301. The adjusted tritium concentration is 0.048± 0.018 pCi/ml, which would be measured at U.S. Highway 301 if only the tritium released from the D-Area was counted.

WASP5 Simulations for 1993 Tritium Measurements

WASP5 was used to simulate the surface water transport of tritium released from D-Area

and to calculate the tritium concentration at U.S. Highway 301. The input data required by WASP5 include tritium release rates (Ci/day) from D-Area and the flow rates (m^3/s) of Beaver Dam Creek and the Savannah River. The D-Area release rates (Ci/yr) for 1993 listed in Table 2 were converted to Ci/day. The annual averaged Savannah River flow rate of 12,218.67 ft^3/s (345.99 m^3/s) and the annual averaged Beaver Dam Creek flow of 77.85 ft^3/s (2.20 m^3/s) were obtained from References [6] and [7]. The calculated tritium concentration contributed by D-Area at Highway 301 is 0.045 pCi/ml. The measured tritium concentration contributed by D-Area is 0.048± 0.018 pCi/ml. Thus, the calculated tritium concentration at Highway 301 is within the measurement variation.

5. CALCULATIONS

Eighteen (18) cases, listed in Table 3, were analyzed to simulate individual facility tritiated waste water releases and concurrent releases. Flows used for calculations are 5000 cfs for the Savannah River and 31 cfs for the Beaver Dam Creek. The operation conditions simulated for the facilities are based on the requirements specified by the Technical Assistance Request [3].

Discharge from Drum Wash Waste Tank

Tritiated waste water is released from the Drum Wash Waste Tanks twice per month. The inventory of each of the Drum Wash Tanks is 16000 gallon. Thus, to empty a tank, it takes 3200 minutes for a release rate of 5 gpm and 1600 minutes for a release rate of 10 gpm. The maximum tritium concentration in the waste water is 3.5 μCi/ml and the nominal tritium concentration is 1.25 μCi/ml. Six (6) discharge scenarios were simulated. Results of the computer simulations are tabulated in Table 3 and shown by Figures 3 and 4. The calculations show that the downstream tritium concentrations are proportional to the discharge waste water concentrations. The calculations also show that the calculated Savannah River tritium concentrations depend on the release rate and the release duration. At a release rate of 10 gpm of 3.5 μCi/ml tritiated waste water and a release duration of 1600 minutes, the calculated tritium concentration in the Savannah River at U.S. Highway 301 is 15.5 pCi/ml. This concentration drops to 2.8 pCi/ml when the Drum Wash Waste Tanks release rate is 5 gpm of 1.25 μCi/ml tritiated waste water and the release duration is 3200 minutes.

Discharge from Rework Distillate Tanks

The Rework Distillate Tanks are discharged up to six (6) times per day. The release rate is 10 gpm and the release duration is 13 minutes. The maximum tritium concentration of the waste water is 10 μCi/ml. The nominal tritium concentration of the waste water is less than 5 μCi/ml. Case 7 and 8 simulate Rework Distillate Tanks operating with one

discharge for every four (4) hours for three days. Each discharge lasts for 13 minutes at a release rate of 10 gpm. The only difference between Cases 7 and 8 is the concentration of the tritiated waste water. The concentration of the tritiated waste water for Case 7 is 10 μCi/ml, and for Case 8 is 5 μCi/ml. The calculated peak tritium concentration in Savannah River at US Highway 301 is 2.6 pCi/ml for Case 7, and 1.3 pCi/ml for Case 8, as listed in Table 3 and shown by Figure 5. Figure 5 shows that the calculated concentrations start to decrease after 120 hours. The reason is that the simulation assumes that the Rework Distillate Tanks stop releasing tritiated waste water after day three.

Discharge from DW Facility Distillate Tanks

The DW Facility distillate tanks discharge once per week at a release rate of 25 gpm and a release duration of 63 minutes. The maximum tritium concentration of the discharge waste water is 1.0 μCi/ml and the nominal concentration is less than 1.0 μCi/ml. The calculated peak tritium concentrations in Savannah River at US Highway 301 are 1.1 and 0.57 pCi/ml for tritiated waste water concentrations of 1.0 and 0.5 μCi/ml, respectively, as listed in Table 3 and shown by Figure 6.

Concurrent Releases

Four cases (listed in Table 3) were studied to simulate different combination of concurrent releases from the Drum Wash, Rework and DW facilities. In Cases 11 and 12, all facilities discharge with the maximum tritiated waste water concentration. In Cases 13 and 14, all facilities discharge with a nominal tritiated waste water concentration. Table 3 and Figure 7 list release rates and durations for these cases. The maximum peak concentration for these concurrent release combinations was calculated to be 18.0 pCi/ml for Case 12, and the minimum peak concentration was calculated to be 4.0 pCi/ml for Case 13.

Minimize Downstream Tritium Concentrations

For the D-Area Heavy Water Facilities, the Drum Wash Waste Tanks contribute the most of the downstream tritium concentrations, as shown in Table 3. One can minimize the tritium concentration in the Savannah River at U.S. Highway 301 by modifying the Drum Wash Waste Tanks release procedures. Additional cases simulated assume that the Drum Wash Waste Tanks are operating at a batch release mode. The release of each batch lasts 120 or 240 minutes, and the frequency of release is once per day. Case 5C is a modification of Case 5. Case 5C assumes that the Drum Wash Waste Tanks is in a batch release mode. Each release lasts 240 minutes. The release rate is 5 gpm and the discharge concentration of the tritiated waste water is 3.5 μCi/ml. It will take 14 days to empty the Drum Wash Waste Tank inventory of 16,000 gallon. The calculated peak concentration in the Savannah River at U.S. Highway 301 for Case 5C is 2.9 pCi/ml.

