

## 7. REGULATIONS AND GUIDELINES

**CHAPTER 7. REGULATIONS AND GUIDELINES**

Pertinent international and national regulations, advisories, and guidelines regarding nickel in air, water, and other media are summarized in Table 7-1. This table is not an exhaustive list, and current regulations should be verified by the appropriate regulatory agency.

ATSDR develops MRLs, which are substance-specific guidelines intended to serve as screening levels by ATSDR health assessors and other responders to identify contaminants and potential health effects that may be of concern at hazardous waste sites. See Section 1.3 and Appendix A for detailed information on the MRLs for nickel.

**Table 7-1. Regulations and Guidelines Applicable to Nickel**

Agency	Description	Information	Reference
<b>Air</b>			
EPA	RfC		
	Nickel, soluble salts	Not evaluated	<a href="#">IRIS 1994</a>
	Nickel refinery dust	Not evaluated	<a href="#">IRIS 1987a</a>
	Nickel carbonyl	Not evaluated	<a href="#">IRIS 1987c</a>
	Nickel subsulfide	Not evaluated	<a href="#">IRIS 1987b</a>
WHO	Air quality guidelines	No data	<a href="#">WHO 2010</a>
<b>Water &amp; Food</b>			
EPA	Drinking water standards		<a href="#">EPA 2018</a>
	1-day health advisory for a 10-kg child	1 mg/L	
	10-day health advisory for a 10-kg child	1 mg/L	
	DWEL	0.7 mg/L	
	National primary drinking water regulations		<a href="#">EPA 2009</a>
	MCL	No data	
	Public health goal	No data	
	RfD		
	Nickel, soluble salts	0.02 mg/kg/day <sup>a</sup>	<a href="#">IRIS 1994</a>
	Nickel refinery dust	Not evaluated	<a href="#">IRIS 1987a</a>
	Nickel carbonyl	Not evaluated	<a href="#">IRIS 1987c</a>
	Nickel subsulfide	Not evaluated	<a href="#">IRIS 1987b</a>
WHO	Guideline value for chemicals that are of health significance in drinking water	0.07 mg/L (70 µg/L)	<a href="#">WHO 2017</a>
FDA	Substances Added to Food (EAFUS)	21 CFR 176.180 for use as indirect food additive in paper and paper cardboard components	<a href="#">FDA 2021b</a>
		21 CFR 184.1537 GRAS Status	<a href="#">FDA 2021a</a>

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Agency	Description	Information	Reference
<b>Cancer</b>			
HHS	Carcinogenicity classification Nickel compounds  Nickel metallic	Known to be human carcinogens Reasonably anticipated to be a human carcinogen	<a href="#">NTP 2016</a>
EPA	Carcinogenicity classification Nickel, soluble salts Nickel refinery dust Nickel carbonyl Nickel subsulfide	Not evaluated A <sup>b</sup> B2 <sup>c</sup> A <sup>b</sup>	<a href="#">IRIS 1994</a> <a href="#">IRIS 1987a</a> <a href="#">IRIS 1987c</a> <a href="#">IRIS 1987b</a>
IARC	Carcinogenicity classification Nickel compounds Nickel, metallic	Group 1 <sup>d</sup> Group 2B <sup>e</sup>	<a href="#">IARC 2021</a>
<b>Occupational</b>			
OSHA	PEL (8-hour TWA) for general industry Nickel, metal, and insoluble compounds Nickel, soluble compounds PEL (8-hour TWA) for construction industry Nickel, metal, and insoluble compounds Nickel, soluble compounds PEL (8-hour TWA) for shipyard industry Nickel, metal, and insoluble compounds Nickel, soluble compounds	1 mg/m <sup>3</sup> 1 mg/m <sup>3</sup> 1 mg/m <sup>3</sup> 1 mg/m <sup>3</sup> 1 mg/m <sup>3</sup> 1 mg/m <sup>3</sup>	<a href="#">OSHA 2020a</a> 29CFR1910.1000  <a href="#">OSHA 2020b</a> 29CFR1926.55  <a href="#">OSHA 2020c</a> 29CFR1915.1000
NIOSH	REL (up to 10-hour TWA)	0.015 mg/m <sup>3</sup>	<a href="#">NIOSH 2019a</a>
<b>Emergency Criteria</b>			
AIHA	ERPGs	No data	<a href="#">AIHA 2016</a>
EPA	AEGLS-air Nickel carbonyl AEGL 1 10 min 30 min 60 min 4 hr 8 hr AEGL 2 10 min 30 min 60 min 4 hr 8 hr AEGL 3 10 min 30 min 60 min 4 hr 8 hr	No data NR NR NR NR NR 0.10 ppm 0.072 ppm 0.036 ppm 0.0090 ppm 0.0045 ppm 0.46 ppm 0.32 ppm 0.16 ppm 0.040 ppm 0.020 ppm	<a href="#">AEGLs 2018</a>

