transporting these materials from their points of origin to the appropriate Hanford Site facility. Note that only the non-radiological impacts of transportation accidents are evaluated. No radiological impacts would occur (Rao et al. 1982).

The non-radiological accident impacts of transporting construction materials were calculated by first determining the numbers of shipments of each material. This calculation was done by dividing the total material requirements by the capacity of a typical shipment. Typically, the shipment capacities are limited to about 40,000 lb (18,140 kg) of cargo to ensure that the shipments are below legal-weight truck limits (80,000 lb [36,290 kg] gross vehicle weight in most states). The next step was to determine the total distance traveled by these shipments or the product of the round-trip shipping distance and the number of shipments. Finally, the projected numbers of fatalities were determined by multiplying the travel distances times the accident and fatality rates for heavy-combination truck shipping. The accident rate used in this analysis was 1.75E-7 accidents per truck-km (2.8E-7 accidents per truck-mile), and the fatality rate was 7.5E-9 fatalities per truck-km (1.2E-8 fatalities per truck-mile). These rates are representative of accident and fatality rates on Washington State primary highways, similar to the highways and roadways to be used for most of the shipments. The rates used in this analysis were taken from Saricks and Tompkins (1999).

Table H.11 presents the input data and results of the impact analysis for the transport of construction and capping materials. The table includes the estimated impacts associated with each Alternative Group and waste-volume case. Although accidents are expected to occur, in no case were any fatalities projected to occur associated with the transport of construction and capping materials.

The results in Table H.11 indicate that there are not large differences in impacts among the Alternative Groups. For the Hanford Only waste-volume cases, the projected fatalities ranged from about 0.06 for Alternative Groups C, D, and E to 0.15 fatalities for the No Action Alternative. The impacts of all Alternative Groups except for the No Action Alternative are dominated by transport of asphalt, gravel/sand, silt/loam, and basalt, and bentonite to use as capping materials. The impacts for the No Action Alternative are dominated by the transport of steel and concrete.

H.4 Impacts on Traffic

The potential for adverse impacts on traffic would be limited to those associated with the transport of construction materials from offsite, which would be predominantly 4- to 6-lane highways south of the Hanford Site; traffic congestion would not be expected. The transport of the majority of capping resources would be onsite as material from Area C would be delivered under State Route (SR) 240 by conveyors to a holding area in Area B on the Hanford Site east of SR 240. For a conservative view, the transportation-impact analysis assumed that all transport of capping material is by truck.

H.5 Offsite Transportation Impacts

This section presents the transportation-impact analysis for shipping LLW and MLLW to Hanford from offsite generators and for shipping TRU Waste to WIPP.

Table H.11. Impacts of Transporting Construction and Backfill Materials

Alternative		Total Material	Shipment Capacity	Total Shipments	Shipment Source	One-way Distance	Total Miles Traveled	Accidents	Fatalities
A	**Hanford Only**								
	Asphalt (1000 m^3)	392	12 m^3	32,667	Offsite	45	2.9E+06	5.1E-01	2.2E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2394	20 m^3	119,700	Area C	15	3.6E+06	6.3E-01	2.7E-02
	Steel (MT)	1720	10 MT	172	Unspecified	1000	3.4E+05	6.0E-02	2.6E-03
	Concrete (1000 m^3)	8	10 m^3	831	Offsite	45	7.5E+04	1.3E-02	5.6E-04
	Bentonite (MT)	13,900	19 MT	732	Wyoming	1000	1.5E+06	2.6E-01	1.1E-02
	TOTAL						8.4E+06	1.5E+00	6.3E-02
	Lower Bound Volume								
	Asphalt (1000 m^3)	394	12 m^3	32,833	Offsite	45	3.0E+06	5.2E-01	2.2E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2405	20 m^3	120,250	Area C	15	3.6E+06	6.3E-01	2.7E-02
	Steel (MT)	1870	10 MT	187	Unspecified	1000	3.7E+05	6.5E-02	2.8E-03
	Concrete (1000 m^3)	10	10 m^3	991	Offsite	45	8.9E+04	1.6E-02	6.7E-04
	Bentonite (MT)	13,900	19 MT	732	Wyoming	1000	1.5E+06	2.6E-01	1.1E-02
	TOTAL						8.5E+06	1.5E+00	6.4E-02
	Upper Bound Volume								
	Asphalt (1000 m^3)	416	12 m^3	34,667	Offsite	45	3.1E+06	5.5E-01	2.3E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2500	20 m^3	125,000	Area C	15	3.8E+06	6.6E-01	2.8E-02
	Steel (MT)	2280	10 MT	228	Unspecified	1000	4.6E+05	8.0E-02	3.4E-03
	Concrete (1000 m^3)	14	10 m^3	1431	Offsite	45	1.3E+05	2.3E-02	9.7E-04
	Bentonite (MT)	18,200	19 MT	958	Wyoming	1000	1.9E+06	3.4E-01	1.4E-02
	TOTAL						9.4E+06	1.6E+00	7.0E-02

