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## **SRS Facility Impacts on Crackerneck Wildlife Management Area**

by

A. Blanchard

Westinghouse Savannah River Company  
Savannah River Site  
Aiken, South Carolina 29808

A. R. Martin

Westinghouse Safety Management Solutions  
SC USA

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# **SRS Facility Impacts on Crackerneck Wildlife Management Area**

November 9, 1999

A. R. Martin

**Westinghouse Safety Management Solutions LLC**  
1993 South Centennial Avenue, SE  
Aiken, SC 29804



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**SRS Facility Impacts on Crackerneck Wildlife Management Area**

November 17, 1999

A. R. Martin

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ADC &  
Reviewing  
Official: *A. R. Martin*  
(Name and Title)

Date: *Nov 19, 1999*

**APPROVALS**

*A. R. Martin*

\_\_\_\_\_  
A. R. Martin, WSMS Author

*11/17/99*

\_\_\_\_\_  
Date

*D. C. Cresci*

\_\_\_\_\_  
D. C. Cresci, WSMS Technical Reviewer

*11/17/99*

\_\_\_\_\_  
Date

*C. E. Shogren*

\_\_\_\_\_  
C. E. Shogren, WSMS Managing Member

*11/17/99*

\_\_\_\_\_  
Date

*D. P. Matthews*

\_\_\_\_\_  
D. P. Matthews, WSRC Emergency Management

*11/18/99*

\_\_\_\_\_  
Date

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**Acronyms**

BDBE	Beyond Design Basis Event
CEDE	Committed Effective Dose Equivalent
CSTF	Concentrate, Storage and Transfer Facility
EMPP	Emergency Management Program Procedure
EP	Emergency Preparedness
EPHA	Emergency Preparedness Hazards Assessment
ERPG	Emergency Response Planning Guideline
PAC	Protective Action Criteria
SRS	Savannah River Site
TEDE	Total Effective Dose Equivalent
WMA	Wildlife Management Area
WPTF	Waste Pre-Treatment Facility

## SUMMARY

Savannah River Site (SRS) facilities that contain hazardous materials have completed the Emergency Preparedness Hazards Assessment (EPHA) process in accordance with Emergency Management Program Procedure (EMPP) 6Q-001 (Ref. 1). The EPHA determines the consequences of releases from these facilities and identifies events that exceed Protective Action Criteria (PAC) at defined receptor locations for areas of interest. One such area of interest is the Crackerneck Wildlife Management Area (WMA). As such, facilities with releases that have the potential to exceed PAC at the Crackerneck WMA have been identified.

## INTRODUCTION

This report documents the consequences of events that have the potential to exceed PAC at the Crackerneck WMA as determined in the respective facility EPHAs. For operational emergencies, the PAC is a personnel radiation exposure level of 1 rem Total Effective Dose Equivalent (TEDE) or toxic chemical concentration (peak 15 minute average) equal to ERPG-2. Although the radiological PAC is defined in terms of TEDE, for EPHA purposes, the Committed Effective Dose Equivalent (CEDE) is considered equivalent to the TEDE.

## INPUT

The Crackerneck WMA is located south of Jackson off SC 125 and is bounded by Upper Three Runs Creek, the Savannah River and the site boundary. Distances to respective areas (Table 1) have been estimated using Site Maps (Ref. 2).

Table 1 Distance to Crackerneck WMA

Area	Distance to Crackerneck (meters)	Area	Distance to Crackerneck (meters)
A	3.49E+03	L	9.12E+03
B	8.05E+02	M	3.76E+03
C	6.17E+03	N	8.05E+03
D	3.22E+03	P	1.50E+04
E	5.63E+03	R	1.50E+04
F	5.90E+03	S	9.39E+03
H	8.85E+03	T	1.34E+03
K	7.51E+03	Z	9.66E+03

All facilities that have completed the EPHA process are listed below. For each facility, releases having the maximum distance to PAC (i.e., the maximum distance from the release at which PAC is exceeded) were identified. These distances were then compared to the estimated distance to Crackerneck WMA in Table 2. All releases were modeled using adverse meteorological conditions. Note that, for TNX, the Emergency Preparedness (EP) Program has been dismantled as the Delphi Demonstration Unit has been shutdown and all hazardous material has been removed from that area (Ref. 3).