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Agency	Description	Information	Reference
DOE	PACs-air <sup>f</sup>		<a href="#">DOE 2018</a>
	Nickel		
	PAC-1	4.5 mg/m <sup>3</sup>	
	PAC-2	50 mg/m <sup>3</sup>	
	PAC-3	99 mg/m <sup>3</sup>	
	Nickel acetate tetrahydrate		
	PAC-1	13 mg/m <sup>3</sup>	
	PAC-2	140 mg/m <sup>3</sup>	
	PAC-3	830 mg/m <sup>3</sup>	
	Nickel(II) carbonate		
	PAC-1	0.61 mg/m <sup>3</sup>	
	PAC-2	6.6 mg/m <sup>3</sup>	
	PAC-3	40 mg/m <sup>3</sup>	
	Nickel chloride		
	PAC-1	0.66 mg/m <sup>3</sup>	
	PAC-2	22 mg/m <sup>3</sup>	
	PAC-3	130 mg/m <sup>3</sup>	
	Nickel cyanide		
	PAC-1	1.1 mg/m <sup>3</sup>	
	PAC-2	13 mg/m <sup>3</sup>	
	PAC-3	75 mg/m <sup>3</sup>	
	Nickel(II) nitrate		
	PAC-1	0.93 mg/m <sup>3</sup>	
	PAC-2	10 mg/m <sup>3</sup>	
	PAC-3	61 mg/m <sup>3</sup>	
	Nickel oxide		
	PAC-1	0.76 mg/m <sup>3</sup>	
	PAC-2	220 mg/m <sup>3</sup>	
	PAC-3	1,300 mg/m <sup>3</sup>	
	Nickel sulfamate		
	PAC-1	1.3 mg/m <sup>3</sup>	
	PAC-2	12 mg/m <sup>3</sup>	
	PAC-3	71 mg/m <sup>3</sup>	
	Nickel sulfate		
	PAC-1	0.79 mg/m <sup>3</sup>	
	PAC-2	8.6 mg/m <sup>3</sup>	
	PAC-3	51 mg/m <sup>3</sup>	

<sup>a</sup>RfD: The RfD is based on a LOAEL of 50 mg/kg/day for decreased body and organ weights in chronic-duration exposures in rats (Ambrose et al. 1976).

<sup>b</sup>A: human carcinogen

<sup>c</sup>B2: probable human carcinogen

<sup>d</sup>Group 1: carcinogenic to humans

<sup>e</sup>Group 2B: Possibly carcinogenic to humans

<sup>f</sup>Definitions of PAC terminology are available from U.S. Department of Energy (DOE 2016).

AEGL = acute exposure guideline levels; AIHA = American Industrial Hygiene Association; CFR = Code of Federal Regulations; HHS = Department of Health and Human Services; DOE = Department of Energy; DWEL = drinking water equivalent level; EAFUS = Everything Added to Food in the United States; EPA = Environmental Protection Agency; ERPG = emergency response planning guidelines; FDA = Food and Drug Administration;

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Agency	Description	Information	Reference
GRAS = Generally Recognized As Safe; IARC = International Agency for Research on Cancer; IRIS = Integrated Risk Information System; MCL = maximum contaminant level; MCLG = maximum contaminant level goal; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PAC = Protective Action Criteria; PEL = permissible exposure limit; REL = recommended exposure limit; RfC = inhalation reference concentration; RfD = oral reference dose; TWA = time-weighted average; WHO = World Health Organization			