Table H.11. (contd)

Alternative		Total Material	Shipment Capacity	Total Shipments	Shipment Source	One-way Distance	Total Miles Traveled	Accidents	Fatalities
B	**Hanford Only**								
	Asphalt (1000 m^3)	438	12 m^3	36,500	Offsite	45	3.3E+06	5.7E-01	2.5E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2552	20 m^3	127,600	Area C	15	3.8E+06	6.7E-01	2.9E-02
	Steel (MT)	1800	10 MT	180	Unspecified	1000	3.6E+05	6.3E-02	2.7E-03
	Concrete (1000 m^3)	10	10 m^3	1021	Offsite	45	9.2E+04	1.6E-02	6.9E-04
	Bentonite (MT)	33,600	19 MT	1768	Wyoming	1000	3.5E+06	6.2E-01	2.7E-02
	TOTAL						1.1E+07	1.9E+00	8.3E-02
	Lower Bound Volume								
	Asphalt (1000 m^3)	444	12 m^3	37,000	Offsite	45	3.3E+06	5.8E-01	2.5E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2593	20 m^3	129,650	Area C	15	3.9E+06	6.8E-01	2.9E-02
	Steel (MT)	1950	10 MT	195	Unspecified	1000	3.9E+05	6.8E-02	2.9E-03
	Concrete (1000 m^3)	12	10 m^3	1231	Offsite	45	1.1E+05	1.9E-02	8.3E-04
	Bentonite (MT)	33,600	19 MT	1768	Wyoming	1000	3.5E+06	6.2E-01	2.7E-02
	TOTAL						1.1E+07	2.0E+00	8.4E-02
	Upper Bound Volume								
	Asphalt (1000 m^3)	498	12 m^3	41,500	Offsite	45	3.7E+06	6.5E-01	2.8E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2827	20 m^3	141,350	Area C	15	4.2E+06	7.4E-01	3.2E-02
	Steel (MT)	2380	10 MT	238	Unspecified	1000	4.8E+05	8.3E-02	3.6E-03
	Concrete (1000 m^3)	16	10 m^3	1631	Offsite	45	1.5E+05	2.6E-02	1.1E-03
	Bentonite (MT)	57,600	19 MT	3032	Wyoming	1000	6.1E+06	1.1E+00	4.5E-02
	TOTAL						1.5E+07	2.6E+00	1.1E-01

Table H.11. (contd)

Alternative		Total Material	Shipment Capacity	Total Shipments	Shipment Source	One-way Distance	Total Miles Traveled	Accidents	Fatalities
C	**Hanford Only**								
	Asphalt (1000 m^3)	372	12 m^3	31,000	Offsite	45	2.8E+06	4.9E-01	2.1E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2174	20 m^3	108,700	Area C	15	3.3E+06	5.7E-01	2.4E-02
	Steel (MT)	1720	10 MT	172	Unspecified	1000	3.4E+05	6.0E-02	2.6E-03
	Concrete (1000 m^3)	8	10 m^3	800	Offsite	45	7.2E+04	1.3E-02	5.4E-04
	Bentonite (MT)	13,900	19 MT	732	Wyoming	1000	1.5E+06	2.6E-01	1.1E-02
	TOTAL						7.9E+06	1.4E+00	5.9E-02
	Lower Bound Volume								
	Asphalt (1000 m^3)	374	12 m^3	31,167	Offsite	45	2.8E+06	4.9E-01	2.1E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2185	20 m^3	109,250	Area C	15	3.3E+06	5.7E-01	2.5E-02
	Steel (MT)	1870	10 MT	187	Unspecified	1000	3.7E+05	6.5E-02	2.8E-03
	Concrete (1000 m^3)	10	10 m^3	960	Offsite	45	8.6E+04	1.5E-02	6.5E-04
	Bentonite (MT)	13,900	19 MT	732	Wyoming	1000	1.5E+06	2.6E-01	1.1E-02
	TOTAL						8.0E+06	1.4E+00	6.0E-02
	Upper Bound Volume								
	Asphalt (1000 m^3)	396	12 m^3	33,000	Offsite	45	3.0E+06	5.2E-01	2.2E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2280	20 m^3	114,000	Area C	15	3.4E+06	6.0E-01	2.6E-02
	Steel (MT)	2280	10 MT	228	Unspecified	1000	4.6E+05	8.0E-02	3.4E-03
	Concrete (1000 m^3)	14	10 m^3	1400	Offsite	45	1.3E+05	2.2E-02	9.5E-04
	Bentonite (MT)	18,200	19 MT	958	Wyoming	1000	1.9E+06	3.4E-01	1.4E-02
	TOTAL						8.9E+06	1.6E+00	6.7E-02

