C.4.12 Fire in Loadout Bay

This accident involved a diesel fuel fire in the Remote-Handled Waste Facility as a result of a leak in the fuel tank or fuel line of a truck. This fire would involve CH-TRU and remote-handled transuranic (RH-TRU) waste. The frequency of this accident was estimated to be in the range of 10^{-4} to 10^{-6} per year WVNS (2000c). This accident could take place under Alternative A or Alternative B.

The material at risk, damage ratio, airborne release fraction, respirable fraction, and leakpath factor are from WVNS (2000c). Table C-15 lists the material at risk, damage ratio, airborne release fraction, respirable fraction, leakpath factor, and source term for this accident.

Table C-15. Source Term for Fire in Loadout Bay

Nuclide	MAR (curies)	DR	ARF	RF	LPF	ST (curies)
Plutonium-238	11	1.0	6.0×10^{-3}	0.010	1.0	6.8×10^{-4}
Americium-241	3.9	1.0	6.0×10^{-3}	0.010	1.0	2.3×10^{-4}
Plutonium-239	3.2	1.0	6.0×10^{-3}	0.010	1.0	1.9×10^{-4}
Plutonium-240	2.4	1.0	6.0×10^{-3}	0.010	1.0	1.5×10^{-4}
Plutonium-241	71	1.0	6.0×10^{-3}	0.010	1.0	4.2×10^{-3}
Cesium-137	180	1.0	6.0×10^{-3}	1.0	1.0	11
Strontium-90	170	1.0	6.0×10^{-3}	0.010	1.0	9.9×10^{-3}
Curium-244	0.35	1.0	6.0×10^{-3}	0.010	1.0	2.1×10^{-5}
Americium-243	0.17	1.0	6.0×10^{-3}	0.010	1.0	1.0×10^{-5}
Uranium-232	0.051	1.0	6.0×10^{-3}	0.010	1.0	3.0×10^{-6}
Americium-242	0.027	1.0	6.0×10^{-3}	0.010	1.0	1.6×10^{-6}
Thorium-228	0.051	1.0	6.0×10^{-3}	0.010	1.0	3.1×10^{-6}
Americium-242m	0.027	1.0	6.0×10^{-3}	0.010	1.0	1.6×10^{-6}

Acronyms: MAR = material at risk; DR = damage ratio; ARF = airborne release fraction; RF = respirable fraction; LPF = leakpath factor; ST = Source Term

C.5 ATMOSPHERIC DATA

Hourly meteorological data collected at West Valley are shown in Tables C-16 and C-17 for 10-meter (33-foot) and 60-meter (197-foot) heights. These data were collected over a 5-year period from 1994 through 1998 (WVNS 2000a). They are arranged according to direction, atmospheric stability class, and wind speed. When the wind was calm (wind speed = 0 meters per second), the data were assigned to stability classes weighted by the frequency of each stability class. The "greater than 12 meters per second" data were included with the "9.0-12.0 meters per second" data.

C.6 LOCATIONS OF RECEPTORS

Locations of receptors near the WVDP site are listed in Table C-18. To provide a realistic estimate of maximally exposed individual radiation doses from airborne releases during normal operations, radiation doses were evaluated at the locations of nearby residences. For releases from the Process Building, the location that yielded the largest radiation dose was at 1,800 meters (5,900 feet) northwest of the WVDP site. For airborne releases from the Vitrification Facility, the Waste Tank Farm, and the 01/14 Building, the location that yielded the largest radiation dose was at 1,900 meters (6,200 feet) north-northwest of the WVDP site. Population radiation doses from airborne releases during normal operations included contributions from all directions for distances from 0 to 80 kilometers (0 to 50 miles) of the WVDP site.

Table C-16. Hours for Combinations of Direction, Stability Class, and Wind Speed Range at 10-meter (33-foot) Height for 1994-1998 at the WVDP Site[a]

Direction		Stability Class	Wind Speed Range (in meters per second)					
From	To		0.0-1.5	1.5-3.0	3.0-6.0	6.0-9.0	9.0-12.0	> 12.0
S	N	A	4	9	21	1	0	0
SSW	NNE	A	2	11	16	0	0	0
SW	NE	A	1	16	14	0	0	0
WSW	ENE	A	2	10	3	0	0	0
W	E	A	1	11	3	0	0	0
WNW	ESE	A	0	22	40	0	0	0
NW	SE	A	1	46	242	2	0	0
NNW	SSE	A	0	19	67	6	0	0
N	S	A	0	21	20	0	0	0
NNE	SSW	A	0	18	12	0	0	0
NE	SW	A	0	13	10	0	0	0
ENE	WSW	A	0	11	12	0	0	0
E	W	A	0	16	9	0	0	0
ESE	WNW	A	0	7	6	0	0	0
SE	NW	A	0	9	10	0	0	0
SSE	NNW	A	2	6	10	0	0	0
	Calms	A	0					
S	N	B	0	23	42	3	0	0
SSW	NNE	B	2	34	26	0	0	0
SW	NE	B	1	50	27	0	0	0
WSW	ENE	B	0	26	10	0	0	0
W	E	B	1	34	14	0	0	0
WNW	ESE	B	1	67	61	1	0	0
NW	SE	B	0	119	241	1	0	0
NNW	SSE	B	0	34	95	2	0	0
N	S	B	0	24	18	0	0	0
NNE	SSW	B	2	28	15	0	0	0
NE	SW	B	3	22	10	0	0	0
ENE	WSW	B	2	13	4	0	0	0
E	W	B	0	15	7	0	0	0
ESE	WNW	B	0	10	4	0	0	0
SE	NW	B	1	15	16	2	0	0
SSE	NNW	B	2	19	40	0	0	0
	Calms	B	1					
S	N	C	5	68	74	0	0	0
SSW	NNE	C	3	74	29	0	0	0
SW	NE	C	3	102	30	0	0	0
WSW	ENE	C	3	48	19	0	0	0
W	E	C	2	71	21	0	0	0
WNW	ESE	C	8	143	72	2	0	0

Table C-16. Hours for Combinations of Direction, Stability Class, and Wind Speed Range at 10-meter (33-foot) Height for 1994-1998 at the WVDP Site[a] (cont)