Table 2 Identification of Facilities that Exceed PAC

Area	Facility	Tracking #	Distance to Crackerneck	Distance to PAC	Exceeds PAC	Reference
A	SRTC	1-RD-5	3488	900	No	16
B	MHW	2-RD-4B	805	4700	Yes	12
		1-RD-1	805	750	No	12
C	C-Area	1-RD-1	6171	N/A	No	19
D	D-Area	1-RD-1	3220	350	No	4
E	MHW	2-RD-4E	5634	4700	No	12
	E-Area Vaults	5-RD-1	5634	290	No	6
	E-Area Other	1-RD-3	5634	8500	Yes	17
		1-RD-4	5634	5400	No	17
	TRU Pads	2-RD-6	5634	4400	No	20
F	C-Lab	1-RD-1	5902	900	No	15
	F-Sep	1-RD-2.11 & 1-RD-2.15	5902	2000	No	7
	CSTF	G-RD-1	5902	N/A	Yes	18
		1-RD-3c	5902	7000	Yes	18
		1-RD-3a	5902	5800	No	18
H	CSTF/WPTF	G-RD-1	8854	N/A	Yes	18, 9
	CSTF	1-RD-3a	8854	5800	No	18
	H-Sep	4-RD-2.7	8854	6000	No	8
	WPT	1-RD-3 & 2-RD-3	8854	2200	No	9
	RBOF	5-RD-1.1	8854	260	No	14
	Tritium	4-RD-2	8854	3400	No	21
	CIF, SSF, ETF	1-RD-1	8854	530	No	23
K	K-Reactor	4-RD-8	7512	310	No	10
L	L-Reactor	4-RD-8	9122	310	No	10
M	M-Area	3-RD-1	3756	240	No	11
N	MHW	2-RD-4N	8049	4700	No	12
	N-Area	1-RD-1	8049	1100	No	13
P	P-Area	2-RD-1	15024	N/A	No	19
R	R-Area	3-RD-1	15024	870	No	19
S	DWPF	13-RD-5	9390	5000	No	5
T	TNX	None	1341	N/A	N/A	22
Z	Saltstone	none	9659	N/A	No	23

## ANALYSIS

The areas identified in Table 2 that exceed PAC are listed below. Each area was further analyzed to verify that the methodology and assumptions applied reflected current practices and conditions. Table 3 lists the results of the updated analysis.

For B-area, the consequence assessment was updated using ALOHA 5.2 (Ref. 24) and current methodology (i.e., city terrain setting and 300 meter inversion layer). The methodology was also updated for the E-Area HOTSPOT (Ref. 25) consequence assessment. The E-Area and B-Area EPHAs are in revision; therefore source terms and events are susceptible to change.

For CSTF in F-Area, tracking number 1-RD-3c, two distances to PAC are noted. The first (1-RD-3c.1) represents a bounding analysis of Tank 8 slurry operations and corresponds with the current EPHA analysis. In practice, the facility will maintain fill limit requirements on Tank 8 during slurry operations that would result in lower consequences (1-RD-3c.2) as originally determined for Revision 2 of Reference 18. Facility preference was to reanalyze with bounding data as an emergency classification of SAE was maintained without necessitating a reference to limits.

Current conditions for consideration apply to B-Area. Hazardous materials are not currently being stored in B-Area; however, the facility's authorization basis *does* allow for hazardous material storage in this area.

For F-Area CSTF and H-Area CSTF and WPTF, tracking number G-RD-1 represents a qualitative analysis for a Beyond Design Basis Event (BDBE) that results in a tank and berm failure. No specific source term has been generated for this event; hence, distance to PAC cannot be generated.