Table H.11. (contd)

Alternative		Total Material	Shipment Capacity	Total Shipments	Shipment Source	One-way Distance	Total Miles Traveled	Accidents	Fatalities
D	**Hanford Only**								
	Asphalt (1000 m^3)	371	12 m^3	30,917	Offsite	45	2.8E+06	4.9E-01	2.1E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2174	20 m^3	108,700	Area C	15	3.3E+06	5.7E-01	2.4E-02
	Steel (MT)	1710	10 MT	171	Unspecified	1000	3.4E+05	6.0E-02	2.6E-03
	Concrete (1000 m^3)	8	10 m^3	800	Offsite	45	7.2E+04	1.3E-02	5.4E-04
	Bentonite (MT)	13,900	19 MT	732	Wyoming	1000	1.5E+06	2.6E-01	1.1E-02
	TOTAL						7.9E+06	1.4E+00	5.9E-02
	Lower Bound Volume								
	Asphalt (1000 m^3)	371	12 m^3	30,917	Offsite	45	2.8E+06	4.9E-01	2.1E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2204	20 m^3	110,200	Area C	15	3.3E+06	5.8E-01	2.5E-02
	Steel (MT)	1870	10 MT	187	Unspecified	1000	3.7E+05	6.5E-02	2.8E-03
	Concrete (1000 m^3)	10	10 m^3	990	Offsite	45	8.9E+04	1.6E-02	6.7E-04
	Bentonite (MT)	13,900	19 MT	732	Wyoming	1000	1.5E+06	2.6E-01	1.1E-02
	TOTAL						8.0E+06	1.4E+00	6.0E-02
	Upper Bound Volume								
	Asphalt (1000 m^3)	383	12 m^3	31,917	Offsite	45	2.9E+06	5.0E-01	2.2E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2331	20 m^3	116,550	Area C	15	3.5E+06	6.1E-01	2.6E-02
	Steel (MT)	2280	10 MT	228	Unspecified	1000	4.6E+05	8.0E-02	3.4E-03
	Concrete (1000 m^3)	14	10 m^3	1400	Offsite	45	1.3E+05	2.2E-02	9.5E-04
	Bentonite (MT)	18,200	19 MT	958	Wyoming	1000	1.9E+06	3.4E-01	1.4E-02
	TOTAL						8.9E+06	1.6E+00	6.7E-02

Table H.11. (contd)

Alternative		Total Material	Shipment Capacity	Total Shipments	Shipment Source	One-way Distance	Total Miles Traveled	Accidents	Fatalities
E	**Hanford Only**								
	Asphalt (1000 m^3)	371	12 m^3	30,917	Offsite	45	2.8E+06	4.9E-01	2.1E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2174	20 m^3	108,700	Area C	15	3.3E+06	5.7E-01	2.4E-02
	Steel (MT)	1710	10 MT	171	Unspecified	1000	3.4E+05	6.0E-02	2.6E-03
	Concrete (1000 m^3)	8	10 m^3	800	Offsite	45	7.2E+04	1.3E-02	5.4E-04
	Bentonite (MT)	13,900	19 MT	732	Wyoming	1000	1.5E+06	2.6E-01	1.1E-02
	TOTAL						7.9E+06	1.4E+00	5.9E-02
	Lower Bound Volume								
	Asphalt (1000 m^3)	371	12 m^3	30,917	Offsite	45	2.8E+06	4.9E-01	2.1E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2185	20 m^3	109,250	Area C	15	3.3E+06	5.7E-01	2.5E-02
	Steel (MT)	1870	10 MT	187	Unspecified	1000	3.7E+05	6.5E-02	2.8E-03
	Concrete (1000 m^3)	10	10 m^3	990	Offsite	45	8.9E+04	1.6E-02	6.7E-04
	Bentonite (MT)	13,900	19 MT	732	Wyoming	1000	1.5E+06	2.6E-01	1.1E-02
	TOTAL						8.0E+06	1.4E+00	6.0E-02
	Upper Bound Volume								
	Asphalt (1000 m^3)	383	12 m^3	31,917	Offsite	45	2.9E+06	5.0E-01	2.2E-02
	Gravel/sand, silt/loam, basalt (1000 m^3)	2280	20 m^3	114,000	Area C	15	3.4E+06	6.0E-01	2.6E-02
	Steel (MT)	2280	10 MT	228	Unspecified	1000	4.6E+05	8.0E-02	3.4E-03
	Concrete (1000 m^3)	14	10 m^3	1400	Offsite	45	1.3E+05	2.2E-02	9.5E-04
	Bentonite (MT)	18,200	19 MT	958	Wyoming	1000	1.9E+06	3.4E-01	1.4E-02
	TOTAL						8.8E+06	1.5E+00	6.6E-02

