NATIONAL ENVIRONMENTAL QUALITY (EMISSION) GUIDELINES

CHAPTER I
General Provisions

Objective

1. These national Environmental Quality (Emission) Guidelines (hereafter referred to as Guidelines) provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health.

Definitions

2. The expressions contained in these Guidelines shall have the same meanings as are assigned to them in the Environmental Impact Assessment (EIA) Procedure. In addition thereto, the following expressions shall have the meanings given hereunder:

   (a) **Ambient** environmental guideline or standard means the allowable amount of substances, as a concentration of a contaminant in water or air, set to protect against anticipated adverse effects on the environment or human health.

   (b) **Concentration** means the quantity of a physical, chemical, biological or pathogenic substance in air or water with the dimension of mass per volume (or sometimes mass per mass) calculated according to a common measurement unit (e.g. milligram per liter).

   (c) **Contaminant** means any physical, chemical, biological, or radiological substance or matter that may pose a potential harm to the environment or human health.

   (d) **Effluent** means wastewater, treated or untreated, that is discharged to surface waters from a treatment plant, sewer, or industrial outfall.

   (e) **Guideline values** are maximum concentrations or specified ranges of parameters that should not be exceeded in air emissions and liquid discharges.

   (f) **Parameter** means indicators used to measure the level or concentration (population density in case of biological pollutants) against guidelines or standards. The result of measurement could be shown in either numeric or textual form.

   (g) **Point of compliance** means the location on land or in water at which a given substance concentration must meet the applicable Guideline value.

   (h) **Pollution** means any direct or indirect alteration, effect of the physical, thermal, chemical or biological properties of any part of the environment including land, water and atmosphere by discharging, emitting, dispersing, or depositing hazardous substances or wastes so as to affect beneficial use of the environment, or to affect public health, safety or welfare.

   (i) **Pollution prevention** refers to the use of processes, practices, materials, products, substances or energy to avoid or minimize the creation of pollutants and waste, and reduce overall risk to the environment or human health.

Scope of Application

3. These Guidelines have been primarily excerpted from the International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines, which provide technical guidance on good international industry pollution prevention practice for application in developing countries. The Guidelines are generally considered to be achievable in new facilities by existing technology at reasonable costs. Application of these Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them.

4. Unless otherwise indicated, these Guidelines refer to emission sources, and are intended to prevent or minimize adverse impacts to environmental quality or human health by ensuring that pollutant concentrations do not reach or exceed ambient guidelines and standards. The Guidelines apply to projects that generate noise or air emissions, and / or that have either direct or indirect discharge of process water, wastewater from utility operations or storm water to the environment.

5. General and industry-specific Guidelines as set out in Annex 1 – Emissions Guidelines shall apply to any project subject to EIA Procedure, as adopted by the Ministry, in order to protect the environment and to control pollution in the Republic of the Union of Myanmar. These Guidelines specifically apply to all project types listed in the EIA Procedure under 'Categorization of Economic Activities for Assessment Purposes' which sets out projects that are subject to EIA or initial environmental examination.

6. Provisions of the general and applicable industry-specific Guidelines shall be reflected in project environmental management plan (EMP) and environmental compliance certificate (ECC) and together constitute a project's commitment to take necessary measures to avoid, minimize and control adverse impacts to human health and safety, and the environment through reducing the total amount of emissions generation; to adopting process modifications, including waste minimization to lower the load of pollutants requiring treatment; and as necessary, to apply treatment techniques to further reduce the load of contaminants prior to release or discharge.

7. Recognizing that these Guidelines are intended to prevent pollution through reducing the mass of pollutants emitted to the environment, dilution of air emissions and effluents to achieve maximum permitted values is not acceptable. Specified guideline values should be achieved, without dilution, at least 95 percent of the time that a project is operating, to be calculated as a proportion of annual operating hours.

8. Further reference should be made by projects to applicable industry-specific IFC EHS guidelines for advice on means of achieving guideline values set out in Annex 1.

CHAPTER II
Implementation Procedures

9. As specified in the EIA Procedure, all projects are obliged to use, comply with and refer to applicable national guidelines or standards or international standards adopted by the Ministry. These Guidelines will henceforth be applied by the Ministry in satisfying this requirement until otherwise modified or succeeded by other guidelines or standards.

10. As specified in the EIA Procedure, following project approval a project shall commence implementation strictly in accordance with the project EMP and any additional requirements set out in the project ECC, which will encompass conditions relating to

emissions. In this regard, the Ministry will require that projects adhere to general and applicable industry guidelines as set out in Annex 1.

11. While these Guidelines generally apply to all projects subject to the EIA Procedure, it is the prerogative of the Ministry to decide how the Guidelines should be applied to existing projects as referred to in the EIA Procedure, as distinguished from new projects. At the Ministry's discretion less stringent levels or measures than provided for in these Guidelines may be specified as appropriate, and a timeframe agreed for a project to fully comply with these Guidelines.

12. As specified in the EIA Procedure, projects shall engage in continuous, proactive and comprehensive self monitoring of the project and comply with applicable guidelines and standards. For purposes of these Guidelines, projects shall be responsible for the monitoring of their compliance with general and applicable industry-specific Guidelines as specified in the project EMP and ECC.

13. Air emissions, noise, odor, and liquid / effluent discharges will be sampled and measured at points of compliance as specified in the project EMP and ECC.

