

## 8. REGULATIONS AND ADVISORIES

The international, national, and state regulations and guidelines regarding stable cesium in air, water, and other media are summarized in Table 8-1. The regulations regarding radioactive cesium are summarized in Table 8-2.

No MRLs were derived for inhalation or oral exposure to stable or radioactive cesium. Two MRLs, derived by the Agency for Toxic Substances and Disease Registry (1999) for external exposure to ionizing radiation, are applicable to external exposure to radioisotopes of cesium. An MRL of 400 mrem (4.0 mSv) was derived for acute-duration external exposure (14 days or less), based on cognitive learning deficit in children who had been exposed to ionizing radiation at critical stages of fetal development (gestation weeks 8–15) during the atomic bombing of Hiroshima and Nagasaki (Schull et al. 1988). An MRL of 100 mrem/year (1.0 mSv/year) above background was derived for chronic-duration external exposure (365 days or more), based on the BEIR V (1990) report that the average annual effective ionizing radiation dose to the U.S. population is 360 mrem/year (3.6 mSv/year), a dose not expected to produce adverse health effects.

The EPA has not derived reference concentrations (RfCs) or reference doses (RfDs) for stable or radioactive cesium (IRIS 2002). The IRIS database does not provide cancer assessments for radioisotopes of cesium. This function is the responsibility of the EPA Office of Radiation and Indoor Air (ORIA). All radionuclides, including radioisotopes of cesium, are classified as known human (Group A) carcinogens. This classification is based on results of epidemiological studies of Japanese atomic bomb survivors, underground uranium miners, radium dial painters, and patients subjected to a variety of radiation treatments, as well as results of laboratory animal research and mammalian tissue culture studies. ORIA has published cancer slope factors (mortality and morbidity cancer risk estimates) for all known radionuclides, by various exposure routes (inhalation, drinking water ingestion, food ingestion, soil ingestion, immersion in a cloud, and external exposure from contaminated soil) for five age groups and 14 radiogenic cancer sites (EPA 2000). Slope factors for  $^{137}\text{Cs}$  and  $^{134}\text{Cs}$  are listed in Table 8-2.

## 8. REGULATIONS AND ADVISORIES

**Table 8-1. Regulations and Guidelines Applicable to Cesium**

Agency	Description	Information	Reference
<u>INTERNATIONAL</u>			
Guidelines:			
IARC		No data	IARC 2000
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air			
ACGIH	TLV (8-hour TWA for a 40-hour workweek) Cesium hydroxide (based on upper respiratory tract, skin, and eye irritation)	2 mg/m <sup>3</sup>	ACGIH 2000, 2001
EPA		No data	
NIOSH	REL (10-hour TWA for a 40-hour workweek) Cesium hydroxide (based on skin, eye, and respiratory irritation)	2 mg/m <sup>3</sup>	NIOSH 1992, 2000
OSHA		No data	
b. Water			
c. Food			
d. Other			
<u>STATE</u>			
		No data	

ACGIH = American Conference of Governmental Industrial Hygienists; EPA = Environmental Protection Agency; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; OSHA = Occupational Safety and Health Administration; REL = recommended exposure limit; TLV = threshold limit value; TWA = time weighted average