Direction		Stability	Wind Speed Range (in meters per second)					
From	To	Class	0.0-1.5	1.5-3.0	3.0-6.0	6.0-9.0	9.0-12.0	> 12.0
NW	SE	C	7	203	341	4	0	0
NNW	SSE	C	4	95	118	5	0	0
N	S	C	1	71	30	0	0	0
NNE	SSW	C	9	39	11	0	0	0
NE	SW	C	5	33	11	0	0	0
ENE	WSW	C	3	18	6	0	0	0
E	W	C	2	17	20	4	0	0
ESE	WNW	C	3	22	14	0	0	0
SE	NW	C	5	39	44	2	0	0
SSE	NNW	C	2	39	42	9	0	0
	Calms	C	0					
S	N	D	284	929	615	25	0	0
SSW	NNE	D	294	938	283	1	0	0
SW	NE	D	257	729	181	1	0	0
WSW	ENE	D	251	501	96	0	0	0
W	E	D	340	827	214	0	0	0
WNW	ESE	D	429	1,441	739	1	0	0
NW	SE	D	370	2,575	1,816	8	0	0
NNW	SSE	D	147	630	492	4	0	0
N	S	D	131	421	126	0	0	0
NNE	SSW	D	139	261	46	0	0	0
NE	SW	D	91	170	29	0	0	0
ENE	WSW	D	90	142	117	8	0	0
E	W	D	103	161	128	1	0	0
ESE	WNW	D	140	314	202	2	0	0
SE	NW	D	191	660	698	114	4	0
SSE	NNW	D	180	534	797	270	29	3
	Calms	D	46					
S	N	E	810	895	315	10	0	0
SSW	NNE	E	446	288	39	0	0	0
SW	NE	E	280	59	3	0	0	0
WSW	ENE	E	267	41	3	0	0	0
W	E	E	290	66	3	0	0	0
WNW	ESE	E	317	183	2	0	0	0
NW	SE	E	175	267	28	0	0	0
NNW	SSE	E	60	34	3	0	0	0
N	S	E	38	8	1	0	0	0
NNE	SSW	E	38	8	0	0	0	0
NE	SW	E	32	9	0	0	0	0
ENE	WSW	E	54	8	0	0	0	0

Table C-16. Hours for Combinations of Direction, Stability Class, and Wind Speed Range at 10-meter (33-foot) Height for 1994-1998 at the WVDP Site[a] (cont)

Direction		Stability	Wind Speed Range (in meters per second)					
From	To	Class	0.0-1.5	1.5-3.0	3.0-6.0	6.0-9.0	9.0-12.0	> 12.0
E	W	E	95	15	4	0	0	0
ESE	WNW	E	114	73	7	0	0	0
SE	NW	E	275	433	199	3	0	0
SSE	NNW	E	575	692	476	94	11	0
	Calms	E	219					
S	N	F	632	98	0	0	0	0
SSW	NNE	F	276	9	0	0	0	0
SW	NE	F	166	1	0	0	0	0
WSW	ENE	F	111	4	0	0	0	0
W	E	F	68	7	0	0	0	0
WNW	ESE	F	28	2	0	0	0	0
NW	SE	F	20	6	0	0	0	0
NNW	SSE	F	23	4	0	0	0	0
N	S	F	16	0	0	0	0	0
NNE	SSW	F	10	1	0	0	0	0
NE	SW	F	20	0	0	0	0	0
ENE	WSW	F	17	0	0	0	0	0
E	W	F	42	1	0	0	0	0
ESE	WNW	F	96	14	1	0	0	0
SE	NW	F	223	72	3	0	0	0
SSE	NNW	F	711	136	10	0	0	0
	Calms	F	537					
S	N	G	696	22	0	0	0	0
SSW	NNE	G	168	0	0	0	0	0
SW	NE	G	89	0	0	0	0	0
WSW	ENE	G	51	1	0	0	0	0
W	E	G	16	1	0	0	0	0
WNW	ESE	G	4	0	0	0	0	0
NW	SE	G	8	0	0	0	0	0
NNW	SSE	G	9	0	0	0	0	0
N	S	G	5	0	0	0	0	0
NNE	SSW	G	4	0	0	0	0	0
NE	SW	G	6	0	0	0	0	0
ENE	WSW	G	12	0	0	0	0	0
E	W	G	16	0	0	0	0	0
ESE	WNW	G	53	3	0	0	0	0
SE	NW	G	260	27	0	0	0	0
SSE	NNW	G	1,197	85	0	0	0	0
	Calms	G	611					

Source: WVNS 2000a.

a. Total hours recorded (1994-1998) for wind blowing from the direction and at the speed range indicated.

Table C-17. Hours for Combinations of Direction, Stability Class, and Wind Speed Range at 60-meter (197-foot) Height for 1994-1998 at the WVDP Site[a]

Direction		Stability Class	Wind Speed Range (in meters per second)					
From	To		0.0-1.5	1.5-3.0	3.0-6.0	6.0-9.0	9.0-12.0	> 12.0
S	N	A	0	2	15	7	1	0
SSW	NNE	A	0	2	22	5	0	0
SW	NE	A	0	5	21	12	0	0
WSW	ENE	A	0	5	11	5	0	0
W	E	A	1	4	16	4	1	0
WNW	ESE	A	1	7	87	70	2	0
NW	SE	A	0	8	122	59	3	0
NNW	SSE	A	0	9	41	21	1	0
N	S	A	0	7	34	2	0	0
NNE	SSW	A	0	3	26	0	0	0
NE	SW	A	0	3	19	0	0	0
ENE	WSW	A	0	6	17	0	0	0
E	W	A	1	9	19	0	0	0
ESE	WNW	A	0	4	6	0	0	0
SE	NW	A	1	2	13	1	0	0
SSE	NNW	A	1	3	8	1	0	0
	Calms	A	1					
S	N	B	0	8	34	7	2	0
SSW	NNE	B	1	3	45	15	1	0
SW	NE	B	1	5	72	12	0	0
WSW	ENE	B	0	9	42	10	1	0
W	E	B	0	16	38	19	0	0
WNW	ESE	B	0	31	159	55	6	0
NW	SE	B	0	31	168	51	1	0
NNW	SSE	B	0	23	72	7	0	0
N	S	B	3	14	22	0	0	0
NNE	SSW	B	0	21	21	0	0	0
NE	SW	B	1	19	16	0	0	0
ENE	WSW	B	0	8	10	0	0	0
E	W	B	0	7	14	0	0	0
ESE	WNW	B	2	9	4	1	0	0
SE	NW	B	0	7	15	5	0	0
SSE	NNW	B	2	6	29	12	0	0
	Calms	B	0					
S	N	C	4	15	61	11	0	0
SSW	NNE	C	2	28	107	9	0	0
SW	NE	C	2	30	121	17	0	0
WSW	ENE	C	1	29	71	13	0	0
W	E	C	0	35	115	14	2	0
WNW	ESE	C	1	48	266	79	12	0