Annex 1
Emission Guidelines

1.0 GENERAL GUIDELINES

1.1 Air Emissions

Projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimize impacts by ensuring that: (i) emissions do not result in concentrations that reach or exceed national ambient quality guidelines and standards, or in their absence current World Health Organization (WHO) Air Quality Guidelines[1] for the most common pollutants as summarized below; and (ii) emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards (i.e. not exceeding 25 percent of the applicable air quality standards) to allow additional, future sustainable development in the same air shed. Industry-specific guidelines summarized hereinafter shall be applied by all projects to ensure that air emissions conform to good industry practice. Reference should be made to WHO's Air Quality Guidelines for Europe[2] for air pollutants not included in the following table.

Parameter	Averaging Period	Guideline Value µg/m^3
Nitrogen dioxide	1-year 1-hour	40 200
Ozone	8-hour daily maximum	100
Particulate matter PM_{10}[a]	1-year 24-hour	20 50
Particulate matter $PM_{2.5}$[b]	1-year 24-hour	10 25
Sulfur dioxide	24-hour 10-minute	20 500

[a] Particulate matter 10 micrometers or less in diameter

[b] Particulate matter 2.5 micrometers or less in diameter

The following small-combustion facilities emission guideline applies to project systems designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of fuel type, with a total, rated heat input capacity of 3-50 megawatt thermal. The industry-specific Thermal Power guideline applies to larger facilities exceeding 50 megawatt generation.

Combustion Technology / Fuel	Particulate matter PM_{10}[a]	Sulfur Dioxide	Nitrogen Oxides
Gas	-	-	200[b] mg/Nm^3[c] 400[d] mg/Nm^3 1,600[e] mg/Nm^3

[1] Air quality guidelines global update. 2005. World Health Organization.

[2] Air quality guidelines for Europe. 1997. WHO regional publications, European series No. 23. World Health Organization.

Liquid	100	3%	1,600-1,850[f] mg/Nm^3
Natural gas (3-<15 MW[g])	-	-	90[h] mg/Nm^3 210[i] mg/Nm^3
Natural gas (15-<50 MW)	-	-	50 mg/Nm^3
Fuels other than natural gas (3-<15 MW)	-	0.5% sulfur	200[h] mg/Nm^3 310[j] mg/Nm^3
Fuels other than natural gas (15-<50 MW)	-	0.5% sulfur	150 mg/Nm^3
Gas	-	-	320 mg/Nm^3
Liquid	150 mg/Nm^3	2,000 mg/Nm^3	460 mg/Nm^3
Solid[j]	150 mg/Nm^3	2,000 mg/Nm^3	650 mg/Nm^3

[a] Particulate matter 10 micrometers or less in diameter

[b] Spark ignition; [d] dual fuel; [e] compression ignition

[c] Milligrams per normal cubic meter at specified temperature and pressure

[f] Higher value applies if bore size >400 mm

[g] Megawatt

[h] Electric generation; [j] mechanical drive

[j] Includes biomass

1.2 Wastewater

Industry-specific guidelines apply during the operations phase of projects and cover direct or indirect discharge of wastewater to the environment. They are also applicable to industrial discharges to sanitary (domestic) sewers that discharge to the environment without any treatment. Wastewater generated from project operations includes process wastewater, wastewater from utility operations, runoff from process and storage areas, and miscellaneous activities including wastewater from laboratories, and equipment maintenance shops. Projects with the potential to generate process wastewater, sanitary sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety or the environment. Industry-specific guidelines summarized hereinafter shall be applied by all projects, where applicable, to ensure that effluent emissions conform to good industry practice.

For project types where industry-specific guidelines are not set out in these Guidelines, the following general guideline values, or as stipulated on a case-by-case basis, apply during project operations.

Wastewater, Storm Water Runoff, Effluent and Sanitary Discharges (general application)[3]

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1

[3] Pollution prevention and abatement handbook. 1998. Toward cleaner production. World Bank Group in collaboration with United Nations Environment Programme and the United Nations Industrial Development Organization.

Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Fluoride	mg/l	20
Heavy metals (total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

In addition to general and industry-specific wastewater guidelines applicable during project operations, the following guideline values apply during the construction phase of projects, covering storm water or surface water, and sanitary wastewater discharges from all project sites.

Site Runoff and Wastewater Discharges (construction phase)

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria[4]	100 ml	400

[4] Coliforms refer to a group of bacteria which are found in the intestines of warm blooded animals and therefore are present in sewage, and on / in soils, surface waters and vegetation. Total coliforms is used as an indicator organism which, although by itself is not considered to cause diseases in man or animals, usually indicates the presence of pathogenic or disease-causing organisms. By

Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

1.3 Noise Levels

Noise prevention and mitigation measures should be taken by all projects where predicted or measured noise impacts from a project facility or operation exceed the applicable noise level guideline at the most sensitive point of reception. Noise impacts should not exceed the levels shown below, or result in a maximum increase in background levels of three decibels at the nearest receptor location off-site.