Table H.11. (contd)

Alternative		Total Material	Shipment Capacity	Total Shipments	Shipment Source	One-way Distance	Total Miles Traveled	Accidents	Fatalities
No Action	**Hanford Only**								
	Asphalt (1000 m^3)	35	12 m^3	2933	Offsite	45	2.6E+05	4.6E-02	2.0E-03
	Gravel/sand, silt/loam, basalt (1000 m^3)	2648	20 m^3	132,405	Area C	15	4.0E+06	7.0E-01	3.0E-02
	Steel (MT)	59,100	10 MT	5910	Unspecified	1000	1.2E+07	2.1E+00	8.9E-02
	Concrete (1000 m^3)	420	10 m^3	42,000	Offsite	45	3.8E+06	6.6E-01	2.8E-02
	Bentonite (MT)	0	19 MT	0	Wyoming	1000	0	0	0
	TOTAL						2.0E+07	3.5E+00	1.5E-01
	Lower Bound Volume								
	Asphalt (1000 m^3)	35	12 m^3	2933	Offsite	45	2.6E+05	4.6E-02	2.0E-03
	Gravel/sand, silt/loam, basalt (1000 m^3)	2648	20 m^3	132,405	Area C	15	4.0E+06	7.0E-01	3.0E-02
	Steel (MT)	59,200	10 MT	5920	Unspecified	1000	1.2E+07	2.1E+00	8.9E-02
	Concrete (1000 m^3)	422	10 m^3	42,200	Offsite	45	3.8E+06	6.6E-01	2.8E-02
	Bentonite (MT)	0	19 MT	0	Wyoming	1000	0	0	0
	TOTAL						2.0E+07	3.5E+00	1.5E-01

H.5.1 Impacts of Transportation of TRU Wastes to WIPP

This section presents the expected radiological and non-radiological impacts of transporting TRU wastes from Hanford to the WIPP in New Mexico. The information presented in this section was taken from the *Waste Isolation Pilot Plant Disposal Phase Final Environmental Impact Statement* (WIPP SEIS-2, DOE 1997b) adjusted to the Hanford TRU waste volumes projected in this EIS. The WIPP SEIS-2 impacts were adjusted to account for waste volumes projected in this EIS. Table H.12 summarizes the results from the WIPP SEIS-2. Note that the impacts are for the entire route between Hanford and WIPP. The following subsections provide the bases for the values in the table followed by a comparison with the HSW-EIS bases and assumptions.

Waste Volume

The waste volume presented in Table H.12 is for the Action Alternative 1 in the WIPP SEIS-2. It includes both the "Basic Inventory" and "Additional Inventory" of TRU waste projected to be shipped from Hanford to WIPP.

Table H.12. Summary of Impacts of Transporting TRU Waste by Truck from Hanford to WIPP[(a)]

Waste Type	Waste Volume, m^3	Number of Shipments	Radiological Impacts, LCFs[(b)]			Non-Radiological Impacts		
			Routine Occupational	Routine Non-Occupational	Accident Impacts	Number of Accidents	Fatalities	Vehicle Pollution LCFs
CH-TRU	120,000	18,729	**0** (2.2E-1)	**2** (1.9E+0)	**0** (4.1E-1)	**40** (3.6E+1)	**3** (3.2E+0)	**0** (1.1E-1)
RH-TRU	43,000	48,807	**0** (2.0E-1)	**5** (4.9E+0)	**0** (6.5E-2)	**90** (9.3E+1)	**8** (8.3E+0)	**0** (2.8E-1)
Total	**163,000**	**67,536**	**0** (4.2E-1)	**7**	**0** (4.7E-1)	**130**	**11**	**0** (3.9E-1)

(a) Impacts are based on information in WIPP SEIS-2 (DOE 1997b). The results presented here may not exactly match the WIPP SEIS-2 estimates due to rounding errors.
(b) LCFs = latent cancer fatalities

Number of Shipments

The numbers of shipments in the WIPP SEIS-2 (DOE 1997b) were calculated by dividing the total volume of CH- and RH-TRU wastes by the capacity of the shipping containers used to transport the two types of TRU waste materials. For CH TRU waste, the shipping capacity was about 6.4 m^3 per shipment (three TRUPACT containers carrying fourteen 55-gal-drum equivalents per container). For RH-TRU wastes, the RH-72B shipping cask was used, which carries about 0.9 m^3 per shipment.

