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TABLE 11.3
Typical Permissible Ambient Concentrations of Various Substances

Permissible plant stack gas emissions may be 100 to 1000 times greater than air values shown because of atmospheric dilution. Permissible wastewater emissions are typically 10 to 100 times greater than drinking water standards. Actual numbers depend somewhat on process type, capacity, and location.

			Air[a]		Water (ppm or mg/l)	
Compound or substance	Formula	mw	(μg/m³)	(ppmv)	Drinking water standard	Toxic waste limit
Acetone	C_3H_6O	58	0.1	4×10^{-5}		
Acrylonitrile	C_3H_3N	53	0.1	4×10^{-5}		
Alachlor					0.002	
Aldehydes						
Aldrine						
Alkalinity (as $CaCO_3$)					50	
Aluminium					0.2	
Ammonia	NH_3	17	8,000	10	12	
Antimony	Sb		2		10	
Aromatics						
Arsenic	As	75	1.5		0.05	5
Asbestos			400	[1×10^6 fibers/m³]		
Atrazine					0.003	
Barium	Ba	137			1	100
Benzene	C_6H_6	78	600	0.2	0.005	0.5
Benzo[a]pyrene					0.0002	
Beryllium	Be	9	1.5		0.1	
BOD (biological oxygen demand)					30	
Cadmium	Cd	112.4	1		0.005	0.05
Calcium	Ca	40			100	
Carbon dioxide	CO_2	44	600,000	300	250	
Carbon disulfide	CS_2	76	100	0.03		
Carbon monoxide	CO	28	10,000	9		
Carbon tetrachloride	CCl_4	154	75	0.01	0.005	0.5
Chlordane	$C_{10}H_6Cl_8$	410			0.003	0.03
Chlorine	Cl_2	71	600	0.2	4	
Chlorides	Cl^-	35.5	3,000	20	250	
Chlorobenzene (mono)	C_6H_5Cl	112.6			0.1	
Chlorofluorocarbons	$C_2F_3Cl_3$	187.4	1,000	0.1	0.1	
Chloroform	$CHCl_3$	119.4	7,000	1.5	0.06	6
Chromium II and III	Cr	52	500		0.05	5
Chromium VI	Cr	52	1		0.05	5
Cobalt	Co	59			0.05	
COD (chemical oxygen demand)					150	
Copper	Cu		1		0.5	
Cresols				1	0.2	
Cyanogen	C_2N_2	52	50	0.025	0.001	
Cyanides	RCN		120	0.05	0.2	
p,p′-DDT					0.001	
p-dichlorobenzene			1		0.075	
o-dichlorobenzene					0.6	
1,2-dichloroethane			700		0.005	
1,1-dichloroethylene					0.007	
Dichloromethane	CH_2Cl_2	85	4,000	1.2	0.005	
2,4-dinitrotoluene					0.0013	
Dioxins			0.0003		3×10^{-4}	
Endrine	$C_{12}H_{10}OCl_6$	383			0.002	0.02
Ethyl alcohol	C_2H_5OH	46	400,000	200		
Ethybenzene					0.7	
Ethylene dibromide					5×10^{-5}	
Ethylene oxide	C_2H_4O	44	1000	0.5		
Fluorides	F^-	19	2.5		4	

TABLE 11.3
Typical Permissible Ambient Concentrations of Various Substances *(Continued)*

Permissible plant stack gas emissions may be 100 to 1000 times greater than air values shown because of atmospheric dilution. Permissible wastewater emissions are typically 10 to 100 times greater than drinking water standards. Actual numbers depend somewhat on process type, capacity, and location.

			Air[a]		Water (ppm or mg/l)	
Compound or substance	Formula	mw	($\mu g/m^3$)	(ppmv)	Drinking water standard	Toxic waste limit
Fluorine	F_2	38	1			
Fluorocarbons						
Formaldehyde	CH2O	30	500	0.4		
Furans			0.0003			
Grease					10	
Halogenated hydrocarbons					5	
Halogens				5		
Heptachlor	$C_{10}H_7Cl_7$	375.5			0.0004	
Hexachlorobenzene	C_6Cl_6	285			1×10^{-5}	
Hexachloroethane					0.003	
Hydrocarbons	C_xH_y	$12 \times y$	500	0.24		
Hydrocyanic acid	HCN	27				
Hydrogen chloride	HCl	36.5	4,000	2		
Hydrogen fluoride	HF	20	1			
Hydrogen sulfide	H_2S	34	15	0.01	20	
Iron	Fe	55.9			0.3	
Ketones		100	5,000	1	2	
Lead	Pb	207	1.5		0.015	5
Lindane	$C_6H_6Cl_6$	291			0.0002	
Magnesium	Mg	24.3			0.5	
Manganese	Mn	54.9	1		0.2	
Mercury	Hg	201	1		0.002	0.2
Methoxychlor	$Cl_6H_{15}O_2C_{13}$	245.5			0.1	10
Methyl bromide	CH_3Br	95	1			
Methylene chloride	CH_2Cl_2	84.9	70,000	20	0.005	
Methyl ethyl ketone	C_4H_8O	72	1,400	0.5	0.1	
Molybdenum	Mo	96			0.1	
Napthalene	$C_{10}H_8$	128	11,000	2		
Nickel	Ni	58.7	1.5		0.1	
Nitrates/nitrides			See "Nitric/Nitrous oxides"		20	
Nitrobenzene	$C_6H_5NO_2$	123			20	
Nitric oxide	N_2O	44	40	0.02	See "Nitrates"	
Nitrogen dioxide	NO_2	46	100	0.05	See "Nitrates"	
Nitrogen	N_2	28			See "Nitrates"	
Nitrous oxide	N_2O	44	100	0.05	See "Nitrates"	
Oils (see grease)						
Organics			5		8	
Organohalides						
Ozone	O_3	48	100	0.05		
Particles			60		See "Solids"	
Particles (<10mm)			20		See "Solids"	
Particles (<2.5 mm)			12		See "Solids"	
PCBs (polychlorinated biphenyls					0.001	
Pentachlorophenol					0.2	
Phenols			40,000	10	0.001	
Phosgene	$COCl_2$	99	100	0.02		
Phosphorus	P	31			6	
Propylene oxide	C_3H_6N	58	2500	1		
Pyridine	C_3H_6O	79	3300	1	0.05	
Selenium	Se_8	631.7			0.01	1
Silica	SiO_2	60			50	