Table C-17. Hours for Combinations of Direction, Stability Class, and Wind Speed Range at 60-meter (197-foot) Height for 1994-1998 at the WVDP Site[a] (cont)

Direction		Stability Class	Wind Speed Range (in meters per second)					
From	To		0.0-1.5	1.5-3.0	3.0-6.0	6.0-9.0	9.0-12.0	> 12.0
NW	SE	C	3	53	260	41	1	0
NNW	SSE	C	4	53	98	15	0	0
N	S	C	2	52	45	0	0	0
NNE	SSW	C	1	36	22	0	0	0
NE	SW	C	4	28	17	0	0	0
ENE	WSW	C	1	14	14	1	0	0
E	W	C	1	14	21	7	3	0
ESE	WNW	C	3	14	15	4	0	0
SE	NW	C	1	27	40	4	1	1
SSE	NNW	C	0	16	38	14	6	
	Calms	C	0					
S	N	D	42	162	475	278	54	5
SSW	NNE	D	24	242	908	204	6	0
SW	NE	D	29	408	1,334	296	2	0
WSW	ENE	D	46	438	1,066	181	2	0
W	E	D	49	528	1,737	506	24	0
WNW	ESE	D	49	585	2,320	748	32	0
NW	SE	D	70	524	1,425	322	8	0
NNW	SSE	D	67	311	469	46	0	0
N	S	D	82	312	262	14	0	0
NNE	SSW	D	84	234	167	1	0	0
NE	SW	D	74	193	99	6	0	0
ENE	WSW	D	76	105	195	10	3	0
E	W	D	62	126	214	12	1	0
ESE	WNW	D	85	219	281	33	0	0
SE	NW	D	86	371	671	226	53	6
SSE	NNW	D	38	227	685	323	204	45
	Calms	D	24					
S	N	E	65	178	523	226	28	1
SSW	NNE	E	39	174	728	136	0	0
SW	NE	E	38	153	589	69	0	0
WSW	ENE	E	30	200	249	6	0	0
W	E	E	32	184	299	7	0	0
WNW	ESE	E	42	165	286	10	1	0
NW	SE	E	47	134	201	6	0	0
NNW	SSE	E	56	65	62	0	0	0
N	S	E	55	72	10	0	0	0
NNE	SSW	E	43	34	4	0	0	0
NE	SW	E	36	32	7	0	0	0
ENE	WSW	E	40	35	14	0	0	0

Table C-17. Hours for Combinations of Direction, Stability Class, and Wind Speed Range at 60-meter (197-foot) Height for 1994-1998 at the WVDP Site[a] (cont)

Direction		Stability Class	Wind Speed Range (in meters per second)					
From	To		0.0-1.5	1.5-3.0	3.0-6.0	6.0-9.0	9.0-12.0	> 12.0
E	W	E	55	59	14	6	0	0
ESE	WNW	E	111	121	42	1	0	0
SE	NW	E	224	507	455	50	0	0
SSE	NNW	E	166	337	536	207	76	14
	Calms	E	59					
S	N	F	72	100	140	1	0	0
SSW	NNE	F	19	87	115	0	0	0
SW	NE	F	26	46	66	0	0	0
WSW	ENE	F	27	56	30	1	0	0
W	E	F	18	50	22	0	0	0
WNW	ESE	F	26	55	25	0	0	0
NW	SE	F	43	52	35	0	0	0
NNW	SSE	F	44	34	13	0	0	0
N	S	F	42	8	0	0	0	0
NNE	SSW	F	20	4	0	0	0	0
NE	SW	F	28	3	0	0	0	0
ENE	WSW	F	28	3	0	0	0	0
E	W	F	39	7	0	0	0	0
ESE	WNW	F	72	35	6	0	0	0
SE	NW	F	374	390	162	3	0	0
SSE	NNW	F	457	286	134	8	0	0
	Calms	F	77					
S	N	G	99	172	122	1	0	0
SSW	NNE	G	36	114	166	1	0	0
SW	NE	G	25	87	49	0	0	0
WSW	ENE	G	32	68	7	0	0	0
W	E	G	20	37	8	0	0	0
WNW	ESE	G	21	25	6	0	0	0
NW	SE	G	31	44	6	0	0	0
NNW	SSE	G	24	16	1	0	0	0
N	S	G	15	2	0	0	0	0
NNE	SSW	G	19	1	0	0	0	0
NE	SW	G	28	0	0	0	0	0
ENE	WSW	G	17	2	0	0	0	0
E	W	G	27	1	0	0	0	0
ESE	WNW	G	63	12	2	0	0	0
SE	NW	G	317	369	89	0	0	0
SSE	NNW	G	554	511	110	0	0	0
	Calms	G	44					

Source: WVNS 2000a.

a. Total hours recorded (1994-1998) for wind blowing from the direction and at the speed range indicated.

Table C-18. Locations of Receptors at WVDP Site (in meters)[a]

Direction	Site Boundary Distance	Nearest Residence Distance
S	1,958	2,300
SSW	1,806	2,800
SW	1,538	2,100
WSW	1,405	2,200
W	1,051	1,800
WNW	1,051	1,200
NW	1,153	1,300
NNW	1,223	1,900
N	1,598	2,500
NNE	1,604	2,600
NE	1,604	1,900
ENE	1,615	2,000
E	1,856	2,500
ESE	2,430	2,600
SE	2,406	2,900
SSE	2,223	3,100

Sources: WVNS 2000a (site boundary); WVNS 2002b (nearest residence).
a. To convert meters to feet, multiply by 3.2808.