There is a significant reduction in the calculated tritium concentration from Case 5, 7.7 pCi/ml, to Case 5C, 2.9 pCi/ml, as shown in Figure 4 and Table 3. There are only three peaks shown in Figure 4 for Cases 5C. The reason of this is that the batch release of the Drum Wash Waste Tank was simulated for 3 days to show the typical tritium concentration downstream.

Case 6C is a modification of Case 6. The difference between Case 6 and Case 6C is that Case 6 releases twice per month, and each release lasts for 1600 minutes. Case 6C is in a batch mode. Each batch release lasts 120 minutes. It will take 14 days to empty the Drum Wash Waste Tank inventory of 16,000 gallon. The calculated peak concentration in the Savannah River at U.S. Highway 301 for Case 6C is 2.9 pCi/ml. There is a significant reduction in the calculated tritium concentration from Case 6, 15.5 pCi/ml, to Case 6C, 2.9 pCi/ml, as shown in Figure 4 and Table 3. There are only three peaks shown in Figure 4 for Cases 6C. The reason of this is that the batch release of the Drum Wash Waste Tank was simulated for 3 days to show the typical tritium concentration downstream.

For concurrent releases, Case 11C is a modification of Case 11. The difference between Cases 11 and 11C is the release pattern for Drum Wash Waste Tanks. For Case 11, the Drum Wash Waste Tanks release twice per month, and each release lasts for 3200 minutes. For Case 11C, the Drum Wash Waste Tank is in a batch release mode as described in Case 5C. The calculated peak concentration in the Savannah River at U.S. Highway 301 for Case 11C is 5.9 pCi/ml. There is a significant reduction in the calculated tritium concentration from Case 11, 10.3 pCi/ml, to Case 11C, 5.9 pCi/ml, as shown in Figure 8.

Case 12C is a modification of Case 12. The difference between Cases 12 and 12C is the release pattern for Drum Wash Waste Tanks. For Case 12, the Drum Wash Waste Tanks release twice per month, and each release lasts for 3200 minutes. For Case 12C, the Drum Wash Waste Tanks are in batch release mode as described in Case 6C. The calculated peak concentration in the Savannah River at U.S. Highway 301 for Case 12C is 6.063 pCi/ml. There is a significant reduction in the calculated tritium concentration from Case 12, 18.0 pCi/ml, to Case 12C, 6.063 pCi/ml, as shown in Figure 8. It will take 14 days for Cases 11C and 12C to empty the Drum Wash Waste Tank inventory of 16,000 gallon. There are only three peaks shown in Figure 8 for Cases 11C and 12C. The reason of this is that the batch release of the Drum Wash Waste Tank was simulated for 3 days to show the typical tritium concentration downstream.

6. CONCLUSIONS

The contributions of the D-Area Heavy Water Facilities tritium releases to the tritium concentration in the Savannah River have been analyzed. The U.S. EPA WASP5 computer code was used to simulate surface water transport for tritium releases from the D-Area Drum Wash, Rework and DW facilities. The WASP5 model was qualified with the 1993 tritium measurements at U.S. Highway 301. At the maximum tritiated waste water concentrations, the calculated tritium concentration in the Savannah River at U.S. Highway 301 due to concurrent releases from D-Area Heavy Water Facilities varies from 5.9 to 18.0 pCi/ml as a function of the operation conditions of these facilities. The calculated concentration becomes the lowest when the batch releases method for the Drum Wash Waste Tanks is adopted.

7. REFERENCES:

1. D. W. Hayes, "Predicted Peak Tritium Concentrations at Highway 301 for Planned Aqueous Releases from SRS Facilities," SRT-ETS-920123, June 6, 1992.

2. "Environmental Release Prevention and Control Plan (ERP&CP)," WSR-92067, June 30, 1992.

3. J. J. Shake, "Technical Assistance Request: Surface Water Modeling Using an EPA Computer Code for Tritiated Water Discharges from the Heavy Water Facility," July 27, 1995.

4. Ambrose, Robert B., Wool, Tim A. and Martin, James L., "The Water Quality Analysis Simulation Program, WASP5, Part A: Model Documentation; Part B: Input Data Set," Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, Georgia, September 20, 1993.

5. Arnett, Margaret W., "Savannah River Site Environmental Data for 1993," WSRC-TR-94-077.

6. "Water Resources Data South Carolina Water Year 1993," U.S. Geological Survey Water-Data Report SC-93-1.

7. "Water Resources Data South Carolina Water Year 1994," U.S. Geological Survey Water-Data Report SC-94-1.