Receptor	One Hour LAeq (dBA)[a]	
	Daytime 07:00 - 22:00 (10:00 - 22:00 for Public holidays)	**Nighttime 22:00 - 07:00** (22:00 - 10:00 for Public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

[a] Equivalent continuous sound level in decibels

1.4 Odor[5]

Point and diffuse source odors from industries should be minimized using available prevention and control techniques as described in the IFC EHS industry-specific guidelines. Point source activities are those that involve stack emissions of odor and which generally can be controlled using waste reduction, waste minimization and cleaner production principles or conventional emission control equipment. Diffuse source activities are generally dominated by area or volume source emissions of odor (e.g. intensive agricultural activities) and which can be more difficult to control. Projects should control odors to ensure that odors that are offensive or unacceptable to neighbors do not occur. Generally, odor levels should not exceed five to ten odorant units[6] at the edge of populated areas in the vicinity of a project. Projects with multiple odorous point or diffuse releases, or emitting complex odors should conduct an odor impact assessment to determine ground-level maximum concentrations taking into account site-specific factors including proximity to populated areas.

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measuring the number of total coliforms present in a sample a judgment can be made as to the water's usability for a given purpose.

[5] Industrial odor control. 2002. Environmental guideline No.9, Danish Environmental Protection Agency, Ministry of Environment.

[6] The detectability of an odor is a sensory property that refers to the minimum concentration that produces an olfactory response or sensation. An odorant unit is defined as the amount of odorant mixtures which distributed in one cubic meter of air results in odor intensities corresponding to a defined threshold value. The odorant unit is therefore defined by a physiologically measured amount of substance. In practice, offensive odor can only be judged by public reaction to the odor, with the nuisance level being as low as two odorant units and as high as ten odorant units for less offensive odors. An odor assessment criteria of five to ten odorant units is likely to represent the level below which offensive odors should not occur.

2.0 INDUSTRY-SPECIFIC GUIDELINES

2.1 Energy Sector Development

2.1.1 Thermal Power[7]

This guideline applies to combustion processes fueled by gaseous, liquid, and solid fuels and biomass and designed to deliver electrical or mechanical power, steam, heat, or any combination of these, regardless of the fuel type (except for solid waste which is covered under the guideline for Waste Management Facilities), with a total rated heat input capacity above 50 megawatt thermal input on high heating value basis. It applies to boilers, reciprocating engines, and combustion turbines in new and existing facilities.

Effluent Levels

Parameter	Unit	Guideline Value
Arsenic	mg/l	0.5
Cadmium	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Iron	mg/l	1
Lead	mg/l	0.5
Mercury	mg/l	0.005
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total residual chlorine	mg/l	0.2
Total suspended solids	mg/l	50
Zinc	mg/l	1

[a] Standard unit

[b] Temperature increase due to discharge of once-through cooling water

Air Emission Levels (applicable to non-degraded air sheds)

Combustion Technology / Fuel	Parameter / Guideline Values		
	Particulate matter PM_{10}[a]	Sulfur dioxide	Nitrogen oxides
Combustion turbine			
Fuels other than natural gas (unit > 50 MW[c])	50 mg/Nm^3[b]	Use of ≤ 1% Sulfur fuel	310 mg/Nm^3
Natural gas (all turbine types; unit > 50 MW)	-	-	100 mg/Nm^3
Boiler			
Liquid fuels (plant > 600 MW)	50 mg/Nm^3	200 mg/Nm^3	400 mg/Nm^3

[7] Environmental, health, and safety guidelines for thermal power. 2007. International Finance Corporation, World Bank Group.

Liquid fuels (plant 50-600 MW)	50 mg/Nm^3	900 mg/Nm^3	400 mg/Nm^3
Natural gas	-	-	240 mg/Nm^3
Other gaseous fuels	50 mg/Nm^3	400 mg/Nm^3	240 mg/Nm^3
Solid fuels (plant > 600 MW)	50 mg/Nm^3	200 mg/Nm^3	510 mg/Nm^3
Solid fuels (plant 50-600 MW)	50 mg/Nm^3	900 mg/Nm^3	510 mg/Nm^3
Reciprocating engine			
Biofuels / gaseous fuels other than natural gas	50 mg/Nm^3	-	30% higher than for other fuels
Liquid fuels (plant > 300 MW)	50 mg/Nm^3	585 mg/Nm^3	740 mg/Nm^3
Liquid fuels (plant 50-300 MW)	50 mg/Nm^3	1,170 mg/Nm^3	1,460 mg/Nm^3
Natural gas	-	-	200 mg/Nm^3

[a] Particulate matter 10 micrometers or less in diameter

[b] Milligrams per normal cubic meter at specified temperature and pressure

[c] Megawatt

2.1.2 Geothermal Power[8, 9]

This guideline applies to geothermal power generation activities. Potential contaminants in geothermal effluents will vary according to the mineralogy of the host geological formation, temperature of the geothermal water, and site-specific facility processes. Spent geothermal fluids are typically re-injected to the host rock formation, resulting in minor effluent volumes. If spent geothermal fluids are not re-injected, and effluents are considered likely to have elevated heavy metal concentrations the following effluent levels should apply. Minor air emissions of hydrogen sulfide, mercury vapor, and sulfur dioxide may arise as fugitive emissions from the cooling tower if the condensation process involves direct contact of steam with cooling water. Although geothermal energy projects do not normally generate significant point source emissions during construction and operations, hydrogen sulfide and other types of emissions should not result in ambient concentrations exceeding the following ambient air quality levels.