Table 3 PAC Exceedence

Area	Facility	Tracking #	Source Term (Ci Pu-238 <sub>eq</sub> )	Dose at Crackerneck Boundary (rem)	Distance to Crackerneck (meters)	Distance to PAC (meters)
Radiological						
E	E-Area Other	1-RD-3	4.02E+00	1.60E+00	5634	8000
F	CSTF	G-RD-1	N/A <sup>1</sup>	N/A	5902	N/A
F	CSTF	1-RD-3c.1	3.42E+00	1.20E+00	5902	7000
		1-RD-3c.2	2.24E-01	8.40E-02	5902	1000
H	CSTF/WPTF	G-RD-1	N/A <sup>1</sup>	N/A	8854	N/A
Chemical						
B	MHW	2-RD-4B	0.57 kg/min	0.88 mg/m <sup>3</sup>	805	3200

<sup>1</sup> Qualitative analysis. No source term generated.

## CONCLUSION

Several SRS facilities have the potential to impact Crackerneck WMA. Current conditions in B-Area, if maintained, will not produce the consequences indicated in the EPHA. Furthermore, conservative rather than bounding analysis of F-Area release 1-RD-3c will not exceed PAC at Crackerneck WMA. However, if bounding analysis is applied, PAC is exceeded for a distance of 1100 meters into the WMA. For CSTF and WPTF release G-RD-1, a worst case event could be analyzed to generate distance to PAC. The distance to PAC for release 1-RD-3 in E-Area will exceed PAC for 2370 meters into the WMA. As mentioned earlier, E-Area EPHA is in revision and subject to change.

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## **ATTACHMENT 1**

**ALOHA and HOTSPOT Runs**

**Attachment 1 – ALOHA and HOTSPOT Runs**

B-Area, SW, 2-RD-4B  
Adverse Meteorology

**SITE DATA INFORMATION:**

Location: AIKEN, SOUTH CAROLINA  
Building Air Exchanges Per Hour: 60 (User specified)  
Date and Time: Fixed at June 30, 1997 0000 hours

**CHEMICAL INFORMATION:**

Chemical Name: MERCURY                      Molecular Weight: 200.59 kg/kmol  
TLV-TWA: -unavail-                      IDLH: 0.02 ppm  
Footprint Level of Concern: 0.1 mg/(cu.m)  
Boiling Point: 356.90° C  
Vapor Pressure at Ambient Temperature: 3.33e-006 atm  
Ambient Saturation Concentration: 3.38 ppm or 3.38e-004%

**ATMOSPHERIC INFORMATION: (MANUAL INPUT OF DATA)**

Wind: 1.7 meters/sec from 0° true  
Inversion Height: 300 meters  
Stability Class: E                      Air Temperature: 29° C  
Relative Humidity: 50%                      Ground Roughness: Urban or forest  
Cloud Cover: 0 tenths

**SOURCE STRENGTH INFORMATION:**

Direct Source: 0.5667 kilograms/min  
Source Height: 0  
Release Duration: ALOHA limited the duration to 1 hour  
Release Rate: 567 grams/min  
Total Amount Released: 34.0 kilograms

**FOOTPRINT INFORMATION: (GAUSS SELECTED)**

Dispersion Module: Gaussian  
User specified LOC: 0.1 mg/(cu.m)  
Max Threat Zone for LOC: 3.2 kilometers  
Max Threat Zone for IDLH: 2.1 kilometers

**TIME DEPENDENT INFORMATION:**

Concentration Estimates at the point:  
Downwind: 805 meters  
Off Centerline: 0 meters  
Max Concentration:  
Outdoor: 0.878 mg/(cu.m)