Table 1
Specified Input Conditions

	DW Distillate	RW Distillate	Drum Wash Tank
Capacity (gal)	1565.0	125.0	16000.0
Discharge Rate (gpm)	25.0	10.0	5.0 - 10.0
Max. H^3 Concentration (μCi/ml)	1.0	10.0	3.5
Nominal H^3 Acitivity (μCi/ml)	<1.0	<5.0	1.25
Release Duration (min.)	63.0	13.0	3200.0*
Discharge Frequency (avg.)	1/week	6/day	2/month

* Batch release

Table 2
Estimated Tritium Releases in SRS Streams and the Savannah River

		Direct Releases (Curies)					
Area	Release Point	1988	1989	1990	1991	1992	1993
Reactor							
100–P	Par Pond overflow to Lower-Three Runs Creek	327	(321)[a]	(207)[a]	221	100	64
	*Process sewer to Par Pond		164	67	(43)[a]		
	*Reactor heat exchanger cooling water to Par Pond		464	125	(67)[a]		
	*Combined in 1992 (P019)					(8)[a]	(3)[a]
100–L	L-Lake overflow to Steel Creek	502	(556)[a]	(358)[a]	723	515	650
	*Process sewer to L Lake		24	27	(11)[a]		
	*Reactor heat exchanger coolingwater to L Lake		98	72	(112)[a]		
	*Combined in 1992 (L007)					(58)[a]	(9)[a]
100–K	*Process sewer to Pen Branch	264	100	169	74		
	*Reactor heat exchanger coolingwater to Pen Branch	2,470	112	249	6,470[b]		
	*Combined in 1992 (K-Canal)					126	16
	(K008)					3	
	K-Area secondary effluent				6	3	
100–C	Process Sewer to Four Mile Creek (C-Canal)	11	16	1	13	28	12
	Subtotal	3,570	978	710	7,510	775	742
Separations							
200–F	Effluent to Four Mile Creek	14	8	327	6	5	4
	Effluent to Upper Three Runs		2	0	0	1	1
200–H	Effluent to Four Mile Creek	12	20	22	14	13	12
	Effluent to Upper Three Runs		1	4	5	15	17
	Effluent Treatment Facility	101	2,070	1,200	3,070	1,010	395
	Subtotal	127	3,100	1,550	3,090	1,040	426
400–D	Process sewer to Beaver Dam Creek	1,740	562	358	681	576	499
	Subtotal	1,740	562	358	681	576	499
	Total Direct Releases[c]	**5,440**	**3,640**	**2,620**	**11,300**	**2,390**	**1,670**

a Not used in totals because release was counted elsewhere
b Includes heat exchanger leak of December 22-25, 1991
c Because of rounding, sums of individual columns might not equal totals.

Table 2
Estimated Tritium Releases in SRS Streams and the Savannah River

		Migration (Curies)					
Area	**Release Point**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**
200–F&H	Solid Waste Disposal Facility and H-Area seepage basin to Four Mile Creek	3,670	3,600	4,280	6,420	4,090	5,330
	200–F seepage basin to Four Mile Creek	3,330	4,440	3,570	5,750	4,260	2,180
	200–H seepage basin to Four Mile Creek	3,980	3,310	1,900	1,810	1,470	1,020
100–C	Seepage basin to Four Mile Creek			7			
100–K	904–88G to Indian Grave Branch	2,780	2,220	3,560	2,160	1,530	1,100
100–P	Seepage basin to Steel Creek	133	137	224	(364)[a]	(232)[a]	(382)[a]
	Subtotal	13,900	13,700	13,500	16,100	11,400	9,630
	Total Direct Releases and Migration[b]	**19,300**	**17,300**	**16,100**	**27,400**	**13,800**	**11,300**

		Stream Transport (Curies)					
Area	**Release Point**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**
400–D	Beaver Dam Creek at swamp	2,510	879	756	801	576	499
20–F&H	Four Mile Creek at Road A13	11,200	11,200	9,370	13,300	8,710	9,000
100–K	Pen Branch at Road A	3,220	2,700	2,510	7,100	1,850	1,580
100–L	Steel Creek at Road A	502	556	358	723	515	650
100–P	Lower Three Runs at Road B	327	321	207	221	100	64
ETF	Upper Three Runs at Road A	535	2,160	2,380	4,410	1,300	879
	Total[b]	**18,300**	**17,800**	**15,600**	**26,600**	**13,100**	**12,700**

a Not used in totals because release was counted elsewhere
b Because of rounding, sums of individual columns might not equal totals.

Table 2
Estimated Tritium Releases in SRS Streams and the Savannah River

	River Transport (Curies)					
	1988	1989	1990	1991	1992	1993
Tritium measured in the Savannah River below SRS		17,110	16,570	28,700	16,000	12,600
Tritium measured in the Savannah River above SRS		1,480	2,080	2,420	2,210	433
Tritium measured in the Savannah River below SRS (downriver minus upriver)[a]	**14,600**	**15,600**	**14,490**	**26,300**	**13,800**	**12,200**

a Because of rounding, differences in individual columns might not equal totals.

Table 3
WASP5 Calculations of Peak Tritium Concentrations in the Savannah River at U.S. Highway 301 due to Tritiated Liquid Waste Releases from the D-Area Heavy Water Facilities

Discharge from Drum Wash Waste Tank

Case	H^3 Concentration in the Waste Water µCi/ml	Release			Calculated H^3 at US Hwy 301 pCi/ml
		Rate gpm	Duration min.	Frequency	
1	1.25	5	3200	2/month	2.8
2	1.25	10	1600	2/month	5.5
3	3.4	5	3200	2/month	7.5
4	3.4	10	1600	2/month	15.0
5	3.5	5	3200	2/month	7.7
5C	3.5	5	240	1/day	2.9
6	3.5	10	1600	2/month	15.5
6C	3.5	10	120	1/day	2.9

Discharge from Rework Distillate Tank

Case	H^3 Concentration in the Waste Water µCi/ml	Release			Calculated H^3 at US Hwy 301 pCi/ml
		Rate gpm	Duration min.	Frequency	
7	10	10	13	6/day	2.6
8	5	10	13	6/day	1.3