Radiological Routine Exposure Risks

The WIPP SEIS-2 did not provide a breakdown of routine exposures by shipping site. However, the per-shipment routine exposures for shipments from Hanford to WIPP were provided. Therefore, the routine radiological impacts presented in Table H.12 were calculated by multiplying together the per-shipment impacts and number of shipments for both CH- and RH-TRU waste shipments.

Radiological Accident Impacts

WIPP SEIS-2 provided a breakdown on radiological-accident impacts by shipping site so the values in Table H.12 were taken directly from that document.

Non-Radiological Impacts

Similar to the radiological routine impacts, WIPP SEIS-2 provided the per-shipment impacts but not a site-by-site breakdown. Consequently, the results in Table H.12 were calculated by combining the per-shipment impacts and the numbers of shipments.

Impacts for HSW-EIS TRU Waste Volumes

The volumes of TRU waste projected to be shipped from Hanford to WIPP in this EIS are substantially lower than the bounding volumes assumed in WIPP SEIS-2. The CH-TRU waste volume projected to be shipped to WIPP in the HSW EIS is about 38,000 m^3 for Alternative Groups A through E. For the No Action Alternative, the projected CH-TRU waste volume to be shipped to WIPP is about 31,000 m^3. This is about one-third of the CH-TRU waste volume projected in WIPP SEIS-2. Similarly, the RH-TRU waste volume projected to be shipped to WIPP in Alternative Groups A through E is about 2800 m^3, or about one-fifteenth of the WIPP SEIS- projections. The ratios of these values were used to adjust the WIPP SEIS-2 impacts for TRU waste shipments from Hanford to the HSW-EIS TRU waste-volume projections. The results are shown in Table H.13.

H.5.2 Transportation Impacts Within Washington and Oregon of Offsite Shipments

This section calculates the impacts of offsite transportation of solid wastes to and from Hanford. Included are the impacts of transporting LLW and MLLW from offsite generators to Hanford Site treatment and disposal facilities and the impacts of transporting MLLW from Hanford to offsite commercial disposal facilities.

Radiological Routine Exposure and Accident Impact Analysis Parameters

The RADTRAN 4 computer code was used to perform the transportation-impact calculations. For offsite shipments, the key differences in RADTRAN parameters are primarily related to the route characteristics (e.g., shipping distances, travel fractions, and population densities in rural, suburban, and urban population zones). For the purposes of this EIS, two routes through Oregon and Washington are

Table H.13. Impacts of Offsite Transportation of TRU Wastes from Hanford to WIPP Adjusted for HSW-EIS Waste Volume[a]

Waste Type	Waste Volume, m^3	Shipments	Radiological Impacts, LCFs			Non-Radiological Impacts		
			Routine Occupational	Routine Non-Occupational	Accidents	Number of Accidents	Fatalities	Vehicle Pollution LCFs
Alternative Groups A, B, C, D, and E								
CH-TRU	40,154[b]	6267	7.5E-2	6.3E-1	1.4E-1	1.2E+1	1.1E+0	3.6E-2
RH-TRU	2815	3195	1.3E-2	3.2E-1	4.3E-3	6.1E+0	5.4E-1	1.9E-2
Total	**42,969**	**9462**	**0** (8.8E-2)	**1** (9.5E-1)	**0** (1.4E-1)	**18** (1.8E+1)	**2** (1.6E+0)	**0** (5.5E-2)
No Action								
CH-TRU	32,714[b]	5106	6.1E-2	5.1E-1	1.1E-1	9.7E+0	8.7E-1	3.0E-2
RH-TRU	0	0	0	0	0	0	0	0
Total	**32,714**	**5106**	**0** (6.1E-2)	**1** (5.1E-1)	**0** (1.1E-1)	**9** (9.7E+0)	**1** (8.7E-1)	**0** (3.0E-2)

LCF = latent cancer fatality

(a) Intermediate values may not add to totals due to rounding.

(b) Includes Hanford Only waste volumes as well as an additional 1500 m^3 of TRU waste to account for small generator sites included in the *Transuranic Waste Performance Management Plan* (DOE 2002b).

assumed to be used exclusively. The first enters Oregon at approximately Ashland, Oregon, on Interstate 5 and travels north to Portland, Oregon. Near Portland, the shipment takes Interstate 205 to Interstate 84 and then travels up the Columbia River Gorge to Umatilla, Oregon. Near Umatilla, the shipments exit Interstate 84 onto Interstate 82, cross into the State of Washington, and travel to Richland, Washington. Near Richland, the shipment exits onto State Route 240 and travels to the Hanford Site. The second route enters the State of Oregon near Ontario, Oregon, on Interstate 84, and travels to Umatilla, Oregon, where it exits onto Interstate 82 and follows the same path to Hanford described for the first route. Note that both routes enter the State of Washington at the Umatilla, Oregon/Patterson, Washington ports of entry.