Attachment 1 – ALOHA and HOTSPOT Runs

E-Area, SW, 1-RD-3  
 Adverse Meteorology

HOTSPOT 8.01 GENERAL PLUME 10-28-1999 12:10

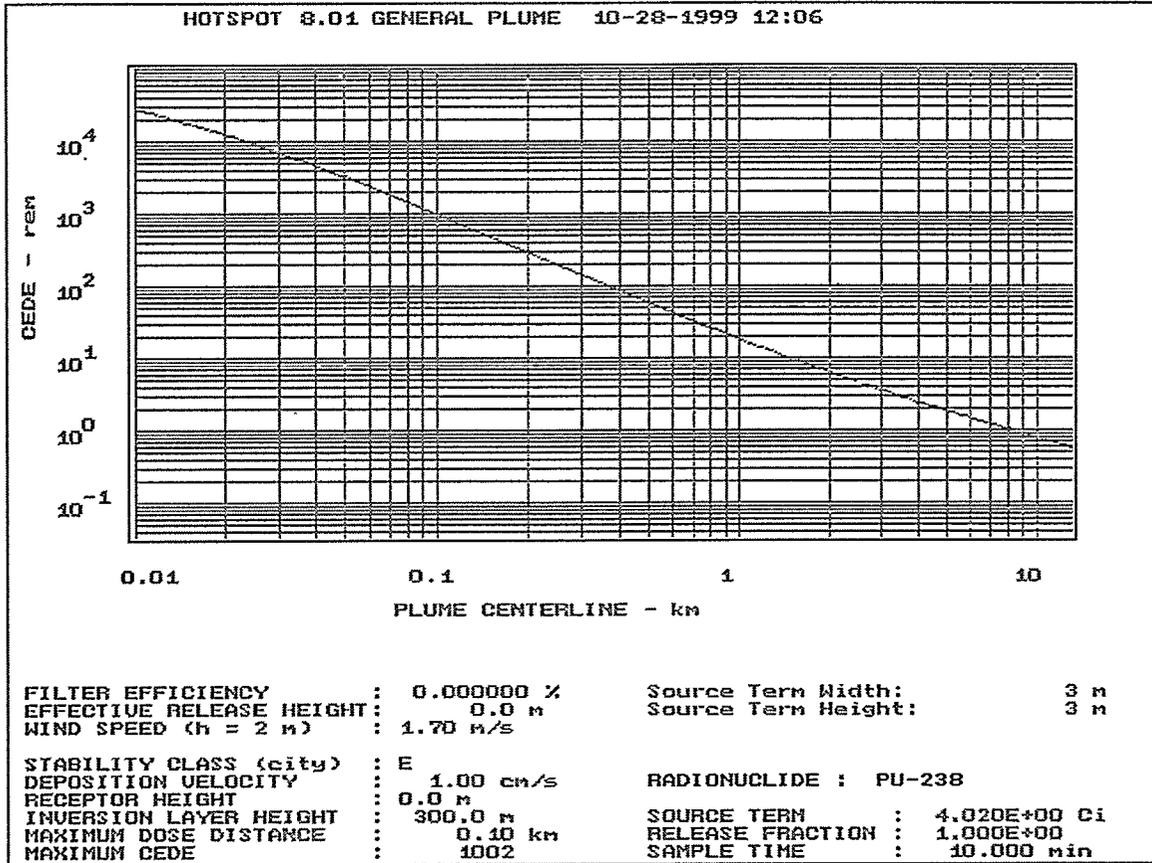
RADIONUCLIDE : PU-238  
 Inhalation Class : W  
 HALFLIFE : 87.740 years  
 SOURCE TERM : 4.020E+00 Ci  
 Source Term Width: 3 m Source Term Height: 3 m  
 RELEASE FRACTION : 1.000E+00  
 FILTER EFFICIENCY: 0.000000 %  
 EFFECTIVE RELEASE HEIGHT : 0.00 m  
 WIND SPEED (h=2 m): 1.7 m/s  
 STABILITY CLASS (city) : E DEPOSITION VELOCITY : 1.00 cm/s  
 RECEPTOR HEIGHT : 0.0 m  
 INVERSION LAYER HEIGHT : 300.0 m  
 SAMPLE TIME : 10.000 min  
 MAXIMUM DOSE DISTANCE : < 0.10 km MAXIMUM CEDE : > 1.0E+03  
 rem