To provide a conservative estimate of maximally exposed individual radiation doses from airborne releases during accidents, radiation doses were evaluated at the WVDP site boundary because radiation doses at the site boundary were slightly larger than at nearby residences. For ground-level releases, the location that yielded the largest radiation dose was at 1,051 meters (3,448 feet) west-northwest of the WVDP site for 95-percent meteorology and at 1,223 meters (4,012 feet) north-northwest for 50-percent meteorology. For elevated releases, the location that yielded the largest radiation dose was at 1,806 meters (5,925 feet) south-southwest of the WVDP site for 95-percent meteorology and 50-percent meteorology.

For accidents, radiation doses for workers were also evaluated at an onsite evaluation point located 640 meters (2,100 feet) from the accident. For ground-level releases, the north-northwest direction yielded the largest radiation dose for 95-percent meteorology and 50-percent meteorology. For elevated releases, the southwest direction yielded the largest radiation dose for 95-percent meteorology and 50-percent meteorology.

Population radiation doses from airborne releases during accidents were evaluated for the direction that yielded the largest population radiation dose. For ground-level and elevated releases, the north-northwest direction yielded the largest population radiation dose for 95-percent meteorology and 50-percent meteorology. For distances from 0 to 80 kilometers (0 to 50 miles) of the WVDP site, this direction had a population of about 680,000 people.

C.7 POPULATION DATA

The 2000 population within 80 kilometers (50 miles) of the WVDP site was 1,535,963 (Table C-19). This was an increase of about 15 percent since 1990, with most of the growth being in the southern suburbs of Buffalo, north and north-northwest of the WVDP site. The 2000 population within 10 kilometer (6.2 miles) of the WVDP site was 8,978; this was a decrease of about 2 percent since 1990.

Table C-19. 2000 Population Distribution Around the WVDP Site

Direction	Distance (in kilometers)[a]										
	0 to 2	2 to 3	3 to 5	5 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 80	Total (0 to 80)
S	3	6	19	140	998	1,849	5,874	1,420	1,7190	6,109	33,608
SSW	4	3	44	205	540	1,957	2,669	691	437	15,236	21,786
SW	9	4	19	166	780	2,163	2,563	4,148	7,935	54,727	72,514
WSW	13	7	32	167	497	674	2,386	2,304	5,201	13,869	25,150
W	14	13	41	105	390	5,710	1,819	4,129	29,437	10,830	52,488
WNW	20	40	203	68	1,276	7,277	6,140	8,614	0	0	23,638
NW	8	32	58	236	915	5,206	19,405	1,407	0	0	27,267
NNW	1	6	40	2,554	1,518	8,536	59,778	106,966	294,784	213,344	687,527
N	5	10	53	2380	1,680	4,329	24,337	80,620	109,284	112,259	334,957
NNE	7	12	69	306	914	3,824	3,940	5,758	10,979	35,272	61,081
NE	8	14	47	160	1,343	1,649	2,155	2,596	10,031	17,803	35,806
ENE	7	16	40	122	4,082	3,586	1,419	2,218	5,687	26,411	43,588
E	7	12	95	171	1,323	1,376	1,752	4,048	1,600	11,020	21,404
ESE	10	23	64	175	1,411	578	1,127	2,668	4,521	17,611	28,188
SE	22	22	105	318	725	2,689	2,432	3,820	4,541	7,076	21,750
SSE	1	19	40	358	353	698	2,427	24,822	6,562	9,931	45,211
Total	139	239	969	7,631	18,745	52,101	140,223	256,229	508,189	551,498	1,535,963

a. To convert kilometers to miles, multiply by 0.62137.

C.8 RADIATION DOSES FROM CONTINUED MANAGEMENT FOR WVDP WORKERS AND THE PUBLIC

Using data from DOE Radiation Exposure Monitoring System (DOE 2001) for 1995 through 1999, the average collective radiation dose to workers at the WVDP site was about 15 person-rem per year (Table C-20). Over this same time period, the average individual radiation dose to workers at the WVDP site was about 59 millirem (mrem) per year. This radiation dose is well below the WVDP site administrative control level of 500 mrem per year (WVNS 2001b).

Table C-20. Radiation Doses to WVDP Workers from Continued Management Activities

Year	Number of People Monitored	Number of People with Measurable Doses	Collective Dose (person-rem/yr)	Individual Dose (mrem/yr)
1999	1,064	243	12.5	52
1998	1,115	260	18.2	70
1997	1,206	174	6.9	40
1996	1,365	231	11.2	48
1995	1,518	311	26.9	87
Average	1,254	244	15	59

Source: DOE 2001.

Using data from the West Valley Annual Site Environmental Reports (WVNS 1996, 1997, 1998, 1999a, 2000b) for 1995 through 1999, the collective radiation dose to people living around the WVDP site from airborne releases was about 0.17 person-rem per year (Table C-21). The individual radiation dose from airborne releases was about 0.021 mrem per year.

Table C-21. Radiation Doses to WVDP Members of the Public from Continued Management Activities

Pathway	Individual Dose (mrem/yr)	Collective Dose (person-rem/yr)
Airborne		
1999	0.011	0.11
1998	0.034	0.26
1997	0.049	0.39
1996	8.7×10^{-3}	0.070
1995	4.3×10^{-4}	8.6×10^{-3}
Annual Average	0.021	0.17
Waterborne[a]		
1999	0.056	0.13
1998	0.031	0.067
1997	0.024	0.038
1996	0.067	0.084
1995	0.028	0.094
Annual Average	0.041	0.083
All-Pathways		
1999	0.068	0.24
1998	0.065	0.33
1997	0.073	0.43
1996	0.076	0.15
1995	0.028	0.10
Annual Average	0.062	0.25
Background		
1999	300	380,000
1998	300	380,000
1997	300	380,000
1996	300	390,000
1995	300	390,000
Annual Average	300	380,000

a. Includes effluents and North Plateau drainage.
Sources: WVNS 1996, 1997, 1998, 1999a, and 2000b

Over this same time period, radiation doses from waterborne releases, including effluents and North Plateau drainage, were estimated to be 0.041 mrem per year for individuals and 0.083 person-rem per year for the population within 80 kilometers (50 miles) of the WVDP site.