The HIGHWAY computer code (Johnson et al. 1993) was used to develop this information for the RADTRAN runs. A summary of the route characteristics for transport in Washington and Oregon are shown in Table H.14.

Table H.14. Route Characteristics for Transport in Washington and Oregon

Route Description	Distance, km	Travel Percentage			Population Density, per sq. km		
		Rural	Suburban	Urban	Rural	Suburban	Urban
Enter OR at Ashland	824	75.8%	20.6%	3.6%	10.4	320.2	2242.4
Enter OR at Ontario	430	90.1%	9.1%	0.8	3.9	400.8	1979.6

Table H.15 summarizes the LLW, MLLW, and TRU waste volumes to be transported from offsite generators to Hanford under the Lower Bound and Upper Bound waste-volume cases and the TRU waste volume to be transported from Hanford to WIPP.

Table H.15. Offsite Shipping Volumes Used for Oregon and Washington Impacts Calculations

Shipment Type	Route	Waste Type	Volume, m^3	Number of Shipments
Lower Bound Case				
LLW to Hanford	Ontario, OR	All LLW	23,281	1412
	Ashland, OR	All LLW	1719	105
MLLW to Hanford	Ontario, OR	All MLLW	99	6
	Ashland, OR	All MLLW	1	1
TRU Waste to Hanford	Ontario, OR	CH TRU	1274	161
	Ashland, OR	CH TRU	286	36
TRU Waste to WIPP	Ontario, OR	CH-TRU	40,154	6267
		RH-TRU	2815	3195
		Total TRU	42,969	9462
Upper Bound Case				
LLW to Hanford	Ontario, OR	All LLW	220,707	13,388
	Ashland, OR	All LLW	16,293	992
MLLW to Hanford	Ontario, OR	All MLLW	138,936	8426
	Ashland, OR	All MLLW	1364	1403
TRU Waste to Hanford	Ontario, OR	CH TRU	1274	161
	Ashland, OR	CH TRU	286	36
TRU Waste to WIPP	Ontario, OR	CH-TRU	40,154	6267
		RH-TRU	2815	3195
		Total TRU	42,969	9462

(a) TRU waste volume shipped to Hanford and from Hanford to WIPP includes 1500 m^3 in addition to Upper Bound and Lower Bound waste volumes.

For comparison purposes, the remaining RADTRAN parameters were assumed to be the same as for onsite shipments. This is a realistic assumption because the shipping containers for onsite shipments are required to meet equivalent packaging and transportation standards as shipping containers for onsite shipments. Table H.16 summarizes these routine exposure parameters used in the RADTRAN calculations. Table H.17 summarizes these accident-analysis parameters used in the RADTRAN calculations.

Non-Radiological Impact Analysis Parameters

Impacts from two potential sources of non-radiological impacts are calculated here, including impacts from traffic accidents (fatalities) and routine emissions of vehicular pollutants (latent cancer fatalities). Both types of impacts were calculated by combining unit rates (i.e., fatalities per km traveled), distance per shipment, and the number of shipments. Unit fatality rates for traffic accidents in Washington and Oregon were taken from Saricks and Tompkins (1999). Oregon traffic-fatality-rate data was incomplete

Table H.16. RADTRAN Routine Exposure Parameters Used in Offsite Transportation-Impact Calculations

Parameter	Value[a]
Transport Index (Dose rate at 1 m from vehicle, mrem/hr)[b]	
- LLW and MLLW	3
- CH TRU Waste	7
- RH TRU Waste	7
Number of Truck Crew	2
Average Vehicular Speed (km/hr)	
- Rural	88
- Suburban	40
- Urban	24
Stopped Time (hr/km)	0.011
Number of People Exposed While Stopped	50
Average Exposure Distance at Stops, m	20
Number of People per Vehicle Sharing Route	2
Population Densities (Persons/km^2)	Route-Specific
One-Way Traffic Count (Vehicles/hr)	
- Rural	470
- Suburban	780
- Urban	2800

(a) Source of the parameter values is Neuhauser and Kanipe (1992), except where indicated otherwise.
(b) Source: WM PEIS (DOE 1997a).

in Saricks and Tompkins (1999), so national average fatality rates, which are about four times higher than the average rates in Washington, were used. The unit fatality rate for vehicular emissions was taken from Rao et al. (1982). Both sets of unit-fatality-rate data are commonly used in EISs.

Analysis Results

The transportation impacts in Washington and Oregon for offsite shipments of LLW, MLLW, and TRU waste are presented in Table H.18. The table includes the impacts in Washington and Oregon for both the Lower Bound and Upper Bound waste-volume cases. Table H.19 presents the impacts by state. The estimates in Table H.19 were calculated by scaling the overall results in Table H.18 by the ratio of the mileages in each state to the total mileage traveled in Washington and Oregon. Note that no fatalities are estimated in Washington and Oregon from the offsite shipments. Also note that, although traffic accidents are expected to occur, no fatalities are estimated to result from the traffic accidents.