Effluent Levels

Parameter	Unit	Guideline Value
Arsenic	mg/l	0.1
Cadmium	mg/l	0.05
Chemical oxygen demand	mg/l	150
Chromium (hexavalent)	mg/l	0.1
Copper	mg/l	0.3
Cyanide	mg/l	1
Cyanide (free)	mg/l	0.1
Cyanide (weak acid dissociable)	mg/l	0.5

[8] Environmental, health, and safety guidelines for geothermal power generation. 2007. International Finance Corporation, World Bank Group.

[9] Air quality guidelines for Europe. 2000. Second edition. WHO regional publication, European series No. 91. World Health Organization.

Iron (total)	mg/l	2
Lead	mg/l	0.2
Mercury	mg/l	0.002
Nickel	mg/l	0.5
pH	S.U.[a]	6-9
Temperature	°C	<3 degree differential
Total suspended solids	mg/l	50
Zinc	mg/l	0.5

[a] Standard unit

Ambient Air Quality

Parameter	Unit	Guideline Value
Hydrogen sulfide	$\mu g/m^3$	7[a]
Inorganic mercury vapor	$\mu g/m^3$	1[b]
Sulfur dioxide	$\mu g/m^3$	500[c]

[a] Average over 30 minute period; [b] Annual average; [c] Average over 10 minute period

2.1.3 Wind Power[10]

This guideline applies to onshore and offshore wind energy facilities. Wind power facilities do not typically generate process effluents and emissions during operations. Any wastewater discharges should be treated as required to achieve the following effluent levels. General air emission and noise guidelines shall apply.

Effluent Levels

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[10] Environmental, health, and safety guidelines for wind energy. 2007. International Finance Corporation, World Bank Group.

2.1.4 Onshore Oil and Gas[11]

This guideline applies to seismic exploration, exploratory and production drilling, development and production activities, transport activities including pipelines, other facilities (i.e. pump stations, metering stations, pigging stations, compressor stations, storage facilities), ancillary and support operations, and decommissioning. For onshore oil and gas facilities located near the coast (e.g. coastal terminals, marine supply bases, loading / offloading terminals), additional guidance is given in the guideline for Ports, Harbors and Terminals.

Emissions, Effluent and Waste Levels

Parameter	Guideline
Drilling fluids and cuttings	Treatment and disposal in accordance with applicable standards provided in the IFC EHS Onshore Oil and Gas Development guideline
Produced sand	Treatment and disposal in accordance with applicable standards provided in the IFC EHS Onshore Oil and Gas Development guideline
Produced water	Treatment and disposal in accordance with applicable standards provided in the IFC EHS Onshore Oil and Gas Development guideline For discharge to surface waters or to land: − 5-day Biochemical oxygen demand 25 mg/l − Chemical oxygen demand 125 mg/l − Chlorides 600 mg/l (average), 1,200 mg/l maximum − Heavy metals (total)[a] 5 mg/l − pH 6-9[b] − Phenols 0.5 mg/l − Sulfides 1 mg/l − Total hydrocarbon content 10 mg/l − Total suspended solids 35 mg/l
Hydrotest water	Treatment and disposal in accordance with applicable standards provided in the IFC EHS Onshore Oil and Gas Development guideline For discharge to surface waters or to land: − 5-day Biochemical oxygen demand 25 mg/l − Chemical oxygen demand 125 mg/l − Chlorides 600 mg/l (average), 1,200 mg/l maximum − Heavy metals (total) 5 mg/l − pH 6-9 − Phenols 0.5 mg/l − Sulfides 1 mg/l − Total hydrocarbon content 10 mg/l − Total suspended solids 35 mg/l
Completion and well work-over fluids	Treatment and disposal in accordance with applicable standards provided in the IFC EHS Onshore Oil and

[11] Environmental, health, and safety guidelines for onshore oil and gas development. 2007. International Finance Corporation, World Bank Group.

	Gas Development guideline For discharge to surface waters or to land: − pH 6-9 − Total hydrocarbon content 10 mg/l
Storm water drainage	Storm water runoff should be treated through an oil / water separation system able to achieve oil and grease concentration of 10 mg/l
Cooling water	The effluent should result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 meters from point of discharge
Sewage	Holding and discharge to municipal or centralized wastewater treatment systems or onboard treatment to achieve: − 5-day Biochemical oxygen demand 30 mg/l − Chemical oxygen demand 125 mg/l − Oil and grease 10 mg/l − pH 6-9 − Total coliform bacteria 400/100 ml − Total nitrogen 10 mg/l − Total phosphorus 2 mg/l − Total suspended solids 50 mg/l
Air emissions	Achieve WHO ambient air quality guidelines, and apply the following guideline value to emissions: − Hydrogen sulfide 5 mg/Nm[3c]

[a] Heavy metals include: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Vanadium and Zinc

[b] Standard unit

[c] Milligrams per normal cubic meter at specified temperature and pressure

2.1.5 Offshore Oil and Gas[12]

This guideline applies to seismic exploration, exploratory and production drilling, development and production activities, offshore pipeline operations, offshore transportation, tanker loading and unloading, ancillary and support operations, and decommissioning. It also addresses potential onshore impacts that may result from offshore oil and gas activities.

Effluent Levels

This guideline is primarily applicable to discharges in offshore locations (i.e. greater than 12 nautical miles from shore). Discharge water quality to near-shore waters should be established on a case specific basis taking into account the environmental sensitivities and assimilative capacity of receiving waters.

[12] Environmental, health, and safety guidelines for offshore oil and gas development. 2007. International Finance Corporation, World Bank Group.