TABLE 11.3
Typical Permissible Ambient Concentrations of Various Substances *(Continued)*

Permissible plant stack gas emissions may be 100 to 1000 times greater than air values shown because of atmospheric dilution. Permissible wastewater emissions are typically 10 to 100 times greater than drinking water standards. Actual numbers depend somewhat on process type, capacity, and location.

			Air[a]		Water (ppm or mg/l)	
Compound or substance	Formula	mw	($\mu g/m^3$)	(ppmv)	Drinking water standard	Toxic waste limit
Silver	Ag	108			0.2	5
Solids (dissolved)			See "Particles"		250	
Solids (suspended)			See "Particles"		30	
Solids (total)			See "Particles"		250	
Styrene	C_8H_8	104	200		0.005	
Sulfates	SO_4 =	96	50		250	
Sulfur dioxide	SO_2	64	100	0.04		
Sulfur trioxide	SO_3	80	1			
Tetrachloroethane	$C_2H_2Cl_4$	167.9			0.005	
Tetrachloroethylene (dry cleaning solvent)	C_2Cl_4	165.9	4,000	50	0.005	
Thallium	Tl	204.4	0.2		0.002	
THMs (total)					0.1	
TOC					0.065	
Toluene	C_7H_8	92.1	4,500	1	1	
Toxaphene	$C_{10}H_{10}Cl_{18}$	769			0.005	0.5
1,2,4–trichlorobenzene	$C_6H_3Cl_3$	181.5			0.07	
1,1,1–trichloroethane	$C_2H_3Cl_3$	133.4	45,000	8	0.2	
1,1,2–trichlorethane	$C_2H_3Cl_3$	133.4	1,300	0.2	0.005	
Trichloroethylene	C_2HCl_3	131.4	6,400	1	0.005	
Trichloromethane	C_4HCl_3	155.5	1			
2,4,5–trichlorophenol	$C_6H_3OCl_3$	197.5			0.01	1
2,4,6–Trichlorophenol	$C_6H_3OCl_3$	197.5			0.02	
Vanadium	V	51	1		0.1	
Vinyl chloride	C_2H_3Cl	62.5	30	0.01	0.002	
VOCs (volatile organic compounds)[b]			200	0.1		
Xylenes	C_8H_{10}	106.2	10,000	2	1	
Zinc	Zn	91			2	

EPA and WHO New Source Air Pollution Performance Standards

	Particles	SO_2	NO_x
Coal-burning power generators	43 g/GJ	520 g/GJ	300 g/GJ
Oil–burning power generators:		344 g/GJ	130 g/GJ
H_2SO_4 plants		0.25 g/kg acid	
Municipal solid waste combustors[c]		1 mg/Nm^3	180 ppm

Sources: DeZuane [1990]; Colls [1997]; Longhurst, Elsom, and Power [2000]; Evanoff (Freeman [1995], Chapter 32); Osantowski, Liello, and Applegate (Freeman [1995], Chapter 36); Perry [1997], Section 25; Peirce, Weiner, and Vesilind [1998]; Ray [1995]; Valsaraj [2000] (Error of 10^3 in p. 666 numbers corrected.); Vignes [2001].

[a]ppmv = parts per million by volume. For gaseous pollutants, ppmv = $\mu g/m^3 \times (0.024/mw)$, based on air at 1 atm and 20°C. In the absence of better values, TLVs from ACGIH [2003] can be used to estimate ambient air standards. Threshold limit values (TLVs) represent maximum concentrations to which it is believed workers may be exposed day after day without health damage. The TLV is divided by 10 to adjust for a diverse general population and divided by another factor of 4.2 to convert 40-hour-per-week to full exposure. The result, TLV divided by 42 or "TLV/42," is an estimate of Maximum Acceptable Ground-Level concentrations (MAGLC). See DEPA [2003] and Vignes [2001] for a nicely framed discussion of this.

[b]See Edwards [2000] for details regarding treatment technique.

[c]See Doolittle, Woodhull, and Venkatesh [2002] and Kimbro, McCormick, Knisley, and Evans [2001] for more detailed specifications.