The collective radiation dose through all exposure pathways (air and water) to people living around the WVDP site was about 0.25 person-rem per year. The individual radiation dose through all exposure pathways to people living within 80 kilometers (50 miles) of the WVDP site was about 0.062 mrem per year. For perspective, the population radiation dose from background radiation to people living within 80 kilometers (50 miles) of the WVDP site was 380,000 person-rem per year, and the individual radiation dose from background radiation to people living within 80 kilometers of West Valley was about 300 mrem per year.

C.9 AIR QUALITY

New York State is divided into nine regions for assessing state ambient air quality. The WVDP site is located in Region 9, which is comprised of Niagara, Erie, Wyoming, Chautauqua, Cattaraugus, and Allegany counties. The WVDP site and the surrounding area in Cattaraugus County are in attainment with the National Primary and Secondary Ambient Air Quality Standards contained in 40 CFR 50 and

New York State air quality standards contained in 6 NYCRR 257. The city of Buffalo, located about 48 km (30 mi) from the WVDP site, is a marginal nonattainment area for ozone (EPA 2002).

Under all of the proposed alternatives, the primary impacts to air quality would be through the continued emission of four criteria pollutants—nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matter—from the two Cleaver Brooks boilers at the WVDP site. These boilers are used to generate steam for heating and other processes at the site, and each have a capacity of 20.2 million British thermal units per hour. Together, these boilers use about 2 million cubic meters (70 million cubic feet) of natural gas and about 24,000 liters (6,300 gallons) of No. 2 fuel oil per year. The other two criteria pollutants, lead and ozone, are produced in insufficient quantities by the boilers for consideration in this analysis.

Emissions from the boilers are presented in Table C-22. These emissions were calculated using the emission factors from *Compilation of Air Pollutant Emission Factors* (EPA 1998) (Chapter 1.3 for fuel oil combustion and Chapter 1.4 for natural gas combustion and are for boilers with a capacity of less than 100 million British thermal units per hour). The particulate matter emissions include both filterable particulate matter and condensable particulate matter, and all particulate matter was assumed to have an aerodynamic diameter of less than 10 micrometers. Back-up generators at the WVDP site do not contribute significantly to these emissions. Other data used in the analysis are listed in Table C-23.

The SCREEN3 computer code (EPA 1995) was used to model the potential impacts to air quality from these emissions. Three analyses were performed: (1) a simple terrain analysis for flat terrain, (2) a simple elevated terrain analysis for terrain lower than the physical stack height, and (3) a complex terrain analysis for terrain higher than the physical stack height. The simple elevated terrain analysis and the complex terrain analysis were performed because of the many hills and valleys around the WVDP site. Many offsite locations were examined in these analyses. The nearest location was at 1,051 meters (3,450 feet) from the boiler stacks, which corresponds to the nearest the WVDP site boundary location. The furthest location was at 50,000 meters (30 miles) from the site. The simple elevated terrain analysis yielded the highest estimates of criteria pollutant concentrations (Table C-24). The highest concentrations occurred at 1,379 meters (4,524 feet) from the WVDP site. As shown in Table C-24, the concentrations of criteria pollutants from the WVDP site emissions are well below the National Primary and Secondary Ambient Air Quality Standards contained in 40 CFR 50 and the New York State air quality standards contained in 6 NYCRR 257. It should be noted that the background concentrations used in Table C-24 were from near Buffalo, New York; actual background concentrations near the WVDP site would be lower. WVDP emissions of nitrogen dioxide and sulfur dioxide are also well below the New York State Department of Environmental Conservation's annual emission cap of 90,700 kilograms (100 tons).

Table C-22. Annual Criteria Pollutant Emissions from WVDP Boilers (in tons)[a]

Criteria Pollutant	Emissions from Natural Gas	Emissions from No. 2 Fuel Oil
Nitrogen Dioxide	3.5	0.063
Sulfur Dioxide	0.021	0.22
Carbon Monoxide	2.9	0.016
Particulate Matter	0.27	0.010

Source: EPA 1998.

a. To convert tons to kilograms, multiply by 907.18.

Note: Emissions are based on using 70 million cubic feet of natural gas and 6,300 gallons of No. 2 fuel oil per year. The boilers were assumed to operate 180 days per year. Emissions were calculated using the emission factors from AP-42, Chapter 1.3 for fuel oil combustion and AP-42, Chapter 1.4 for natural gas combustion, and are for boilers with a capacity of less than 100 million British thermal units per hour.

Table C-23. Data Used to Model Criteria Pollutant Emissions

Parameter	Value
Stack Height	7.62 meters (25 feet)
Stack Diameter	0.6096 meter (24 inches)
Stack Velocity	8 meters per second (26 feet per second)
Stack Temperature	154°C (427°K)
Ambient Temperature	20°C (293°K)
Boiler Capacity	20.2 million British thermal units per hour
Boiler Operating Time	180 days per year
Minimum site boundary distance	1,051 meters (3,450 feet)
Maximum distance	50,000 meters (30 miles)
Maximum sulfur content of No. 2 fuel oil	0.5 percent
Excess oxygen	3 percent
Fuel factor (natural gas)	8,710 dry standard cubic feet per million British thermal units
1-hour averaging time to 3-hour averaging time multiplying factor	0.9 (a)
1-hour averaging time to 8-hour averaging time multiplying factor	0.7 (a)
1-hour averaging time to 24-hour averaging time multiplying factor	0.4 (a)
1-hour averaging time to annual averaging time multiplying factor	0.08 (a)

Source: EPA 1992.

Table C-24 also shows the regional background concentrations of the criteria pollutants as measured near Buffalo, New York (EPA 2001). When combined with concentrations from WVDP emissions, the resulting total concentrations are also below the National Primary and Secondary Ambient Air Quality Standards contained in 40 CFR 50 and the New York State air quality standards contained in 6 NYCRR 257.