Discharge from DW Distillate Tank

Case	H^3 Concentration in the Waste Water µCi/ml	Release			Calculated H^3 at US Hwy 301 pCi/ml
		Rate gpm	Duration min.	Frequency	
9	1	25	63	1/week	1.1
10	0.5	25	63	1/week	0.57

Table 3 (Cont'd)
WASP5 Calculations of Peak Tritium Concentrations in the Savannah River at U.S. Highway 301 due to Tritiated Liquid Waste Releases from the D-Area Heavy Water Facilities

Concurrent Discharge from Drum Wash, Rework and DW Facilities

	H^3 Concentration in the Waste Water µCi/ml	Release Rate gpm	Release Duration min.	Release Frequency	
Case 11					
Rework	10	10	13	6/day	
Drum Wash	3.5	5	3200	2/month	
DW	1.0	25	63	1/week	
Calculated H^3 Concentration at US HWY 301 (pCi/ml)					10.3
Case 11C					
Rework	10	10	13	6/day	
Drum Wash	3.5	5	240	1/day	
DW	1.0	25	63	1/week	
Calculated H^3 Concentration at US HWY 301 (pCi/ml)					5.9
Case 12					
Rework	10	10	13	6/day	
Drum Wash	3.5	10	1600	2/month	
DW	1.0	25	63	1/week	
Calculated H^3 Concentration at US HWY 301 (pCi/ml)					18.0
Case 12C					
Rework	10	10	13	6/day	
Drum Wash	3.5	10	120	1/day	
DW	1.0	25	63	1/week	
Calculated H^3 Concentration at US HWY 301 (pCi/ml)					5.9
Case 13					
Rework	5	10	13	6/day	
Drum Wash	1.25	5	3200	2/month	
DW	0.5	25	63	1/week	
Calculated H^3 Concentration at US HWY 301 (pCi/ml)					4.0
Case 14					
Rework	5	10	13	6/day	
Drum Wash	1.25	10	1600	2/month	
DW	0.5	25	63	1/week	
Calculated H^3 Concentration at US HWY 301 (pCi/ml)					6.8