Parameter	Guideline
Drilling fluids and cuttings (non-aqueous drilling fluid)	Non-aqueous drilling fluid, re-inject or ship-to-shore; no discharge to sea Drilled cuttings, re-inject or ship-to-shore; no discharge except: − Oil concentration lower than 1% by weight on dry cuttings − Mercury maximum 1 mg/kg dry weight in stock barite − Cadmium maximum 3 mg/kg dry weight in stock barite − Discharge via a caisson at least 15 meters below sea surface
Drilling fluids and cuttings (water-based drilling fluid)	− Water-based drilling fluid, re-inject or ship-to-shore; no discharge to sea Water-based drilling fluids and cuttings, re-inject or ship-to-shore; no discharge to sea except: − Mercury 1 mg/kg dry weight in stock barite − Cadmium 3 mg/kg dry weight in stock barite − Maximum chloride concentration must be less that four time's ambient concentration of fresh or brackish receiving water − Discharge via a caisson at least 15 meters below sea surface
Produced water	Re-inject, discharge to sea maximum one day oil and grease discharge should not exceed 42 mg/l; 30 day average should not exceed 29 mg/l
Completion and well work-over fluids	Ship-to-shore or re-inject, no discharge to sea except: − Maximum one day oil and grease discharge should not exceed 42 mg/l; 30 day average should not exceed 29 mg/l − Neutralize to attain a pH of 5[a] or more
Produced sand	Ship-to-shore or re-inject, no discharge to sea except when oil concentration lower than 1% by weight on dry sand
Hydrotest water	− Send to shore for treatment and disposal − Discharge offshore following environmental risk analysis, careful selection of chemicals − Reduce use of chemicals
Cooling water	The effluent should result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 meters from point of discharge
Desalination brine	Mix with other discharge waste streams if feasible[b]
Sewage	Compliance with MARPOL 73/78[b]
Food waste	Compliance with MARPOL 73/78[b]
Storage displacement water	Compliance with MARPOL 73/78[b]
Bilgewater	Compliance with MARPOL 73/78[b]

Deck drainage	Compliance with MARPOL 73/78[b]

[a] Standard unit

[b] In nearshore waters, carefully select discharge location based on environmental sensitivities and assimilative capacity of receiving waters

2.1.6 Petroleum Refining[13]

This guideline applies to processing operations from crude oil to finished liquid products, including liquefied petroleum gas, motor gasoline, kerosene, diesel oil, heating oil, fuel oil, bitumen, asphalt, sulfur, and intermediate products (e.g. propane / propylene mixtures, virgin naphtha, middle distillate and vacuum distillate) for the petrochemical industry. Finished products are produced from the blending of intermediate products

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	30
Benzene	mg/l	0.05
Benzo(a)pyrene	mg/l	0.05
Chemical oxygen demand	mg/l	150
Chromium (hexavalent)	mg/l	0.05
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Iron	mg/l	3
Lead	mg/l	0.1
Mercury	mg/l	0.02
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenol	mg/l	0.2
Sulphides	mg/l	1
Temperature increase	°C	<3[b]
Total nitrogen	mg/l	10[c]
Total phosphorus	mg/l	2
Total suspended solids	mg/l	30
Vanadium	mg/l	1

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

[c] The effluent concentration of total nitrogen may be up to 40 mg/l in processes that include hydrogenation

[13] Environmental, health, and safety guidelines for petroleum refining. 2007. International Finance Corporation, World Bank Group.

Air Emission Levels

Parameter	Unit	Guideline Value
Hydrogen sulfide	mg/Nm^{3a}	10
Nickel	mg/Nm^3	1
Nitrogen oxides	mg/Nm^3	450
Particulate matter PM_{10}[b]	mg/Nm^3	50
Sulfur oxide	mg/Nm^3	150 (for sulfur recovery units) 500 (for other units)
Vanadium	mg/Nm^3	5

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

2.1.7 Natural Gas Processing[14]

This guideline applies to production of liquid products from natural gas, including naphtha, gasoline, kerosene, diesel fuel, waxes, lubes, and methanol.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	150
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Heavy metals (total)	mg/l	5
Iron	mg/l	3
Lead	mg/l	0.1
Nickel	mg/l	1.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenol	mg/l	0.5
Total Nitrogen	mg/l	40
Total phosphorus	mg/l	3
Total residual chlorine	mg/l	0.2
Total suspended solids	mg/l	50
Zinc	mg/l	1

[a] Standard unit

[14] Environmental, health, and safety guidelines for natural gas processing. 2007. International Finance Corporation, World Bank Group.

Air Emission Levels

Parameter	Unit	Guideline Value
Carbon monoxide	mg/Nm^{3a}	100
Nitrogen oxides	mg/Nm^3	150^b 50^c
Particulate matter PM_{10}^{d}	mg/Nm^3	10
Sulfur dioxide	mg/Nm^3	75
Volatile organic compounds	mg/Nm^3	150

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Applicable to facilities with a total heat input capacity of up to 300 MW

[c] Applicable to facilities with a total heat input capacity greater than 300 MW

[d] Particulate matter 10 micrometers or less in diameter

2.1.8 Natural Gas Liquefaction[15]

This guideline applies to liquefied natural gas base load liquefaction plants, transport by sea, and re-gasification and peak shaving terminals. For coastal liquefied natural gas facilities including harbors, jetties, and terminals additional guidance is given in the guideline for Ports, Harbors and Terminals. For issues related to vessels, guidance is provided in the guideline for Shipping.