D = 5.600 km  
 DEP = 1.0E-01 uCi/m<sup>2</sup>  
 CHI = 1.0E-05 (Ci-s)/m<sup>3</sup>  
 50-YR DOSE COMMITMENT:

-----  
 SURFACE BONE 2.8E+01 rem  
 RED MARROW 2.3E+00 rem  
 LIVER 6.3E+00 rem  
 GONADS 3.5E-01 rem  
 EFFECTIVE DOSE  
 EQUIVALENT 1.6E+00 rem

Attachment 1 – ALOHA and HOTSPOT Runs

E-Area, SW, 1-RD-3  
Adverse Meteorology



Attachment 1 – ALOHA and HOTSPOT Runs

F-Area, CSTF, 1-RD-3c.1  
 Adverse Meteorology

HOTSPOT 8.01 GENERAL PLUME 10-28-1999 11:35

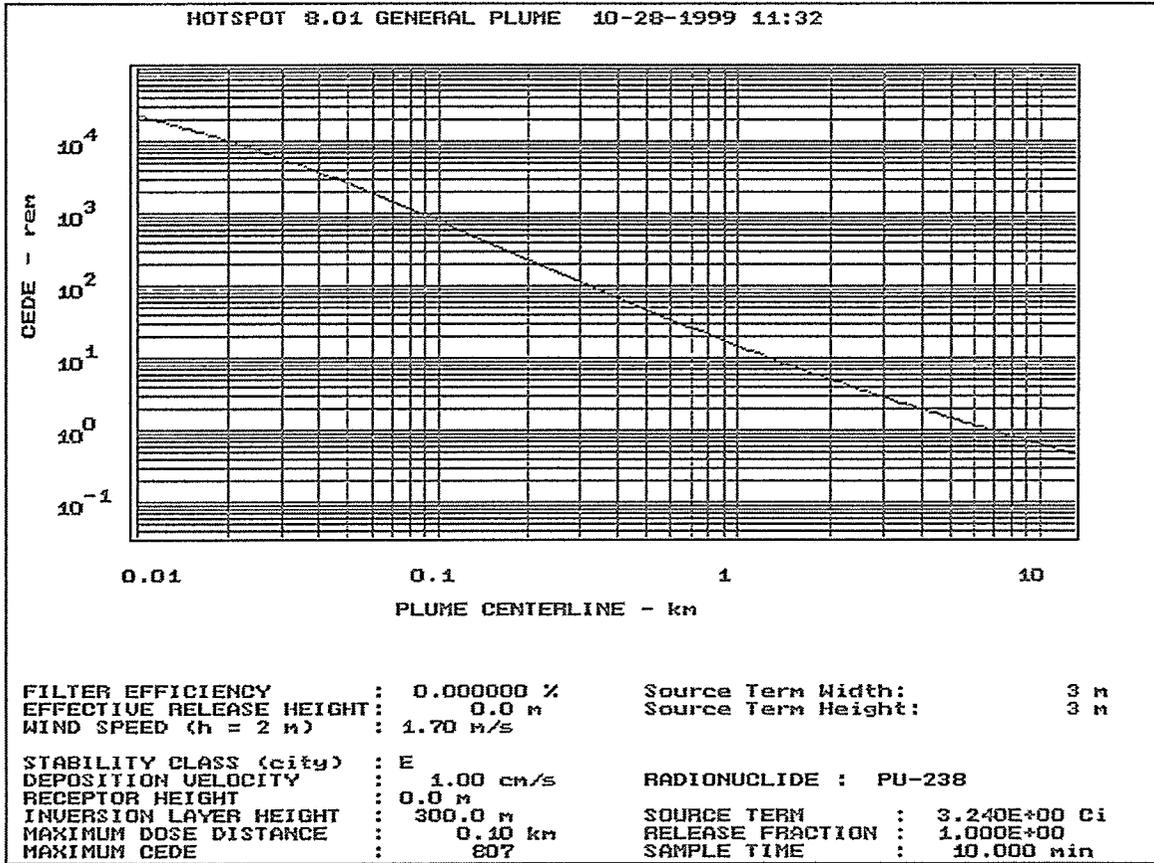
RADIONUCLIDE : PU-238  
 Inhalation Class : W  
 HALFLIFE : 87.740 years  
 SOURCE TERM : 3.240E+00 Ci  
 Source Term Width: 3 m Source Term Height: 3 m  
 RELEASE FRACTION : 1.000E+00  
 FILTER EFFICIENCY: 0.000000 %  
 EFFECTIVE RELEASE HEIGHT : 0.00 m  
 WIND SPEED (h=2 m): 1.7 m/s  
 STABILITY CLASS (city) : E DEPOSITION VELOCITY : 1.00 cm/s  
 RECEPTOR HEIGHT : 0.0 m  
 INVERSION LAYER HEIGHT : 300.0 m  
 SAMPLE TIME : 10.000 min  
 MAXIMUM DOSE DISTANCE : < 0.10 km MAXIMUM CEDE : > 8.1E+02  
 rem