Air emissions of radionuclides from WVDP, are regulated by the EPA under the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations, 40 CFR Part 61, Subpart H, National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities. Annual reporting of the radionuclide emissions for calendar year 2000 was less than 0.1 percent of EPA's standards (WVNS, 2001).

C.10 OFFSITE IMPACTS

This section describes how the data in Table 2-6 were derived from the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a) (WM PEIS), the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997b) (WIPP SEIS-II), and the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002) (Yucca Mountain Repository EIS).

LLW and Mixed LLW Disposal at Hanford, NTS, or a Commercial Disposal Site such as Envirocare. In the WM PEIS, DOE analyzed the potential environmental impacts of managing (treating, storing, or disposing of) LLW, mixed LLW, TRU waste, high-level waste (HLW), and hazardous waste. For each waste type, DOE considered a Decentralized Alternative (DOE sites where waste was currently

Table C-24. Criteria Pollutant Concentrations from WVDP Boiler Emissions and Regional Background

Criteria Pollutant	Averaging Time	Standard[a,b]	Concentration From WVDP Emissions[b,c]	Background Concentration[b,d]	Total Concentration[b]	Percent of Standard
Nitrogen dioxide	Annual	100[g,h,i] (0.053 ppm)	1.5	41	42	42
Carbon monoxide	1 hour	40,000[g,i] (35 ppm)	15	5,800	5,800	14
Carbon monoxide	8 hours	10,000[g,i] (9 ppm)	11	3,200	3,200	32
Sulfur dioxide	Annual	80[g,i] (0.03 ppm)	0.10	17	17	22
Sulfur dioxide	24 hours	365[g,i] (0.14 ppm)	0.50	63	64	17
Sulfur dioxide	3 hours	1,300[h,i] (0.5 ppm)	1.1	160	160	12
Particulate matter[e]	Annual	50[g,h]	0.11	21	21	42
Particulate matter[f]	24 hours	150[g,h]	0.56	61	61	41
Ozone	1 hour	235[g,h] (0.12 ppm)	(--)	210	210	89
Lead	Quarterly	1.5[g,h]	(--)	0.03	0.03	2

a. Standards from 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards and 6 NYCRR 257, Air Quality Standards. Comparisons to the standards for particulate matter with an aerodynamic diameter less than 2.5 micrometers and the 8-hour ozone standard were not made because these standards have been remanded to the U.S. Environmental Protection Agency by the U.S. Court of Appeals.
b. Units in micrograms per cubic meter. Parts per million not calculated for substances that do not exist as a gas or vapor at normal room temperature and pressure.
c. The maximum criteria pollutant concentrations from WVDP boiler emissions were located 1,379 meters (4,524 feet) from the WVDP site.
d. Source: EPA 2001. Background concentrations were measured near Buffalo, New York.
e. Annual state standard is 45 to 75 micrograms per cubic meter according to level designation.
f. 24-hour state standard is 250 micrograms per cubic meter.
g. National primary ambient air quality standard.
h. National secondary ambient air quality standard.
i. New York State air quality standard.

generated or stored), one or more Regionalized Alternatives (a few DOE sites at various locations across the nation), and one or more Centralized Alternatives (one DOE site). Of particular relevance to this WVDP Waste Management EIS, the WM PEIS described human health impacts of disposing of 1.5 million cubic meters (53.5 million cubic feet) of LLW at Hanford (Centralized Alternative 3) or NTS (Centralized Alternative 4) and disposing of 219,000 cubic meters (7.8 million cubic feet) of mixed LLW at Hanford (Centralized Alternative) or NTS (Regionalized Alternative 3) (WM PEIS, Section 1.5 and Table 1-6.2).

For these two waste types, the WVDP waste represents less than 2 percent of the total waste volume from all DOE sites analyzed in the WM PEIS (for Class A waste, the WVDP represents 0.3 percent of the total LLW volume; for LLW, the WVDP waste represents 1.3 percent of the total LLW volume; and for mixed LLW, the WVDP waste represents 0.1 percent of the total mixed LLW volume). Because impacts, particularly human health impacts, are directly related to waste volume, the impacts of managing WVDP LLW and mixed LLW at either Hanford or NTS would be no more than 2 percent of the total impacts at those sites, as described in the WM PEIS. Table 2-6 shows the potential human health impacts of disposing of WVDP LLW and mixed LLW at Hanford or NTS. These impacts are 2 percent of the

impacts described in the site data tables for those sites in Volume II of the WM PEIS. The impacts of the disposal of these waste types at Envirocare are assumed to be similar to impacts at Hanford.

TRU Waste Interim Storage at Hanford, INEEL, ORNL, or SRS. The WM PEIS also analyzed the treatment and interim storage of differing volumes of TRU waste from several DOE sites (including WVDP) at Hanford, INEEL, ORNL, or SRS (Regionalized Alternative 3). Table 2-6 shows the potential human health impacts of all TRU waste treatment and interim storage at those sites as stated in the WM PEIS. Because the WVDP TRU waste to be stored at those sites would not be treated and would be a smaller volume than that analyzed in the WM PEIS (and included in Table 2-6), the data in Table 2-6 substantially overstate the potential impacts of storing WVDP TRU waste at those sites.

TRU Waste Interim Storage at WIPP. The WM PEIS analyzed the treatment of TRU waste generated at most DOE sites at WIPP (Centralized Alternative). Table 2-6 shows the potential human health impacts of WVDP TRU waste interim storage at WIPP. These impacts are the impacts described in the WIPP SEIS-II for TRU waste treatment at WIPP. Because the volume of WVDP TRU waste is less than the volume analyzed in the WM PEIS, and because the impacts of interim storage at WIPP would be less than the impacts of TRU waste treatment at that site, the data in Table 2-6 substantially overstate the potential impacts of WVDP TRU waste interim storage at WIPP.

HLW Interim Storage at Hanford or SRS. With respect to HLW storage, the WM PEIS analyzed the interim storage of 340 canisters of WVDP HLW at Hanford (Regionalized Alternative 2) and SRS (Regionalized Alternative 1). Table 2-6 shows the potential human health impacts of WVDP HLW interim storage at these sites as originally reported in the site data tables for Hanford and SRS (Volume II of the WM PEIS). The impacts of interim storage of WVDP HLW would be slightly less because the volume of WVDP HLW (300 canisters) is slightly less than the volume of WVDP HLW analyzed in the WM PEIS (340 canisters).

