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

0.5 percent of the total inventory of each hazardous chemical as respirable particles into the environment. The downwind concentrations are then compared to Temporary Emergency Exposure Limit-2 (TEEL-2) values given by Craig (2001). The TEEL-2 definition follows.

> **TEEL-2**: The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

TEEL-2 values are used here instead of the more widely accepted Emergency Response Planning Guidelines (ERPGs), because ERPG values do not exist for some of the chemicals listed in Table H.6. TEEL values are interim replacements for the peer-reviewed ERPG values and may be used when ERPG values are not available. ERPG-2 is analogous to TEEL-2 and is defined as follows:

> **ERPG-2**: The maximum concentration in air below which it is believed that nearly all individuals could be exposed *for up to 1 hour* without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

The results of the hazardous-chemical-concentration calculations are shown in Table H.20. The results indicate that downwind concentrations of only four hazardous chemicals would exceed the TEEL-2 guidelines following a severe transportation accident involving a maximum-inventory 55-gal drum. These four chemicals are elemental lead, elemental mercury, methyl ethyl ketone (MEK or 2-butanone), and beryllium. For these four chemicals, the Immediately Dangerous to Life and Health (IDLH) values are provided in the table for additional perspective. IDLH concentrations are defined as follows:

> **IDLH**: The maximum concentration from which, in the event of respirator failure, a person could escape within 30 minutes without a respirator and without experiencing any escape-impairing (for example, severe eye irritation) or irreversible health effects.

The IDLH values are driven by worker safety requirements, as indicated by the language on respirator failure.

The downwind concentrations of all four of the IDLH chemicals are well below their respective IDLH values. Based on these observations, the conclusion is that releases of hazardous chemicals from transportation accidents are unlikely to result in a fatality.

The downwind hazardous chemical concentrations are calculated for a person 100 m (109 yd) away from the release point. This assumption is conservative for a member of the public, either offsite or onsite, who is unlikely to be 100 m (109 yd) from the release point for the entire duration of the release. Furthermore, the maximum hazardous-chemical concentrations (referred to as the maximum drum) have been modeled. This model includes, in the case of MLLW, more than 20 hazardous chemicals. It is extremely unlikely that any single 55-gal drum would contain the maximum concentrations of all 20 or more hazardous chemicals. This information provides additional evidence that results shown in Table H.20 are bounding.

Table H.20. Hazardous Chemical Concentrations 100 m (109 yd) Downwind from Severe Transportation Accidents

Hazardous Constituent	Concentration, mg/m^3					
	TEEL-2 Value[(a)]	MLLW[(b)]	TRU Waste[(b)]	Elemental Mercury	Elemental Lead	Comments[(c)]
Acetone	8500	0.49	0	0	0.004	
Ammonium fluoride	12.5	0.19	0	0	0	
Ammonium nitrate	50	0.19	0	0	0	
Ammonium sulfate	500	0.38	0	0	0	
Beryllium	0.025	0.14	0.0049	0	0	IDLH = 10 mg/m^3
Butyl alcohol	50	0.03	0.012	0	0	
Carbon tetrachloride	100	0.89	0.024	0	0	
Cyclohexane	1300	0.09	0	0	0	
Ethanol	3300	0.49	0.0049	0	0	
Hydrazine	0.8	0.21	0	0	0	
Isopropyl alcohol	400	0.71	0	0	0	
Lead	0.25	0	0	0	5.0	IDLH = 700 mg/m^3
Mercury	0.1	0	0	0.67	0	IDLH = 10 mg/m^3
Methanol	1000	0.95	0	0	0	
Methyl ethyl ketone	0.2	0.58	0	0	0	IDLH = 9000 mg/m^3
Methyl isobutyl ketone	500	0.80	0	0	0	
Nitric acid	15	1.48	0.0049	0	0	
Phosphoric acid	500	1.27	0.0073	0	0	
Potassium hydroxide	2	1.37	0	0	0	
Propane	2100	0	0.0097	0	0	
Sodium hydroxide	40	1.86	0.15	0	0	
Styrene	250	0.04	0	0	0	
Sulfuric acid	10	0.08	0.036	0	0	
Tetrahydrofuran	2000	0.07	0	0	0	
Toluene	300	2.53	0	0	0	
Uranium	1	0.009	0	0	0	
Xylene	200	1.26	0.10	0	0	

(a) Source: Craig (2001).
(b) Inventories bound quantities for either CH or RH waste.
(c) IDLH = Immediately Dangerous to Life and Health. Source: National Institute for Occupational Safety and Health (NIOSH 1990).