Figure 1
Savannah River

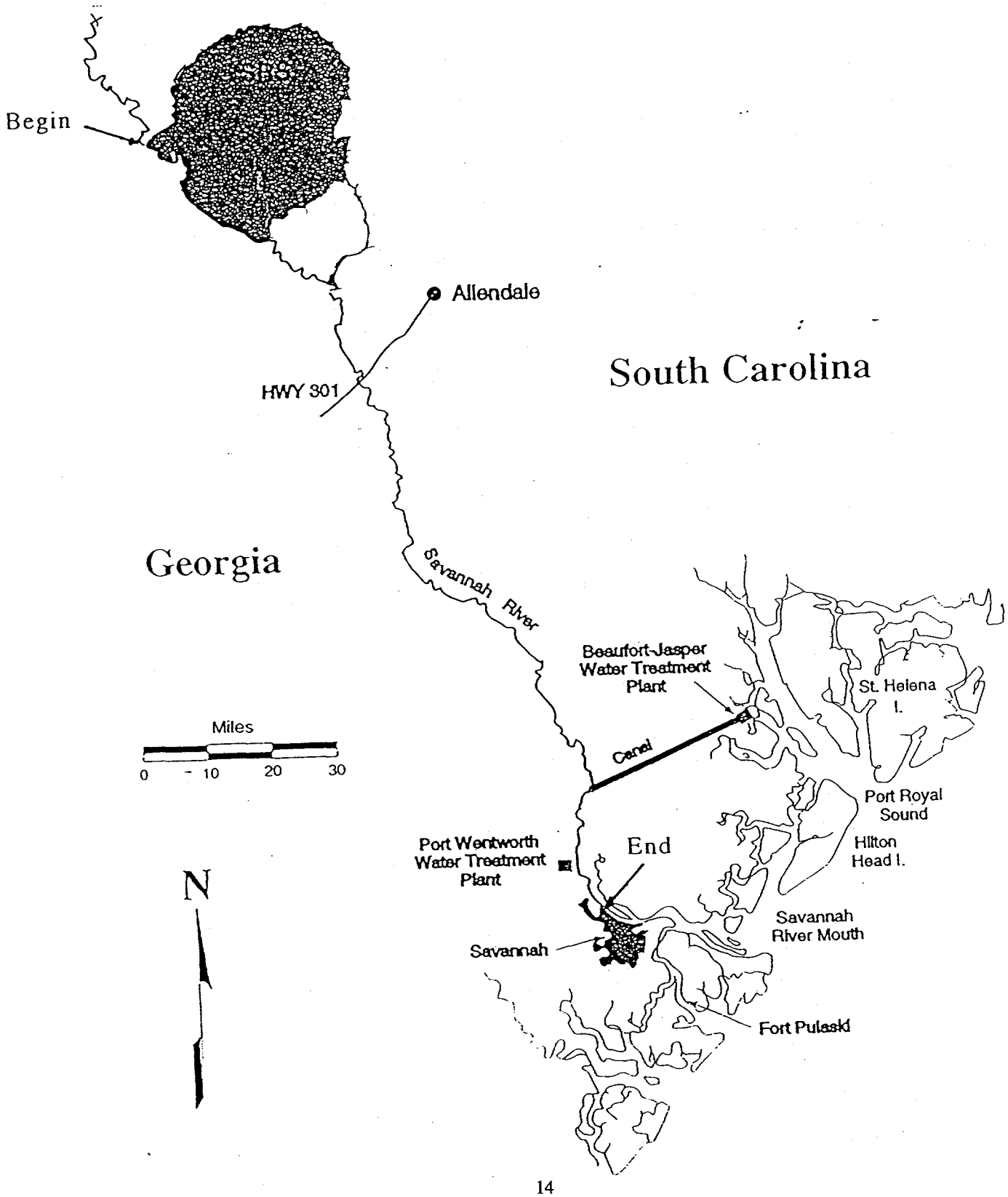


Figure 2
Beaver Dam Creek

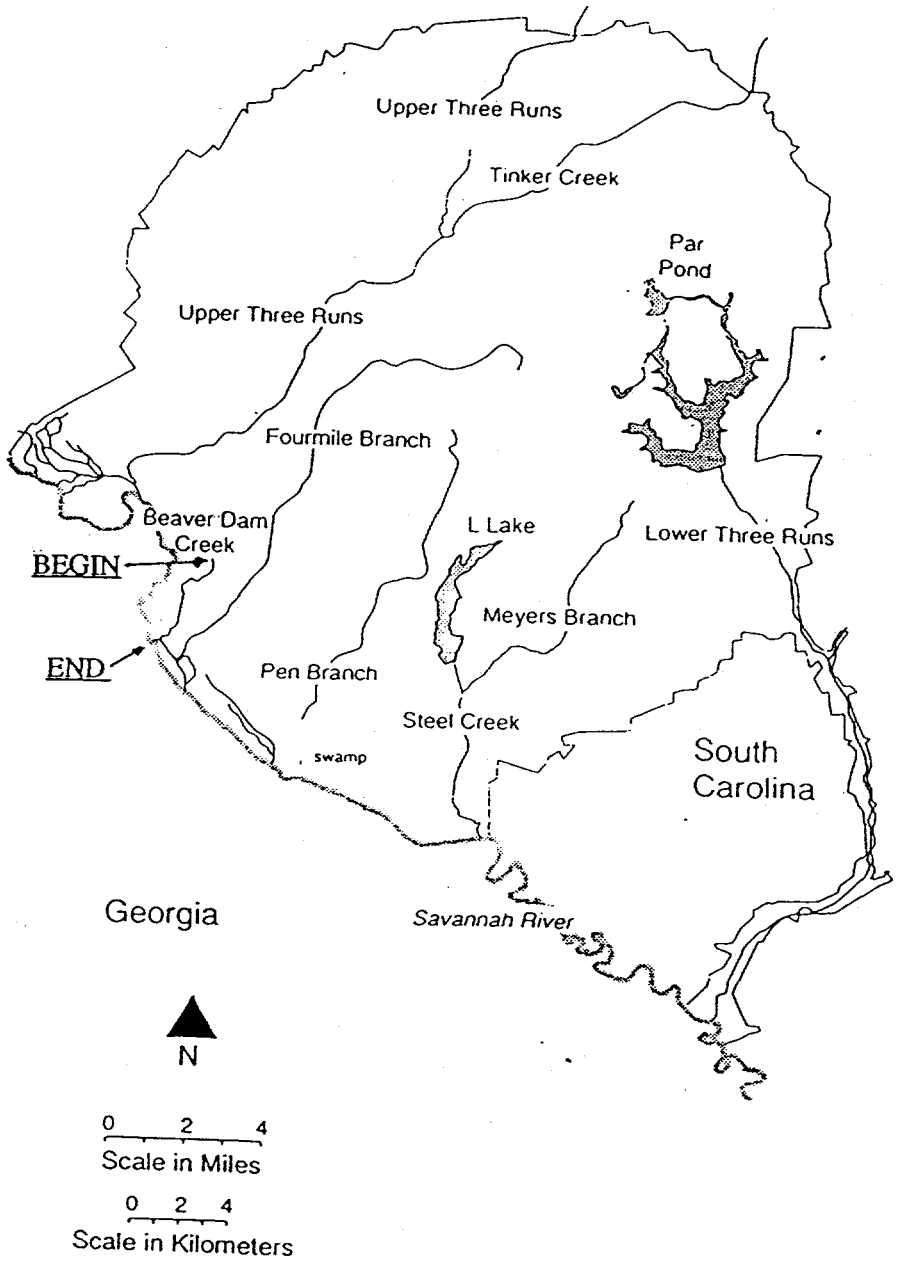


Figure 3
WASP5 Calculations of Tritium Concentrations in the Savannah River at U.S. Highway 301, due to D-Area Drum Wash Waste Tanks Releases

Case	H^3 Concentration in the Waste Water µCi/ml	Release		
		Rate gpm	Duration min.	Frequency
1	1.25	5	3200	2/month
2	1.25	10	1600	2/month
3	3.4	5	3200	2/month
4	3.4	10	1600	2/month

