

Summary of Air Emission and Effluent Discharge Requirements Presented in the Industry Guidelines

Terms Used in the following Tables 1-3

ADP	Air-dried pulp	N	Nitrogen
Ag	Silver	ng/J	Nanograms per joule
AOX	Adsorbable organic halides	NH ₃	Ammonia
As	Arsenic	NH ₄	Ammonium nitrogen
BOD	Biochemical oxygen demand (understood as BOD measured over five days, BOD ₅)	Ni	Nickel
Cd	Cadmium	NO ₃	Nitrate nitrogen
Cl	Chlorine	NO _x	Nitrogen oxides
CN	Cyanide	O&G	Oil and grease
Co	Cobalt	P	Phosphorus
CO	Carbon monoxide	PAH	Polynuclear aromatic hydrocarbons
COD	Chemical oxygen demand	Pb	Lead
Cr ⁺⁶	Hexavalent chromium	pH	Measure of acidity/alkalinity
Cr, total	Total chromium	PM	Particulate matter
CTMP	Chemical, thermal, mechanical process for producing pulp	PM _{2.5}	Particulate matter with aerodynamic diameter less than 2.5 microns
Cu	Copper	PM ₁₀	Particulate matter with aerodynamic diameter less than 10 microns
F	Fluorine	ppm	Parts per million
Fe	Iron	S	Sulfur
g/mm Btu	Grams per million British thermal units	Sb	Antimony
GJ	Gigajoule	Se	Selenium
HC	Hydrocarbons	Sn	Tin
HCl	Hydrogen chloride/hydrochloric acid	SO ₂	Sulfur dioxide
HF	Hydrogen fluoride/hydrofluoric acid	SO _x	Sulfur oxides
Hg	Mercury	t	Metric ton
H ₂ S	Hydrogen sulfide	TCE	Trichloroethylene
kg	Kilogram	Temp. increase	Temperature increase at the edge of the zone where initial mixing and dilution take place; where the zone is not defined, 100 meters from the point of discharge is used
kg/t	Kilograms per metric ton	tpd/MWe	Metric tons per day per megawatt of electricity
mg/l	Milligrams per liter	TSS	Total suspended solids
µg/m ³	Micrograms per cubic meter	V	Vanadium
mg/Nm ³	Milligrams per normal cubic meter	VOCs	Volatile organic compounds
MPN/100 ml	Coliform count expressed as most probable number per 100 milliliters	WAD	Weak acid dissociable cyanide
MWe	Megawatts of electricity	Zn	Zinc

Table 1. Air Emission Requirements: Parameters and Maximum Values

(mg/Nm³, unless otherwise specified)

Guideline	PM	SO _x	NO _x	Other; comments
Aluminum manufacturing	30			Total F: 2; HF: 1; VOCs: 20
Base metal and iron ore mining				
Breweries				
Cement manufacturing	50	400	600	Cl: 3
Chlor-alkali industry				
Coal mining and production	50			
Coke manufacturing	50			Benzene: 5 (leaks); VOCs: 20; sulfur recovery at least 97% (preferably over 99%)
Copper smelting	*	1,000 (SO ₂)		PM: smelters, 20, other sources, 50; As: 0.5; Cd: 0.05; Cu: 1; Pb: 0.2; Hg: 0.05
Dairy industry	50			Odor: acceptable to neighbors
Dye manufacturing				Cl: 10; VOCs: 20
Electronics manufacturing				VOCs: 20; phosphine: 1; arsine: 1; HF: 5; HCl: 10
Electroplating industry				VOCs: 90% recovery
Foundries	*			PM: 20 where toxic metals are present, 50 in other cases
Fruit and vegetable processing				
General environmental guidelines	*	2,000 (SO ₂)	Coal: 750 (260 ng/J or 365 ppm) Oil: 460 (130 ng/J or 225 ppm) Gas: 320 (86 ng/J or 155 ppm)	PM: 50 for ≥ 50 MWe; 100 < 50MWe; dioxins: 2,3,7,8-TCSS equivalent): maximum of 1 ng/Nm ³
Glass manufacturing	*	Oil fired: 1,800 Gas fired: 700	1,000 (up to 2,000 depending on technology and if justified in the EA)	PM: 50 (20 where toxic metals are present); Pb + Cd: 5; heavy metals (other, total): 5; As: 1; F: 5; HCl: 50
Industrial estates	*	2,000	Solid fuels: 750 (260 ng/J or 365 ppm); Liquid fuels: 460 (130 ng/J or 225 ppm); Gaseous fuels: 320 (86 ng/J or 155 ppm)	PM: 50 (> 10 GJ/hr), 150 (< 10 GJ/hr); H ₂ S: 15
Iron and steel manufacturing	50	500 (sintering)	750 (260 ng/J or 365 ppm)	F: 5
Lead and zinc smelting	20	400 (SO ₂)		As: 0.1; Cd: 0.05; Cu: 0.5; Hg: 0.05; Pb: 0.5; Zn: 1
Meat processing and rendering	*			PM: 150 for smokehouses with a carbon content of less than 50; odor: minimize impacts on residents
Mini steel mills	*	2,000	750	PM: 20 where toxic metals are present, 50 in other cases
Mixed fertilizer plants	50		500 (nitrophosphate unit) 70 (mixed acid unit)	NH ₃ : 50; F: 5