TRU Waste Disposal at WIPP. The WIPP SEIS-II analyzed the potential environmental impacts of the shipment of all TRU waste to WIPP for treatment prior to disposal. TRU waste generated and stored at WVDP represents less than 1 percent of the total inventory to be disposed of at WIPP (175,580 cubic meters [6.2 million cubic feet]). Table 2-6 shows the expected human health impacts of disposing of WVDP TRU waste at WIPP. These impacts are 1 percent of the impacts reported in the WIPP SEIS-II (WIPP SEIS-II, Section 3.4, Table 3-18).

HLW Disposal at Yucca Mountain. The Yucca Mountain Repository EIS analyzed the potential environmental impacts of the disposal of 70,000 metric tons of heavy metal of HLW and spent nuclear fuel at the Yucca Mountain Repository. The 300 canisters of HLW (approximately 690 metric tons of heavy metal)[1] at WVDP represent approximately 1 percent of the total inventory of HLW and spent nuclear fuel to be disposed of at Yucca Mountain. Table 2-6 shows the expected human health impacts of disposing of WVDP HLW waste at the Yucca Mountain Repository. These impacts are 1 percent of the impacts reported in the Yucca Mountain Repository EIS (Yucca Mountain Repository EIS, Section 2.4.1, Table 2-7).

C.11 BIOTA SCREENING PROCEDURE

DOE's graded approach for evaluating radiation doses to aquatic and terrestrial biota consists of a three-step process designed to guide a user from an initial, conservative general screening to, if needed, a

[1] DOE estimates that each WVDP HLW canister contains 2.3 metric tons of heavy metal. Thus, 300 canisters would contain 690 metric tons of heavy metal. This volume is 1 percent of the 70,000 metric tons of heavy metal analyzed in the Yucca Mountain Repository EIS.

more rigorous analysis using site-specific information (DOE 2002c). The three-step process includes: (1) assembling radionuclide concentration data and knowledge of sources, receptors, and routes of exposure for the area to be evaluated, (2) applying a general screening methodology that provides limiting radionuclide concentration values (i.e., biota concentration guides in soil, sediment, and water), and (3) if needed, conducting an analysis through site-specific screening, site-specific analysis, or an actual site-specific biota dose assessment.

Internal and external sources of dose (and their contributing exposure pathways) are incorporated in the derivation of the graded approach methodology. Sufficient prudence has been exercised in developing each assumption and default parameter value to ensure that the resulting biota concentration guides are appropriately conservative. In the event that an individual default parameter value is subsequently found to be an upper-end value but not the "most limiting" value for a unique site-specific exposure scenario, the other prudent assumptions and default parameter values will ensure that the biota concentration guides (and resultant doses to biota) should continue to carry the appropriate degree of conservatism for screening purposes.

Biota concentration guides were derived for aquatic animal, riparian animal, terrestrial plant, and terrestrial animal reference organisms. The dose rate limits used to derive the biota concentration guides for each organism type are 1 rad per day, 0.1 rad per day, 1 rad per day, and 0.1 rad per day, respectively. While existing effects data support the application of these dose limits to representative individuals within populations of plants and animals, the assumptions and parameters applied in deriving the biota concentration guides are based on a maximally exposed individual, representing a conservative approach for screening purposes.

The contribution to dose from external radioactive material was estimated assuming that all of the ionizing radiation was deposited in the organism (i.e., no pass-through and no self-shielding). This is conservative and is tantamount to assuming that the radiosensitive tissues of concern (the reproductive tissues) lie on the surface of a very small organism. For external exposure to contaminated soil, the source was presumed to be infinite in extent. In the case of external exposure to contaminated sediment and water, the source was presumed to be semi-infinite in extent. The source medium to which the organisms are continuously exposed is assumed to contain uniform concentrations of radionuclides. These assumptions provide for appropriately conservative estimates of energy deposition in the organism from external sources of radiation exposure.

The contribution to dose from internal radioactive material was conservatively estimated assuming that all of the decay energy is retained in the tissue of the organism, (i.e., 100 percent absorption). Progeny of radionuclides and their decay chains are also included. This overestimates internal exposure, as the lifetimes of many of the biota of interest are generally short compared to the time for the build-up of progeny for certain radionuclides. The radionuclides are presumed to be homogeneously distributed in the tissues of the receptor organism. This is unlikely to underestimate the actual dose to the tissues of concern (i.e., reproductive organs). A radiation weighing factor of 20 for alpha particles is used to calculate the biota concentration guides for all organism types. This is conservative, especially if nonstochastic effects are most important in determining harm to biota.

The limiting concentration in an environmental medium was calculated by first setting a target total dose (e.g., 1 rad per day for aquatic organisms and terrestrial plants, or 0.1 rad per day for riparian and terrestrial animals) and then back-calculating to the medium concentration (i.e., the biota concentration guide) necessary to produce the applicable dose from radionuclides in the organism (internal dose), plus the external dose components from radionuclides in the environment (external dose).

C.12 REFERENCES

DOE (U.S. Department of Energy), 1994. *DOE Handbook, Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities.* Report No. DOE-HDBK-3010-94. Washington, DC: U.S. Department of Energy.

DOE (U.S. Department of Energy), 1997a. *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (Volumes 1 through 5)*, DOE/EIS-0200-F, Washington, DC, May.

DOE (U.S. Department of Energy), 1997b. *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement,* DOE/EIS-0026-S-2, Washington, DC, September.

DOE (U.S. Department of Energy), 2001. Radiation Exposure Monitoring System. <http://rems.eh.doe.gov/>.

DOE (U.S. Department of Energy), 2002a. *Radiation Risk Estimation from Total Effective Dose Equivalents.* Washington, DC, U.S. Department of Energy, Memorandum from A. Lawrence, Office of Environmental Policy and Guidance, August 9.