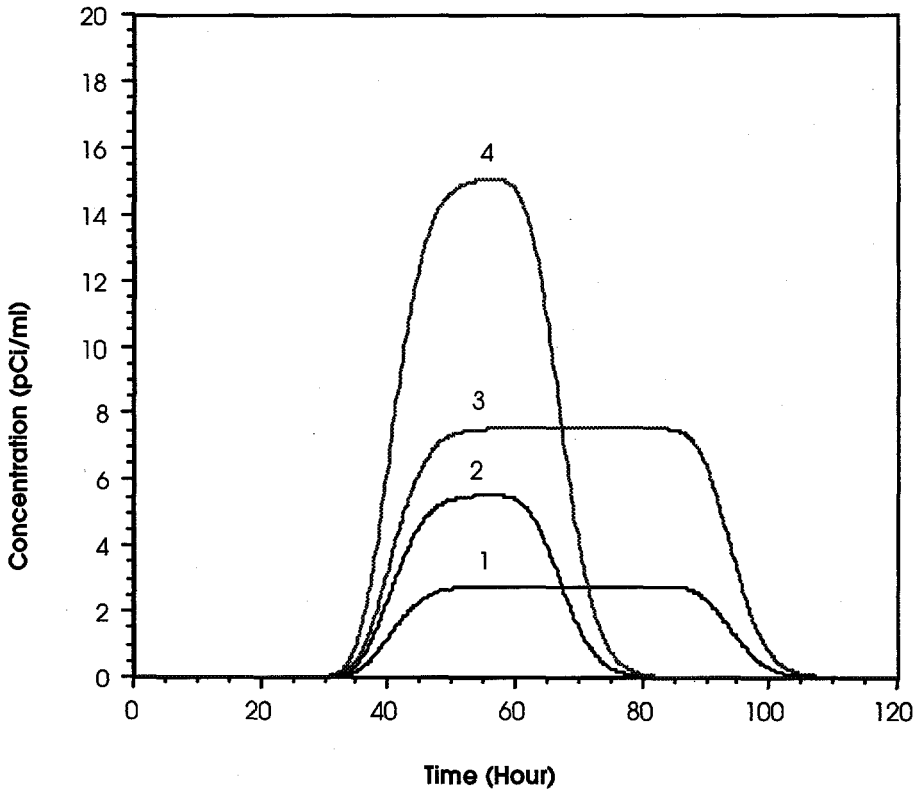


Figure 4
WASP5 Calculations of Tritium Concentrations in the Savannah River at U.S. Highway 301 due to D-Area Drum Wash Waste Tanks Releases

Case	H^3 Concentration in the Waste Water µCi/ml	Release		
		Rate gpm	Duration min.	Frequency
5	3.5	5	3200	2/month
5C	3.5	5	240	1/day
6	3.5	10	1600	2/month
6C	3.5	10	120	1/day

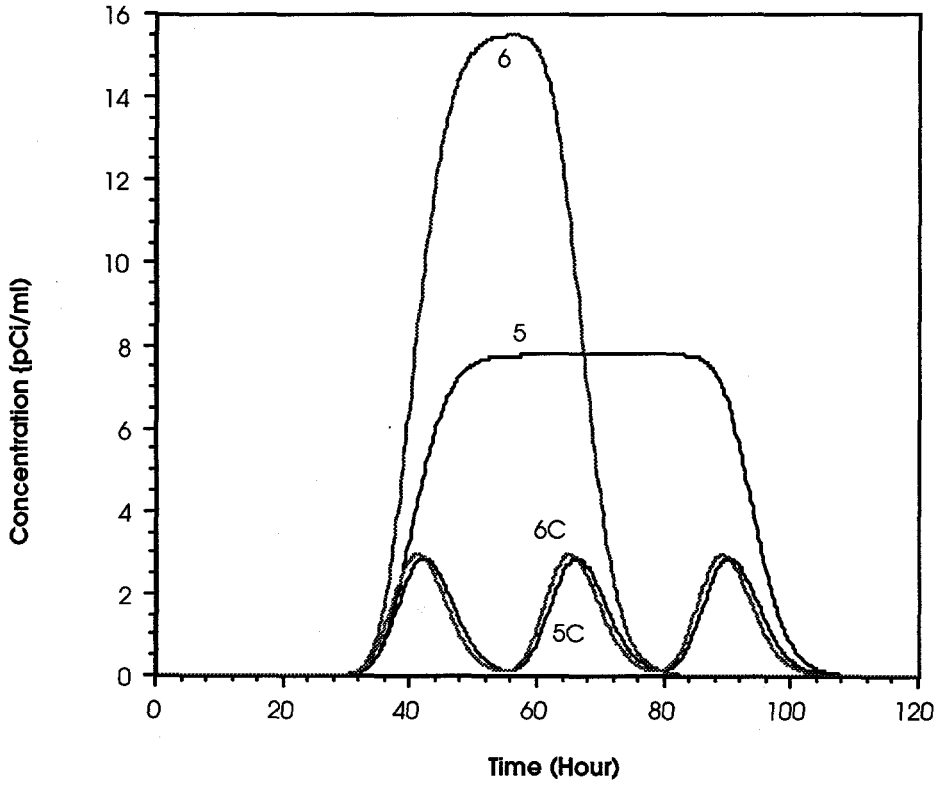


Figure 5
WASP5 Calculations of Tritium Concentrations in the Savannah River at U.S. Highway 301 due to D-Area Rework Distillate Tanks Releases

Case	H^3 Concentration in the Waste Water µCi/ml	Release		
		Rate gpm	Duration min.	Frequency
7	10	10	13	6/day
8	5	10	13	6/day