Effluent Levels

Parameter	Guideline
Hydrotest water	For discharge to surface waters or to land: − Total hydrocarbon content 10 mg/l − pH 6-9[a] − 5-day Biochemical oxygen demand 25 mg/l − Chemical oxygen demand 125 mg/l − Total suspended solids 35 mg/l − Phenols 0.5 mg/l − Sulfides 1 mg/l − Heavy metals (total) 5 mg/l − Chlorides 600 mg/l (average), 1,200 mg/l maximum
Hazardous storm water drainage	Storm water runoff should be treated through an oil / water separation system able to achieve oil and grease concentration of 10 mg/l
Cooling water	The effluent should result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 meters from point of discharge. Free chlorine (total residual oxidant in estuarine / marine water) concentration in cooling / cold water

[15] Environmental, health, and safety guidelines for liquefied natural gas facilities. 2007. International Finance Corporation, World Bank Group.

	discharges (to be sampled at point of discharge) should be maintained at 0.2 parts per million
Sewage	Holding and discharge to municipal or centralized wastewater treatment systems or onboard treatment to achieve: − 5-day Biochemical oxygen demand 30 mg/l − Chemical oxygen demand 125 mg/l − Oil and grease 10 mg/l − pH 6-9 − Total coliform bacteria 400/100 ml − Total nitrogen 10 mg/l − Total phosphorus 2 mg/l − Total suspended solids 50 mg/l

[a] Standard unit

2.1.9 Crude Oil and Petroleum Product Terminals[16]

This guideline is applicable to land and shore-based petroleum storage terminals receiving and dispatching bulk shipments of crude oil, gasoline, middle distillates, aviation gas, lube oil, residual fuel oil, compressed natural gas, liquid petroleum gas, and specialty products from pipelines, tankers, railcars, and trucks for subsequent commercial distribution. Process effluent discharge quality guideline values should be established on a site-specific basis, taking into account effluent characteristics and receiving water use. Storm water runoff from terminals should be treated as required to achieve the following effluent levels. General air emissions guidelines shall apply and volatile organic compound emissions from all sources should be controlled such that ambient air quality levels do not exceed health-based standards.

Effluent Levels

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[16] Environmental, health, and safety guidelines for crude oil and petroleum product terminals. 2007. International Finance Corporation, World Bank Group.

2.1.10 Electric Power Transmission and Distribution[17]

This guideline applies to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas. Power transmission and distribution does not typically give rise to significant effluents or air emissions. Where potentially contaminated water runoff or dust exists, site operations should comply with the following effluent guideline and the general air quality guideline.

Effluent Levels

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

Additionally, exposure limits for general public exposure to electric and magnetic fields should comply with International Commission on Non-ionized Radiation Protection guidelines for limiting general public exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 Gigahertz).

Frequency	Electric Field (V/m[a])	Magnetic Field (μT[b])
50 Hz[c]	5000	100
60 Hz	4150	83

[a] Volts per meter; [b] Micro tesla; [c] Hertz

2.1.11 Gas Distribution Systems[18]

This guideline applies to distribution of natural gas from city gate to residential, commercial and industrial users for use in appliances, heating applications, and industrial process equipment. Although there are no significant point source effluents or emissions from gas distribution systems, fugitive emissions (from city gate and regulating stations, underground piping, and third party damage) constitute a significant portion of the overall atmospheric losses from the natural gas transmission and distribution industry. Gas distribution system should conduct volume reconciliation programs as an indicator of leakages by comparing delivered amounts against sales to customers, and implement inspection and maintenance programs to maintain and upgrade infrastructure and minimize fugitive gas emissions.

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[17] Environmental, health, and safety guidelines for electric power transmission and distribution. 2007. International Finance Corporation, World Bank Group.

[18] Environmental, health, and safety guidelines for gas distribution systems. 2007. International Finance Corporation, World Bank Group.

2.1.12 Retail Petroleum Networks[19]

This guideline is applicable to retail petroleum networks primarily dedicated to the sale of petroleum-based automotive and other fuels, including liquid petroleum gas and compressed natural gas, and which may provide limited vehicle repair and washing services. Guidance applicable to bulk storage and distribution of petroleum or petroleum-related products is included in the guideline for Crude Oil and Petroleum Product Terminals. Wastewater, including storm water, automobile washing and other discharges from retail petroleum facilities should be treated as required to achieve an oil and grease concentration of less than 15 mg/l. General air emissions guidelines shall apply and volatile organic compound emissions from all sources should be controlled such that ambient air quality levels do not exceed health-based standards.

2.1.13 Petroleum-based Organic Chemicals Manufacturing[20]

This guideline applies to large volume petroleum-based organic chemicals projects, including lower olefins, aromatics, oxygenated compounds, nitrogenated compounds, and halogenated compounds.

Effluent Levels

Parameter	Unit	Guideline Value
1,2-Dichloroethane	mg/l	1
5-day Biochemical oxygen demand	mg/l	25
Adsorbable organic halogens	mg/l	1
Benzene	mg/l	0.05
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	150
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Lead	mg/l	0.5
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenol	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	°C	<3[b]
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	30
Vinyl chloride	mg/l	0.05

[19] Environmental, health, and safety guidelines for retail petroleum networks. 2007. International Finance Corporation, World Bank Group.