Nitrogenous fertilizer plants	50		300	NH ₃ : 50; urea: 50
Oil and gas development (onshore)		1,000	Oil: 460 (130 ng/J or 225 ppm) Gas: 320 (86 ng/J or 155 ppm)	VOCs: 20; H ₂ S: 30; odor: not offensive at receptor end (H ₂ S at the property boundary should be less than 5 µg/m ³)
Pesticides formulation	*			PM: 20 (5 where very toxic compounds are present); VOCs: 20; Cl: 5
Pesticides manufacturing	*			PM: 20 (5 where very toxic compounds are present); VOCs: 20; Cl: 5
Petrochemicals manufacturing	20	500	300	HCl: 10; benzene: 5 (emissions), 0.1 ppb (plant fence); 1,2-dichloroethane: 5 (emissions), 1.0 ppb (plant fence); vinyl chloride: 5 (emissions), 0.4 ppb (plant fence); NH ₃ : 15
Petroleum refining	50	150 (sulfur recovery units) 500 (combustion units)	460 (130 ng/J or 225 ppm)	H ₂ S: 15; Ni + V: 2
Pharmaceutical manufacturing	20			Active ingredients (each): 0.15; Class A compounds (total): 20; Class B compounds (total): 80; benzene, vinyl chloride, dichloroethane (each): 5
Phosphate fertilizer plants	50	Sulfuric acid plant: SO ₂ : 2 kg/t acid SO ₃ : 0.15 kg/t acid		F: 5
Printing industry				VOCs: 20; Cl: 10
Pulp and paper mills	*		2 kg/t ADP	PM: 100 (recovery furnace); H ₂ S: 15 (lime kilns); S (total): 1.5 kg/ton ADP (sulfite mills), 1.0 kg/ton ADP (kraft and other)
Sugar manufacturing	*	2,000	Liquid fuels: 460 (130 ng/J or 225 ppm) Solid fuels: 750 (260 ng/J or 365 ppm)	PM: 100 (150 mg/ Nm ³ for small mills with less than 8.7 MW heat input to the boiler); odor: acceptable to residents
Tanning and leather finishing				Odor: acceptable to neighbors
Textiles industry				VOC: 20
Thermal power, new plants	50*	0.2 tpd/MWe (to 500 MWe) 0.1 tpd/MWe (incr. over 500 MWe) Not to exceed 2,000 mg/Nm ³ in flue gases Not to exceed 500 tpd	For thermal power plants: Coal: 750 (260 ng/J or 365 ppm); Oil: 460 (130 ng/J or 225 ppm); Gas: 320 (86 ng/J or 155 ppm) For combustion turbine units: Gas: 125 Diesel fuel (No. 2 oil): 165 Fuel oil (No. 6 and other): 300	Less than 50 MWe: PM 100; for coal with less than 10% volatile matter, NO _x is 1,500 mg/Nm ³
Thermal power, rehabilitation of existing plants	100*			In rare cases, 150 mg/Nm ³ PM is acceptable
Vegetable oil processing	50			Odor: acceptable to neighbors
Wood preserving industry				VOCs: 20

* See column headed "Other; comments."