Table H.17. RADTRAN 4 Accident Parameters for Trucks

Accident Rate State-Specific Values Used			
Fractional Occurrence by Severity Category (Conditional Probability Given an Accident Occurs)[a]			
Severity Category			
I	0.55		
II	0.36		
III	0.07		
IV	0.016		
V	0.0028		
VI	0.0011		
VII	8.5E-5		
VIII	1.5E-5		
Fractional Occurrence by Population Zone (Conditional Probability Given an Accident Occurs of the Specified Severity)[a]			
	Rural	**Suburban**	**Urban**
I	0.1	0.1	0.8
II	0.1	0.1	0.8
III	0.3	0.4	0.3
IV	0.3	0.4	0.3
V	0.5	0.3	0.3
VI	0.7	0.2	0.1
VII	0.8	0.1	0.1
VIII	0.9	0.05	0.05
Release Fraction (Fraction of Container Contents Released from Shipment by Severity Category)[a]			
	Type A (LLW and MLLW)	**Type B (CH- and RH-TRU)[b]**	
I	0	0	
II	0.01	0	
III	0.1	8E-9	
IV	1	2E-7	
V	1	8E-5	
VI	1	2E-4	
VII	1	2E-4	
VIII	1	2E-4	

(a) Data taken from NUREG-0170 (NRC 1977) for Type A shipments. Release fractions are package-type specific whereas the fractional occurrence parameters are independent of package type.

(b) Data taken from WIPP SEIS-2 (DOE 1997b). Includes contributions from impact and thermal release phenomena.

Table H.18. Impacts in Washington and Oregon from Shipments of Solid Waste to Hanford from Offsite Generators and Shipments of TRU Waste to WIPP[(a)]

Shipment	Route	Waste Type	Radiological Impacts, LCFs			Non-Radiological Impacts		
			Occupational	Public	Radiological Accident	Number of Accidents	Accident Fatalities	Emissions, LCFs
Lower Bound Case								
LLW to Hanford	Ontario, OR	LLW	5.1E-3	3.6E-3	5.6E-4	1.0E-1	2.2E-3	9.6E-4
	Ashland, OR	LLW	8.8E-4	5.8E-4	3.6E-4	1.5E-2	3.5E-4	6.1E-4
MLLW to Hanford	Ontario, OR	MLLW	1.1E-2	3.4E-3	2.8E-5	1.8E+0	2.0E-2	8.5E-4
	Ashland, OR	MLLW	8.4E-6	5.5E-6	4.2E-5	1.4E-4	3.3E-6	5.9E-6
TRU Waste to Hanford	Ontario, OR	TRU	6.0E-4	4.2E-4	1.1E-5	1.2E-2	2.5E-4	1.1E-4
	Ashland, OR	TRU	1.7E-3	1.1E-3	1.2E-4	3.0E-2	6.7E-4	1.2E-3
Total – All Offsite Generators		All	1.9E-2	9.1E-3	1.1E-3	2.0E+0	2.4E-2	3.7E-3
TRU to WIPP	Ontario, OR	CH-TRU	1.7E-2	1.6E-2	4.4E-4	4.7E-1	1.0E-2	4.3E-3
		RH-TRU	8.6E-3	1.8E-2	2.2E-4	2.4E-1	5.1E-3	2.2E-3
		Total TRU	2.5E-2	3.4E-2	6.6E-4	7.1E-1	1.5E-2	2.7E-2
GRAND TOTAL	**All waste types, to and from Hanford**		**0** (4.5E-2)	**0** (4.3E-2)	**0** (1.8E-3)	**3** (2.7E+0)	**0** (3.9E-2)	**0** (3.1E-2)
Upper Bound Case								
LLW to Hanford	Ontario, OR	LLW	4.8E-2	3.4E-2	5.3E-3	9.9E-1	2.1E-2	9.1E-3
	Ashland, OR	LLW	8.3E-3	5.5E-3	3.4E-3	1.4E-1	3.3E-3	5.8E-3
MLLW to Hanford	Ontario, OR	MLLW	4.1E-2	2.5E-2	4.0E-2	2.4E+0	3.3E-2	6.5E-3
	Ashland, OR	MLLW	1.2E-2	7.8E-3	5.9E-2	2.0E-1	4.6E-3	8.3E-3
TRU Waste to Hanford	Ontario, OR	TRU	6.0E-4	4.2E-4	1.1E-5	1.2E-2	2.5E-4	1.1E-4
	Ashland	TRU	1.7E-3	1.1E-3	1.2E-4	3.0E-2	6.7E-4	1.2E-3
Total – All Offsite Generators		All	1.1E-1	7.4E-2	1.1E-1	3.8E+0	6.3E-2	3.1E-2
TRU Waste to WIPP	Ontario, OR	CH-TRU	1.7E-2	1.6E-2	4.4E-4	4.7E-1	1.0E-2	4.3E-3
		RH-TRU	8.6E-3	1.8E-2	2.2E-4	2.4E-1	5.1E-3	2.2E-3
		Total TRU	2.5E-2	3.4E-2	6.6E-4	7.1E-1	1.5E-2	2.7E-2
GRAND TOTAL	**All waste types, to and from Hanford**		**0** (1.4E-1)	**0** (1.1E-1)	**0** (1.1E-1)	**5** (4.5E+0)	**0** (7.8E-2)	**0** (5.8E-2)