## 8. REGULATIONS AND ADVISORIES

**Table 8-2. Regulations and Guidelines Applicable to Radioactive Cesium**

Agency	Description	Information	Reference
<u>INTERNATIONAL</u>			
Guidelines:			
IARC		No data	IARC 2000
<u>NATIONAL</u>			
Regulations and Guidelines:			
a. Air			
ACGIH		No data	ACGIH 2000
EPA	Detection limits for man-made beta particle and photon emitters	10 pCi/L	EPA 1999a 40 CFR 141.25
NIOSH		No data	NIOSH 2000
NRC	Effluent concentrations—air		NRC 1999a
	<sup>134</sup> Cs	2x10 <sup>-10</sup> μCi/mL	10 CFR 20 App B
	<sup>137</sup> Cs	2x10 <sup>-10</sup> μCi/mL	
b. Water			
NRC	Effluent concentrations—water		NRC 1999a 10 CFR 20 App B
	<sup>134</sup> Cs	9x10 <sup>-7</sup> μCi/ml	
	<sup>137</sup> Cs	1x10 <sup>-6</sup> μCi/ml	
c. Food			
FDA	Derived intervention level <sup>a</sup> (DIL; Bq/kg food) in accidentally-contaminated human food		FDA 1998
	<sup>134</sup> Cs	930	
	<sup>137</sup> Cs	1360	
d. Other			
EPA	Concentration levels for environmental compliance		EPA 1999a 40 CFR 61 App E
	<sup>134</sup> Cs	0.7x10 <sup>-14</sup> Ci/m <sup>3</sup>	
	<sup>137</sup> Cs	1.9x10 <sup>-14</sup> Ci/m <sup>3</sup>	
	Carcinogenicity—slope factors <sup>b</sup>		EPA 2002
	Lifetime risk per pCi—ingestion		
	Water		
	<sup>134</sup> Cs	4.22x10 <sup>-11</sup>	
	<sup>137</sup> Cs	3.04x10 <sup>-11</sup>	
	Food		
	<sup>134</sup> Cs	5.14x10 <sup>-11</sup>	
	<sup>137</sup> Cs	3.74x10 <sup>-11</sup>	
	Soil		
	<sup>134</sup> Cs	5.81x10 <sup>-11</sup>	
	<sup>137</sup> Cs	4.33x10 <sup>-11</sup>	
	Lifetime risk per pCi—inhalation		
	<sup>134</sup> Cs	1.65x10 <sup>-11</sup>	
	<sup>137</sup> Cs	1.19x10 <sup>-11</sup>	

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**Table 8-2. Regulations and Guidelines Applicable to Radioactive Cesium**

Agency	Description	Information	Reference
<u>NATIONAL</u> (cont.)			
	External exposure—risk/year per pCi/g soil		EPA 2002
	<sup>134</sup> Cs	$7.10 \times 10^{-6}$	
	<sup>137</sup> Cs	$5.32 \times 10^{-10}$	
	<sup>137</sup> Cs (plus disintegration products)	$2.55 \times 10^{-6}$	
NRC	Occupational inhalation exposure		NRC 1999a
	ALIs		10 CFR 20 App B
	<sup>134</sup> Cs	100 $\mu$ Ci	
	<sup>137</sup> Cs	200 $\mu$ Ci	
	DACs		
	<sup>134</sup> Cs	$4 \times 10^{-8}$ $\mu$ Ci/mL	
	<sup>137</sup> Cs	$6 \times 10^{-8}$ $\mu$ Ci/mL	
	Quantities of licensed material requiring labeling		NRC 1999b
	<sup>134</sup> Cs	10 $\mu$ Ci	10 CFR App C
	<sup>137</sup> Cs	10 $\mu$ Ci	
<u>STATE</u>			
a. Air			
Michigan	Gross beta particle activity		MI Dept Environ Quality 2000
	<sup>134</sup> Cs	15 pCi/L	
b. Water			
c. Food			
d. Other			
Louisiana	Quantity required for consideration of need for emergency plan for responding to a release	Release fraction	Quantity LA Dept Environ Quality 2000
	<sup>134</sup> Cs	0.01	2,000 Ci
	<sup>137</sup> Cs	0.01	3,000 Ci

<sup>a</sup>The FDA-recommended Derived Intervention Level (DIL) for radionuclides of cesium, is defined as the DIL for the most sensitive age group (adults) that was calculated from the most limiting Protective Action Goal (PAG; 5 mSv committed effective whole body dose equivalent).

<sup>b</sup>EPA classifies all radionuclides as Group A (known human) carcinogens. Radionuclide risk coefficients, or slope factors, are calculated by EPA's Office of Radiation and Indoor Air (ORIA) to assist HEAST users with risk-related evaluations and decision-making at various stages of the remediation process. Ingestion and inhalation slope factors are central estimates in a linear model of the age-averaged, lifetime attributable radiation cancer incidence (fatal and nonfatal cancer) risk per unit of activity inhaled or ingested, expressed as risk/picocurie (pCi). Ingestion values are tabulated separately for ingestion of tap water, dietary intakes (food), and incidental soil ingestion. External exposure slope factors are central estimates of the lifetime attributable radiation cancer incidence risk for each year of exposure to external radiation from photon-emitting radionuclides distributed uniformly in a thick layer of soil, and are expressed as risk/year per pCi/gram of soil.

ACGIH = American Conference of Governmental Industrial Hygienists; ALI = annual limitations on intake; CFR = Code of Federal Regulations; DAC = derived air concentrations; EPA = Environmental Protection Agency; FDA = Food and Drug Administration; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NRC = Nuclear Regulatory Commission; OSHA = Occupational Safety and Health Administration