Table 2. Effluent Discharge Requirements: Parameters and Maximum Values, Miscellaneous Parameters

(mg/l, except pH and as otherwise specified)

Guideline	pH	BOD ₅	COD	TSS	O&G	Phenol	CN	N	P	F	Cl	Coli-form	Temp. Increase	Other; comments
Aluminum manufacturing	6–9		150	50						20			≤ 3° C	HC: 5
Base metal and iron ore mining	6–9		150	50	10		Free: 0.1 WAD: 0.5 Total: 1.0							
Breweries	6–9	50	250	50	10			NH ₄ : 10	5				≤ 3° C	
Cement manufacturing	6–9			50									≤ 3° C	
Chlor-alkali industry	6–9		150	20							0.2			AOX: 0.5; sulfite: 1.0
Coal mining and production	6–9			50	10									TSS: 35 (monthly average)
Coke manufacturing		30	150	50	10	0.5	Total: 0.2	Total: 10					≤ 3° C	Benzene: 0.05; dibenz(a,h)anthracene: 0.05; benzo(a)pyrene: 0.05
Copper smelting	6–9			50									≤ 3° C	
Dairy industry	6–9	50	250	50	10			Total: 10	2			400 MPN/ 100 ml	≤ 3° C	
Dye manufacturing	6–9	30	150	50	10	0.5								Total organic (each), e.g., benzidine: 0.05; AOX: 1 mg/l
Electronics manufacturing	6–9	50		*	10		Free: 0.1 Total: 1	NH ₃ : 10	5	20				TSS: 50 (maximum), 20 (monthly average); chlorocarbons and hydrochlorocarbons (total): 0.5
Electroplating industry	7–10			25	10		Free: 0.2		5	20				Trichloroethylene and trichloroethane (each): 0.05
Foundries	6–9			50	10								≤ 3° C	
Fruit and vegetable processing	6–9	50	250	50	10			Total: 10	5					
General environmental guidelines	6–9	50	250	50	10	0.5	Total: 1 Free: 0.1	NH ₃ : 10	2	20	0.2	400 MPN/ 100 ml	≤ 3° C	Sulfide: 1.0
Glass manufacturing	6–9		250	50	10									
Industrial estates	6–9	50	250	50*	10	0.5							≤ 3° C	TSS: 20 mg/l where toxic metals are present at significant levels; sulfide: 1; AOX: 1; benzene: 0.05; benzo(a)pyrene: 0.05

Iron and steel manufacturing	6-9	250	50	10	0.5	Free: 0.1 Total: 1			≤ 3° C		
Lead and zinc smelting	6-9			20					≤ 3° C		
Meat processing and rendering	6-9	50	250	50	10		Total: 10	5		400 MPN/ 100 ml	
Mini steel mills	6-9			50	10				≤ 3° C		
Mixed fertilizer plants	6-9			50			NH ₄ : 10	5	20		
Nickel smelting and refining	6-9			50							
Nitrogenous fertilizer plants	6-9			50			NH ₃ : 10 Urea: 1			≤ 3° C	
Oil and gas development (onshore)	6-9	50		50	20*	1				≤ 3° C	O&G: up to 40 mg/l is acceptable for facilities producing < 10,000 tpd.; sulfide: 1
Pesticides formulation	6-9		150	20	10						TSS: 20, monthly average must not exceed 50 mg/l at any time; AOX: 1; organochlorines: 0.05; nitroorganics: 0.05; pyrethroids: 0.05; phenoxy compounds: 0.05; active ingredients (each): 0.05
Pesticides manufacturing	6-9	30	150	10	10	0.5					AOX: 1; active ingredients (each): 0.05; BOD test to be done only when no toxics to microorganisms are present
Petrochemicals manufacturing	6-9	30	150	30	10	0.5	Total: 10			≤ 3° C	Benzene: 0.05; vinyl chloride: 0.05; sulfide: 1
Petroleum refining	6-9	30	150	30	10	0.5	Total: 10			≤ 3° C	Benzene: 0.05; benzo(a)pyrene: 0.05; sulfide: 1
Pharmaceutical manufacturing	6-9	30*	150	10	10	0.5					AOX: 1; active ingredients (each): 0.05; BOD test to be done only when no toxics to microorganisms are present

(Table continues on the following page.)