Note: Public includes non-involved workers.

(a) Radiological impacts (incident-free and accident) are expressed in units of LCFs. Non-radiological accident impacts are expressed as the expected number of accidents and the resulting physical trauma fatalities. Non-radiological emissions impacts are expressed as LCFs.

Table H.19. Impacts in Washington and Oregon by State from Offsite Shipments of Solid Wastes to and from Hanford[(a)]

Shipment	State	Radiological Impacts, LCFs			Non-Radiological Impacts		
		Occupational	Non-Occupational	Radiological Accident	Number of Accidents	Accident Fatalities	Emissions, LCFs
Lower Bound Waste Volume							
LLW, MLLW, and TRU to Hanford[(b)]	WA	4.1E-3	1.9E-3	2.2E-4	3.9E-1	5.4E-3	7.9E-4
	OR	1.5E-2	7.2E-3	9.0E-4	1.6E+0	1.8E-2	2.9E-3
TRU Waste to WIPP	WA	4.4E-3	5.9E-3	1.2E-4	1.2E-1	2.6E-3	4.7E-3
	OR	2.1E-2	2.8E-2	5.4E-4	5.9E-1	1.2E-2	2.2E-2
Total - Offsite Shipments	WA	8.6E-3	7.8E-3	3.4E-4	5.2E-1	8.0E-3	5.5E-3
	OR	3.6E-2	3.5E-2	1.4E-3	2.2E+0	3.1E-2	2.5E-2
Grand Total	**WA + OR**	**0** (4.5E-2)	**0** (4.3E-2)	**0** (1.8E-3)	**3** (2.7E+0)	**0** (3.9E-2)	**0** (3.1E-2)
Upper Bound Waste Volume							
LLW, MLLW, and TRU Waste to Hanford[(b)]	WA	2.1E-2	1.4E-2	2.2E-2	7.3E-1	1.3E-2	6.2E-3
	OR	9.0E-2	6.0E-2	8.6E-2	3.1E+0	5.0E-2	2.5E-2
TRU Waste to WIPP	WA	4.4E-3	5.9E-3	1.2E-4	1.2E-1	2.6E-3	4.7E-3
	OR	2.1E-2	2.8E-2	5.4E-4	5.9E-1	1.2E-2	2.2E-2
Total – Offsite Shipments	WA	2.6E-2	2.0E-2	2.2E-2	8.5E-1	1.5E-2	1.1E-2
	OR	1.1E-1	8.8E-2	8.7E-2	3.6E+0	6.3E-2	4.7E-2
Grand Total	**WA + OR**	**0** (1.4E-1)	**0** (1.1E-1)	**0** (1.1E-1)	**5** (4.5E+0)	**0** (7.8E-2)	**0** (5.8E-2)

Note: Public includes non-involved workers.

(a) Radiological impacts (incident-free and accident) are expressed in units of LCFs. Non-radiological accident impacts are expressed as the expected number of accidents and the resulting physical trauma fatalities. Non-radiological emissions impacts are expressed as LCFs.

(b) MLLW shipments include those from offsite generators to Hanford and those to ORR and back for treatment. TRU waste volumes include 1500 m^3 in addition to the Upper Bound and Lower Bound waste-volume projections to account for small-quantity sites identified in the *Transuranic Waste Performance Management Plan* (DOE 2002b).

H.6 Results of Hazardous Chemical Impact Analysis

Downwind concentrations of hazardous chemicals released from a severe transportation accident are presented in this section. The resulting chemical concentrations are put in perspective by comparing them to safe exposure levels. The methods used are standard facility safety-analysis techniques and are proven methods for assessing potential health effects from accidental releases of hazardous chemical materials.

The hazardous chemical constituents of MLLW and TRU waste to be transported to and on the Hanford Site are shown in Table H.6. The downwind concentrations shown in Table H.20 were calculated assuming a maximum-inventory 55-gal drum is involved in a severe accident and releases