D = 5.900 km  
 DEP = 7.9E-02 uCi/m<sup>2</sup>  
 CHI = 7.9E-06 (Ci-s)/m<sup>3</sup>  
 50-YR DOSE COMMITMENT:

-----  
 SURFACE BONE 2.1E+01 rem  
 RED MARROW 1.8E+00 rem  
 LIVER 4.7E+00 rem  
 GONADS 2.6E-01 rem  
 EFFECTIVE DOSE  
 EQUIVALENT 1.2E+00 rem

Attachment 1 – ALOHA and HOTSPOT Runs

F-Area, CSTF, 1-RD-3c.1  
 Adverse Meteorology



**Attachment 1 – ALOHA and HOTSPOT Runs**

F-Area, CSTF, 1-RD-3c.2  
 Adverse Meteorology

HOTSPOT 8.01 GENERAL PLUME 10-28-1999 11:28

RADIONUCLIDE : PU-238  
 Inhalation Class : W  
 HALFLIFE : 87.740 years  
 SOURCE TERM : 2.240E-01 Ci  
 Source Term Width: 3 m Source Term Height: 3 m  
 RELEASE FRACTION : 1.000E+00  
 FILTER EFFICIENCY: 0.000000 %  
 EFFECTIVE RELEASE HEIGHT : 0.00 m  
 WIND SPEED (h=2 m): 1.7 m/s  
 STABILITY CLASS (city) : E DEPOSITION VELOCITY : 1.00 cm/s  
 RECEPTOR HEIGHT : 0.0 m  
 INVERSION LAYER HEIGHT : 300.0 m  
 SAMPLE TIME : 10.000 min  
 MAXIMUM DOSE DISTANCE : < 0.10 km MAXIMUM CEDE : > 56  
 rem

D = 5.900 km  
 DEP = 5.5E-03 uCi/m<sup>2</sup>  
 CHI = 5.5E-07 (Ci-s)/m<sup>3</sup>  
 50-YR DOSE COMMITMENT:

-----  
 SURFACE BONE 1.5E+00 rem  
 RED MARROW 1.2E-01 rem  
 LIVER 3.3E-01 rem  
 GONADS 1.8E-02 rem  
 EFFECTIVE DOSE  
 EQUIVALENT 8.4E-02 rem

Attachment 1 – ALOHA and HOTSPOT Runs

F-Area, CSTF, 1-RD-3c.2  
 Adverse Meteorology