Table 2. (continued)

Guideline	pH	BOD ₅	COD	TSS	O&G	Phenol	CN	N	P	F	Cl	Coli-form	Temp. Increase	Other; comments
Phosphate fertilizer plants	6–9			50					5	20				
Printing industry	6.5–10	30	150	50	10									
Pulp and paper mills	6–9		*					0.4 kg/t	0.05 kg/t				≤ 3° C	COD: kraft and CTMP, 300 mg/l, 15 kg/t; sulfite, 700 mg/l, 40 kg/t; mechanical and recycled fiber, 10 mg/l, 5 kg/t; paper mills, 250 mg/l; AOX: 40 mg/l, 2 kg/t for new mills (target is 4 mg/l. 0.2 kg/t); 40 mg/l, 2 kg/t for retrofits (target is 8 mg/l, 0.4 kg/t); 4 mg/l for paper mills
Sugar manufacturing	6–9	50	250	50	10			NH ₄ : 10	2				≤ 3° C	
Tanning and leather finishing	6–9	50	250	50	10			NH ₄ : 10	2			400 MPN/100 ml		Sulfide: 1
Textiles industry	6–9	50	250	50	10	0.5						400 MPN/100 ml	≤ 3° C	AOX: 8; pesticides (each): 0.05; sulfide: 1
Thermal power	6–9			50	10						Total residual: 0.2*		≤ 3° C	Chlorine shocking: maximum value is 2 mg/l for up to 2 hours, not to be repeated more frequently than once in 24 hours, with a 24-hour average of 0.2 mg/l
Vegetable oil processing	6–9	50	250	50	10			Total: 10					≤ 3° C	
Wood preserving industry	6–9		150	50	10	0.5				20				PAHs (each): 0.05; pesticides (each): 0.05; dioxins/furans (sum of all): 0.0005

* See column headed "Other; comments."

Table 3. Effluent Discharge Requirements: Parameters and Maximum Values, Metals

(mg/l, unless otherwise specified)

Guideline	Total													Total metals	Other; comments		
	Ag	Al	As	Cd	Cr ⁺⁶	Cr	Cu	Fe	Hg	Ni	Pb	Sn	Zn				
Aluminum manufacturing		0.2															
Base metal and iron ore mining			0.1	0.1	0.1		0.5	3.5	0.01	0.5	0.2		2	10			
Breweries																	
Cement manufacturing																	
Chlor-alkali industry																	
Coal mining and production									3.5					10			
Coke manufacturing																	
Copper smelting			0.1	0.1			0.5	3.5	0.01		0.1		1	10			
Dairy industry																	
Dye manufacturing					0.1		0.5						2	2			
Electronics manufacturing			0.1	0.1	0.1		0.5		0.01	0.5	0.1	2		10			
Electroplating industry	0.5		0.1	0.1	0.1	0.5	0.5		0.01	0.5	0.2		2	10			
Foundries							0.5						2				
Fruit and vegetable processing																	
General manufacturing	0.5		0.1	0.1	0.1	0.5		3.5	0.01	0.5	0.1		2	10		Se: 0.1	
Glass manufacturing											0.1			10			
Industrial estates				0.1	0.1	0.5	0.5			0.5	0.1		2				
Iron and steel manufacturing				0.1		0.5			0.01		0.2		2				
Lead and zinc smelting			0.1	0.1			0.5	3.5	0.01		0.1		2	5			
Meat processing and rendering																	
Mini steel mills				0.1	0.1	0.5	0.5			0.5	0.1						
Mixed fertilizer plants				0.1										10			
Nickel smelting and refining								3.5		0.5				10			
Nitrogenous fertilizer plants																	
Oil and gas development (onshore)														See com-ments		Total toxic metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, zinc): 5	
Pesticides formulation			0.1		0.1		0.5		0.01								
Pesticides manufacturing			0.1		0.1		0.5		0.01								
Petrochemicals manufacturing				0.1	0.1		0.5										

(Table continues on the following page.)

Table 3. (continued)

Guideline	Total													Total metals	Other; comments	
	Ag	Al	As	Cd	Cr ⁺⁶	Cr	Cu	Fe	Hg	Ni	Pb	Sn	Zn			
Petroleum refining					0.1	0.5					0.1					
Pharmaceutical manufacturing			0.1	0.1	0.1				0.01							
Phosphate fertilizer plants				0.1												
Printing industry	0.5			0.1	0.1	0.5	0.5	0.5							2	
Pulp and paper mills																
Sugar manufacturing																
Tanning and leather finishing					0.1	0.5										
Textiles industry						0.5	0.5			0.5				2		Co: 0.5
Thermal power						0.5	0.5	1						1		
Vegetable oil processing																
Wood preserving industry			0.1		0.1	0.5	0.5									