CESIUM

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 ¹³⁷Cs and ¹³⁴Cs are listed in Table 8-2.

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

Table 8-1. Regulations and Guidelines Applicable to Cesium

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

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Regulations and Guidelines:a. AirACGIHNo dataACGIH 2000EPADetection limits for man-made beta particle and photon emitters10 pCi/LEPA 1999a 40 CFR 141.25NIOSHNo dataNIOSH 2000NRCEffluent concentrations-airNRC 1999a 10 CFR 20 App B ^{134}Cs 2x10" ¹⁰ µCi/mLNRC 1999a10 CFR 20 App B ^{134}Cs 9x10" µCi/mLNRC 1999a 10 CFR 20 App B ^{134}Cs 9x10" µCi/mLNRC 1999a 10 CFR 20 App B ^{134}Cs 9x10" µCi/mLNRC 1999a 10 CFR 20 App B ^{134}Cs 9x10" µCi/mLNRC 1999a 10 CFR 20 App B ^{134}Cs 9x10" µCi/mLNRC 1999a 10 CFR 20 App B ^{134}Cs 9x10" µCi/mLState 10 CFR 20 App B ^{134}Cs 9x10" µCi/mLFDA 1998 ^{134}Cs 9x10" µCi/mLFDA 1998 ^{134}Cs 930State 10 CFR 20 App B ^{134}Cs 9301360Garcinogenicity-slope factors ⁰ ^{134}Cs 0.7x10" ¹⁴ Ci/m31360d. OtherEPA 1999a40 CFR 61 App E ^{134}Cs 1.9x10" ¹⁴ Ci/m310 CFR 61 App E ^{134}Cs 5.14x10" ¹¹ 137Cs4.22x10" ¹¹ ^{134}Cs 5.14x10" ¹¹ 137Cs5.14x10" ¹¹ ^{134}Cs 5.14x10" ¹¹ 137Cs5.81x10" ¹¹ ^{134}Cs 5.81x10" ¹¹ 137Cs4.33x10" ¹¹ ^{134}Cs 5.81x10" ¹¹ 137Cs4.33x10" ¹¹ ^{134}Cs 5.81x10" ¹¹ 137Cs4.33x10" ¹¹ ^{134}Cs			No data	IARC 2000
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ACGIH EPA Detection limits for man-made beta particle and photon emitters No data ACGIH 2000 EPA 1999a 40 CFR 141.25 NIOSH No data NIOSH 2000 NRC 1999a NIOSH 2000 NRC 1999a NRC Effluent concentrations-air 13 ⁴ Cs 2x10 ⁻¹⁰ µCi/mL 2x10 ⁻¹⁰ µCi/mL NIOSH 200 App B b. Water Effluent concentrations-water NRC 1999a 10 CFR 20 App B NRC 1999a 10 CFR 20 App B nRC Effluent concentrations-water FDA NRC 1999a 10 CFR 20 App B nRC Effluent concentrations-water FDA 1998 nRC Effluent concentration level ⁶ (DIL; Bq/kg food) in accidentally-contaminated human food FDA 1998 1 ³⁴ Cs 930 13 ⁻⁶ C EPA 1999a 40 CFR 61 App E 1 ³⁴ Cs 0.7x10 ⁻¹⁴ Ci/m ³ EPA 1999a 1 ³⁴ Cs 0.7x10 ⁻¹⁴ Ci/m ³ EPA 2002 Lifetime risk per pCi-ingestion Water 1 ⁻³⁴ Cs 3.04x10 ⁻¹¹ 1 ³⁴ Cs 5.14x10 ⁻¹¹	-	nd Guidelines:		
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¹³⁷ Cs 3.74x10 ⁻¹¹ Soil ¹³⁴ Cs 5.81x10 ⁻¹¹ ¹³⁷ Cs 4.33x10 ⁻¹¹ Lifetime risk per pCi–inhalation ¹³⁴ Cs 1.65x10 ⁻¹¹		¹³⁴ Cs	5.14x10 ⁻¹¹	
$ \begin{array}{c} \text{Soil} \\ & & 1^{34}\text{Cs} & 5.81\text{x}10^{-11} \\ & & 1^{37}\text{Cs} & 4.33\text{x}10^{-11} \\ \text{Lifetime risk per pCi-inhalation} \\ & & 1^{34}\text{Cs} & 1.65\text{x}10^{-11} \end{array} $		¹³⁷ Cs		
$\begin{array}{rcl} {}^{137}\mathrm{Cs} & 4.33\mathrm{x}10^{-11} \\ \text{Lifetime risk per pCi-inhalation} \\ {}^{134}\mathrm{Cs} & 1.65\mathrm{x}10^{-11} \end{array}$		Soil		
$\begin{array}{rcl} {}^{137}\mathrm{Cs} & 4.33\mathrm{x}10^{-11} \\ \text{Lifetime risk per pCi-inhalation} \\ {}^{134}\mathrm{Cs} & 1.65\mathrm{x}10^{-11} \end{array}$		¹³⁴ Cs	5.81x10 ⁻¹¹	
Lifetime risk per pCi–inhalation ¹³⁴ Cs 1.65x10 ⁻¹¹		¹³⁷ Cs		
¹³⁴ Cs 1.65x10 ⁻¹¹		Lifetime risk per pCi–inhalation		
		¹³⁴ Cs	1.65x10 ⁻¹¹	

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

Agency	Description	Information	Reference
NATIONAL (co	nt.)		
	External exposure–risk/year per pCi/g soil		EPA 2002
	¹³⁴ Cs	7.10x10 ⁻⁶	
	¹³⁷ Cs	5.32x10 ⁻¹⁰	
	¹³⁷ Cs (plus disintegration products)	2.55x10 ⁻⁶	
NRC	Occupational inhalation exposure		NRC 1999a
	ALIs		10 CFR 20 App B
	¹³⁴ Cs	100 µCi	
	¹³⁷ Cs	200 µCi	
	DACs		
	¹³⁴ Cs	4x10 ⁻⁸ µCi/mL	
	¹³⁷ Cs	6x10 ⁻⁸ µCi/mL	
	Quantities of licensed material requiring labeling		NRC 1999b
	¹³⁴ Cs	10 µCi	10 CFR App C
	¹³⁷ Cs	10 µCi	
<u>STATE</u>			
a. Air			
Michigan	Gross beta particle activity		MI Dept Environ
	¹³⁴ Cs	15 pCi/L	Quality 2000
b. Water		No data	
c. Food		No data	
d. Other			
Louisiana	Quantity required for consideration of need for	Release Quantity	
	emergency plan for responding to a release	fraction	Quality 2000
	¹³⁴ Cs	0.01 2,000 C	
	¹³⁷ Cs	0.01 3,000 C	1

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

^aThe 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).

^bEPA 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 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