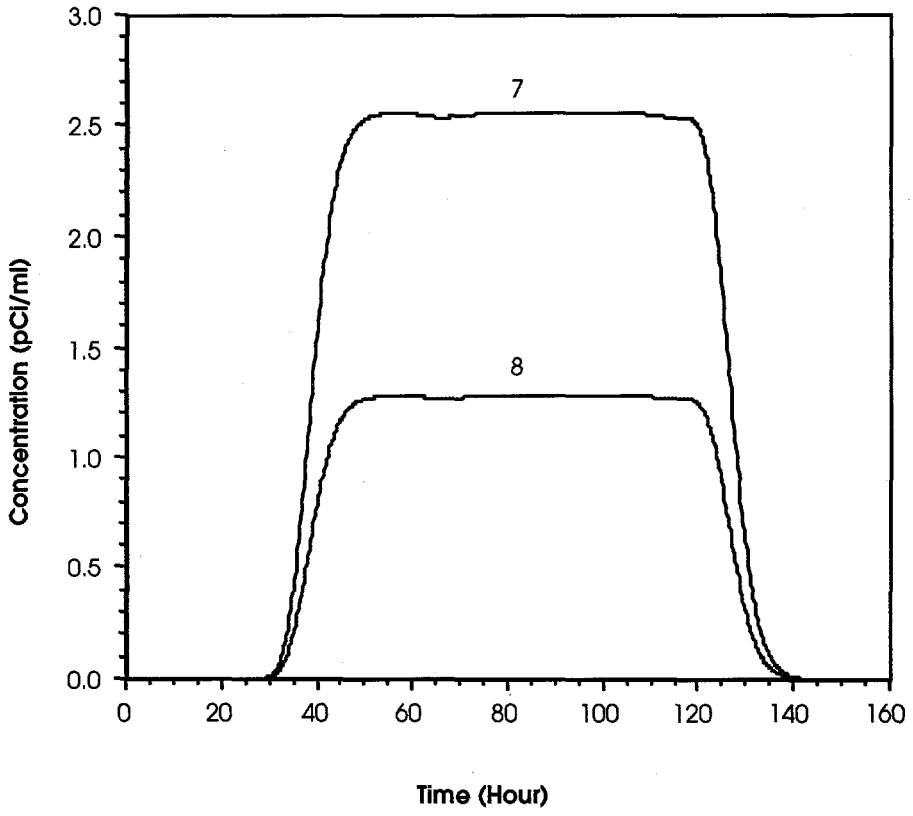


Figure 6
WASP5 Calculations of Tritium Concentrations in the Savannah River at U.S. Highway 301 due to D-Area DuPont Water Distillate Tanks Releases

Case	H^3 Concentration in the Waste Water µCi/ml	Release		
		Rate gpm	Duration min.	Frequency
9	1.0	25	63	1/week
10	0.5	25	63	1/week

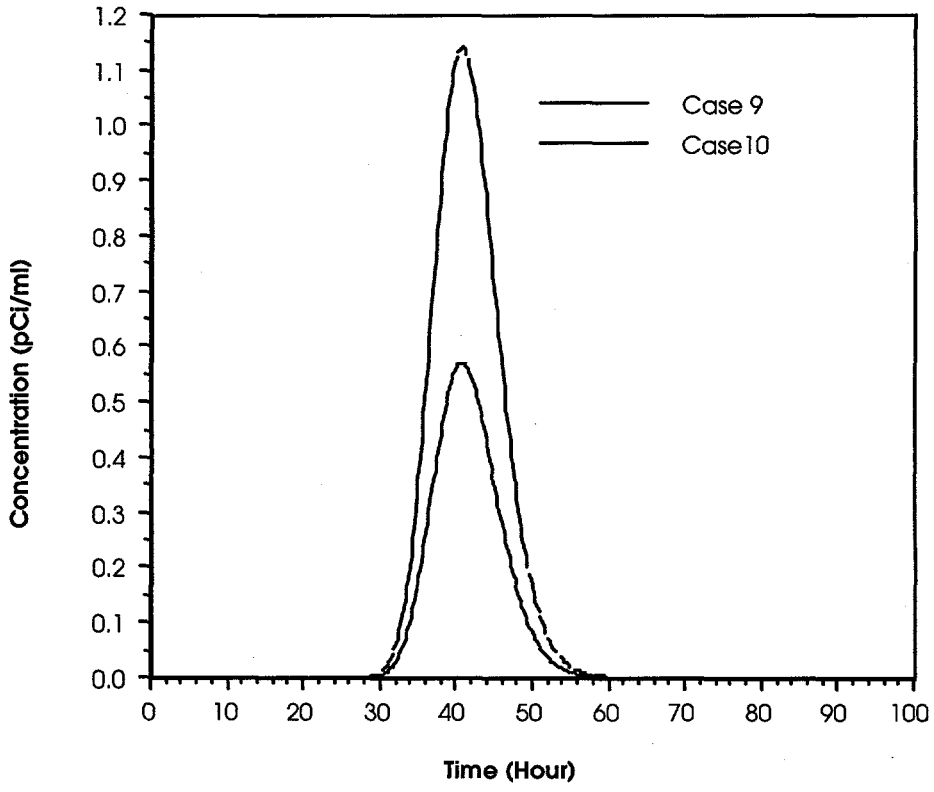


Figure 7
WASP5 Calculations of Tritium Concentrations in the Savannah River at U.S. Highway 301 due to Concurrent Releases from the D-Area Heavy Water Facilities

	H^3 Concentration in the Waste Water µCi/ml	Release Rate gpm	Release Duration min.	Release Frequency
Case 11				
Rework	10	10	13	6/day
Drum Wash	3.5	5	3200	2/month
DW	1.0	25	63	1/week
Case 12				
Rework	10	10	13	6/day
Drum Wash	3.5	10	1600	2/month
DW	1.0	25	63	1/week
Case 13				
Rework	5	10	13	6/day
Drum Wash	1.25	5	3200	2/month
DW	0.5	25	63	1/week
Case 14				
Rework	5	10	13	6/day
Drum Wash	1.25	10	1600	2/month
DW	0.5	25	63	1/week