DOE (U.S. Department of Energy), 2002b. *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-level Radioactive Waste at Yucca Mountain, Nye County, Nevada,* DOE/EIS–0250, Office of Civilian Radioactive Waste Management, Washington, DC, February.

DOE (U.S. Department of Energy), 2002c. *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, Report No. DOE-STD-1153-2002, Washington, DC, July.

Eckerman, K.F. and J.C. Ryman, 1993. *External Exposure to Radionuclides in Air, Water, and Soil.* U.S. Environmental Protection Agency; Federal Guidance Report No. 12, Washington, DC.

Eckerman et al. (K.F. Eckerman, A.B. Wolbarst, and A.C.B. Richardson), 1988. *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion.* U.S. Environmental Protection Agency; Federal Guidance Report No. 11, Washington, DC.

EPA (U.S. Environmental Protection Agency), 1992. *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised.* Report No. EPA-454/R-92-019. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

EPA (U.S. Environmental Protection Agency), 1995. *SCREEN3 Model User's Guide.* Report No. EPA-454/B-95-004. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

EPA (U.S. Environmental Protection Agency), 1998. *Compilation of Air Pollutant Emission Factors. Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42.* Supplement D (July) and Supplement E (September). U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. September.

EPA (U.S. Environmental Protection Agency), 2001. AIRData Monitor Reports. <http://www.epa.gov/air/data/monvals.html>.

EPA (U.S. Environmental Protection Agency), 2002. Greenbook Nonattainment Areas for Criteria Pollutants. <http://www.epa.gov/air/oaqps/greenbk/>

ICRP (International Commission on Radiological Protection), 1977. *Recommendations of the International Commission on Radiological Commission.* ICRP Publication 26. Elmsford, NY: Pergamon Press; Annals of the ICRP, 1(3).

ICRP (International Commission on Radiological Protection, 1991. *1990 Recommendations of the International Commission on Radiological Protection.* ICRP Publication 60. Elmsford, NY: Pergamon Press, Annals of the ICRP; 21(1-3).

Marschke, S.F., 2001. *West Valley Demonstration Project Decontamination and Waste Management Environmental Impact Statement Engineering Report.* Revision 1. Prepared by Stephen F. Marschke, Gemini Consulting Company, for West Valley Nuclear Services Company: West Valley, NY. August.

Napier et al. (B.A. Napier, R.A. Peloquin, D.L. Strenge, and J.V. Ramsdell), 1988. *GENII: The Hanford Environmental Radiation Dosimetry Software System,* Volumes 1 and 2. Report No. PNL-6584. Pacific Northwest Laboratory: Richland, WA.

NCRP (National Council on Radiation Protection and Measurements), 1987. *Ionizing Radiation Exposure of the Population of the United States.* Bethesda, MD: National Council on Radiation Protection and Measurements; NCRP Report No. 93.

NCRP (National Council on Radiation Protection and Measurements), 1993. *Risk Estimates for Radiation Protection.* Bethesda, MD: National Council on Radiation Protection and Measurements, NCRP Report No. 115.

WVNS (West Valley Nuclear Services Company). 1993a. *Safety Analysis Report for Lag Storage and Supercompactor Operations.* Report No. WVNS-SAR-009, Revision 2, West Valley Nuclear Services Company, West Valley, NY.

WVNS (West Valley Nuclear Services Company). 1993b. *Safety Analysis Report, Low-Level Class B and C Radioactive Waste Handling and Storage Operations for the Radwaste Treatment System Drum Cell.* Report No. WVNS-SAR-007, Revision 3, West Valley Nuclear Services Company, West Valley, NY.

WVNS (West Valley Nuclear Services Company). 1996. *West Valley Demonstration Project Site Environmental Report Calendar Year 1995.* U.S. Department of Energy: West Valley, NY.

WVNS (West Valley Nuclear Services Company). 1997. *West Valley Demonstration Project Site Environmental Report Calendar Year 1996.* U.S. Department of Energy: West Valley, NY. June.

WVNS (West Valley Nuclear Services Company). 1998. *West Valley Demonstration Project Site Environmental Report Calendar Year 1997.* U.S. Department of Energy: West Valley, NY. June.

WVNS (West Valley Nuclear Services Company). 1999a. *West Valley Demonstration Project Site Environmental Report Calendar Year 1998.* U.S. Department of Energy: West Valley, NY. June.

WVNS (West Valley Nuclear Services Company), 1999b. *Dose Assessment for and Preparation of the WVDP Annual NESHAP Report.* Report No. EMP-202, Revision 1, West Valley Nuclear Services Company, West Valley, NY.

WVNS (West Valley Nuclear Services Company), 2000a. *Manual for Radiological Assessment of Environmental Releases at the WVDP.* Report No. WVDP-065, Revision 3. West Valley Nuclear Services Company, West Valley, NY. August.

WVNS (West Valley Nuclear Services Company). 2000b. *West Valley Demonstration Project Site Environmental Report Calendar Year 1999.* U.S. Department of Energy: West Valley, NY.

WVNS (West Valley Nuclear Services Company), 2000c. *Preliminary Safety Analysis Report for Remote-Handled Waste Facility.* Report No. WVNS-SAR-023, Revision 0. West Valley Nuclear Services Company, West Valley, NY.

WVNS (West Valley Nuclear Services Company), 2001a. *High-Level Waste Tanks 8D-1 and 8D-2 Radionuclide Inventory Report as of July 31, 2001.* West Valley Nuclear Services Company, West Valley, NY. September.

WVNS (West Valley Nuclear Services Company), 2001b. *WVDP Radiological Controls Manual,* Report No. WVDP-010, U.S. Department of Energy: West Valley, NY. August.

WVNS (West Valley Nuclear Services Company), 2002a. *Safety Analysis for Low-Level Waste Processing and Support Activities.* Report No. WVNS-SAR-002, Revision 9. West Valley Nuclear Services Company, West Valley, NY.

WVNS (West Valley Nuclear Services Company), 2002b. *2002 Land Use Survey in Support of the 2001 National Emissions Standard for Hazardous Air Pollutants (NESHAP) and Annual Site Environmental (ASER) Reports.* Revision 0. West Valley Nuclear Services Company, West Valley, NY.