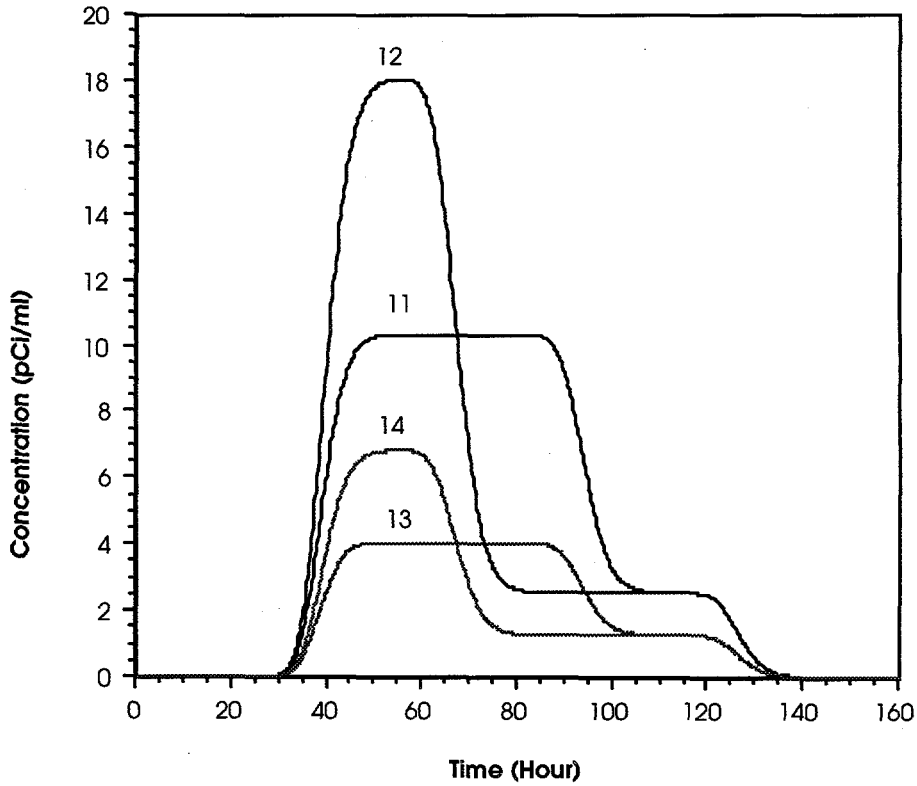
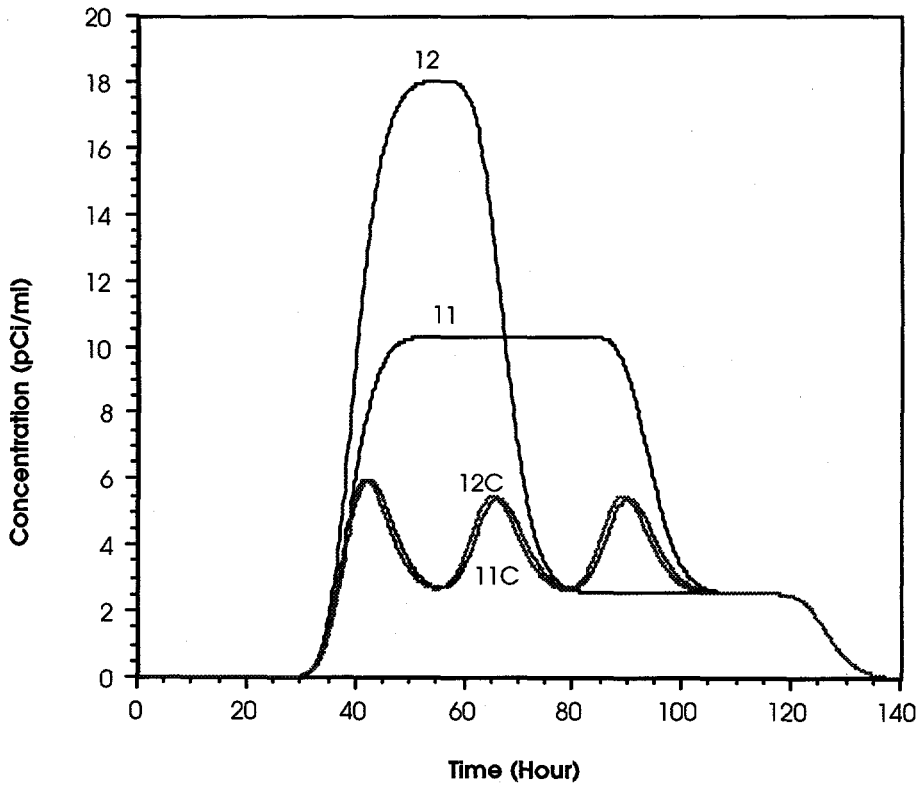


Figure 8
WASP5 Calculations of Tritium Concentrations in the Savannah River at U.S. Highway 301 due to Concurrent Releases from the D-Area Heavy Water Facilities

	H^3 Concentration in the Waste Water µCi/ml	Release Rate gpm	Release Duration min.	Release Frequency
Case 11				
Rework	10	10	13	6/day
Drum Wash	3.5	5	3200	2/month
DW	1.0	25	63	1/week
Case 11C				
Rework	10	10	13	6/day
Drum Wash	3.5	5	240	1/day
DW	1.0	25	63	1/week
Case 12				
Rework	10	10	13	6/day
Drum Wash	3.5	10	1600	2/month
DW	1.0	25	63	1/week
Case 12C				
Rework	10	10	13	6/day
Drum Wash	3.5	10	120	1/day
DW	1.0	25	63	1/week



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