[20] Environmental, health, and safety guidelines for large volume petroleum-based organic chemicals manufacturing. 2007. International Finance Corporation, World Bank Group.

Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
1,2-Dichloroethane	mg/Nm^{3a}	5
Acrylonitrile	mg/Nm^3	0.5 (incineration) 2 (scrubbing)
Ammonia	mg/Nm^3	15
Benzene	mg/Nm^3	5
Caprolactam	mg/m^3	0.1
Dioxin / Furans	ng TEQ^b/Nm^3	0.1
Ethylene	mg/Nm^3	150
Ethylene oxide	mg/m^3	2
Formaldehyde	mg/m^3	0.15
Heavy metals (total)	mg/Nm^3	1.5
Hydrogen chloride	mg/Nm^3	10
Hydrogen cyanide	mg/m^3	2
Hydrogen sulfide	mg/m^3	5
Mercury and compounds	mg/Nm^3	0.2
Nitrobenzene	mg/m^3	5
Nitrogen oxides	mg/Nm^3	300
Organic sulfide and Mercaptans	mg/m^3	2
Particulate matter PM_{10}[c]	mg/Nm^3	20
Phenols, Cresols and Xylols (as Phenol)	mg/Nm^3	10
Sulfur oxides	mg/m^3	100
Vinyl chloride	mg/Nm^3	5
Volatile organic compounds	mg/Nm^3	20

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Toxicity equivalence factor

[c] Particulate matter 10 micrometers or less in diameter

2.2 Agriculture, Livestock and Forestry Development

2.2.1 Plantation Industrial / Crop Production[21, 22]

This guideline applies to large-scale commercial plantation crops, including banana, citrus, sugarcane, olives, palm oil, coffee, and cacao. Crop production covers soil preparation, sowing or planting, crop husbandry, harvest, and post harvest operations. The guideline does not include the processing of raw materials into semi-finished or finished products.

Effluent Levels

Parameter	Unit	Maximum Concentration
Arsenic	mg/l	0.1
Biological oxygen demand	mg/l	30
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	125
Heavy metals (total)	mg/l	10
Lead	mg/l	0.1
Mercury	mg/l	0.01
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total organochlorine pesticides	mg/l	0.1
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

2.2.2 Annual Crop Production[23, 10]

This guideline applies to large-scale commercial annual crops, including cereals, pulses, roots and tubers, oil-bearing crops, fiber crops, vegetables, and fodder crops. Crop production covers soil preparation, sowing or planting, crop husbandry, harvest, and post harvest operations.

Effluent Levels

Parameter	Unit	Maximum Concentration
Arsenic	mg/l	0.1
Biological oxygen demand	mg/l	30
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	125

[21] Environmental, health, and safety guidelines for plantation crop production. 2007. International Finance Corporation, World Bank Group.

[22] Agriculture nonpoint source fact sheet: Polluted runoff. 2005. United States Environmental Protection Agency.

[23] Environmental, health, and safety guidelines for annual crop production. 2007. International Finance Corporation, World Bank Group.

Heavy metals (total)	mg/l	10
Lead	mg/l	0.1
Mercury	mg/l	0.01
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total organochlorine pesticides	mg/l	0.1
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

2.2.3 Mammalian Livestock Production[24]

This guideline applies to cattle ranching and farming, dairy farming, pig farming, and sheep and goat farming operations. It does not include feed production, dairy processing, or meat processing.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

2.2.4 Poultry Production[25]

This guideline applies to intensive poultry production and covers the production of laying hens, broiler chickens, turkeys, ducks and game birds. Poultry production operations include feed manufacture, storage and handling, poultry raising, feeding and watering, egg and/or live bird collection, management of animal waste, and disease and pest control.

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[24] Environmental, health, and safety guidelines for mammalian livestock production. 2007. International Finance Corporation, World Bank Group.

[25] Environmental, health, and safety guidelines for poultry production. 2007. International Finance Corporation, World Bank Group.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

2.2.5 Aquaculture[26]

This guideline applies to semi-intensive and intensive commercial aquaculture production of aquatic species, including crustaceans, mollusks, seaweeds and finfish.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

[26] Environmental, health, and safety guidelines for aquaculture. 2007. International Finance Corporation, World Bank Group.

2.2.6 Forest Harvesting Operations[27]

This guideline applies to management of both plantation and natural forests and covers production of roundwood timber, non-timber forest product collection, forest replanting, and ancillary activities (e.g. vehicles maintenance, nurseries). The forestry sector does not typically give rise to significant effluent discharges or point source air emissions. Where potentially contaminated water runoff or dust exists, the following source effluent levels and general air emissions guideline shall apply.

Effluent Levels

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

2.3 Manufacturing

2.3.1 Food and Beverages Manufacturing

2.3.1.1 Meat Processing[28]

This guideline applies to meat processing, focusing on bovine and porcine slaughtering and processing from reception of the animals until the carcasses are ready for sale or further processing. It additionally applies to simple processing of by-products of meat slaughtering.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10

[27] Environmental, health, and safety guidelines for forest harvesting operations. 2007. International Finance Corporation, World Bank Group.

[28] Environmental, health, and safety guidelines for meat processing. 2007. International Finance Corporation, World Bank Group.

Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

2.3.1.2 Poultry Processing[29]

This guideline applies to the processing of chickens, turkey and ducks, and cover process steps from the reception of live birds, slaughter, evisceration, and simple rendering.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

2.3.1.3 Fish Processing[30]

This guideline applies to fish processing facilities, including the post-harvest processing of fish, crustaceans, gastropods, cephalopods, and bivalves, originating from the sea or freshwater catch or from farming operations in salt or fresh water.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	

[29] Environmental, health, and safety guidelines for poultry processing. 2007. International Finance Corporation, World Bank Group.

[30] Environmental, health, and safety guidelines for fish processing. 2007. International Finance Corporation, World Bank Group.

Chemical oxygen demand	mg/l	250
Chlorine, total residual	mg/l	0.2
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Ammonia	mg/m^3	1
Amines and amides	mg/m^3	5
Hydrogen sulfide, Sulfides, and Mercaptans	mg/m^3	2

2.3.1.4 Food and Beverage Processing[31]

This guideline covers the processing of meat, vegetable, fruit, and other raw materials in value-added food and non-fermented beverage products for human consumption

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[31] Environmental, health, and safety guidelines for food and beverage processing. 2007. International Finance Corporation, World Bank Group.

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Emissions from food processing activities are principally associated with matter and odor. Particulate matter PM_{10} emissions should typically not exceed 50 mg/Nm^3.

2.3.1.5 Dairy Processing[32]

This guideline applies to the reception, storage, and industrial processing of raw milk and the handling and storage of processed milk and dairy products. It does not cover farming activities or collection of raw milk from farmers.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

2.3.1.6 Vegetable Oil Production and Processing[33]

This guideline applies to facilities that extract and process oils and fats from a variety of seeds, grains, and nuts. Additionally covered are crude oil production and refining processes, from the preparation of raw materials to the bottling and packaging of final products for human and animal consumption.

[32] Environmental, health, and safety guidelines for diary processing. 2007. International Finance Corporation, World Bank Group.

[33] Environmental, health, and safety guidelines for vegetable oil production and processing. 2015. International Finance Corporation, World Bank Group.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Dust	mg/Nm^{3a}	10 (dry dust) 40 (wet dust)
Hexane / Volatile organic compounds	mg/Nm^3	100
Volatile organic compounds[b]	Kg solvent loss/t feedstock	Animal fat: 1.5
		Castor: 3
		Rape seed: 1
		Sunflower seed: 1
		Soya beans (normal crush): 0.8
		Soya beans (white flakes): 1.2
		Other seeds and vegetable matter: 1.5 (fractionation excluding degumming) 4 (degumming)

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Refers to total solvent loss

2.3.1.7 Sugar Manufacturing[34]

This guideline applies to sugar manufacturing facilities, involving processing of beet and cane into crystalline sugar and other by-products (e.g. ethanol and other organic chemicals).

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Biocides	mg/l	0.05
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

2.3.1.8 Breweries and Distilleries[35]

This guideline covers the production of beer, wine and spirits from raw material storage to dispatch of the finished product. It does not cover malt production or the production of non-alcoholic beverages and soft drinks.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Active ingredients / Antibiotics	To be determined on a case specific basis	
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10

[34] Environmental, health, and safety guidelines for sugar manufacturing. 2007. International Finance Corporation, World Bank Group.

[35] Environmental, health, and safety guidelines for breweries. 2007. International Finance Corporation, World Bank Group.

Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

2.3.2 Garments, Textile and Leather Products

2.3.2.1 Textiles Manufacturing[36]

This guideline applies to textile manufacturing using natural fibers, synthetic fibers (made entirely from chemicals), and regenerated fibers (made from natural materials by processing these materials to form a fiber structure). It does not include polymer synthesis and natural raw material production.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	30
Adsorbable organic halogens	mg/l	1
Ammonia	mg/l	10
Cadmium	mg/l	0.02
Chemical oxygen demand	mg/l	160
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Cobalt	mg/l	0.5
Color	m^{-1}	7 (436 nm[a], yellow) 5 (525 nm, red) 3 (620 nm, blue)
Copper	mg/l	0.5
Nickel	mg/l	0.5
Oil and grease	mg/l	10
Pesticides	mg/l	0.05-0.10[b]
pH	S.U.[c]	6-9
Phenol	mg/l	0.5
Sulfide	mg/l	1
Temperature increase	°C	<3[d]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	2

[a] Nanometers

[36] Environmental, health, and safety guidelines for textiles manufacturing. 2007. International Finance Corporation, World Bank Group.

[b] 0.05 mg/l for total pesticides (organophosphorus pesticides excluded); 0.10 mg/l for organophosphorus pesticides

[c] Standard unit

[d] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Ammonia	mg/Nm^3[a]	30
Carbon disulfide	mg/Nm^3	150
Chlorine	mg/Nm^3	5
Formaldehyde	mg/Nm^3	20
Hydrogen sulfide	mg/Nm^3	5
Particulates	mg/Nm^3	50[b]
Volatile organic compounds	mg/Nm^3	2/20/50/75/100/150[c,d]

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] As the 30-minute mean for stack emissions

[c] Calculated as Total carbon

[d] As the 30-minute mean for stack emissions: 2 mg/Nm^3 for volatile organic compounds classified as carcinogenic or mutagenic with mass flow greater than or equal to 10 g/hour; 20 mg/Nm^3 for discharges of halogenated volatile organic compounds with a mass flow equal or greater than 100 g/hour; 50 mg/Nm^3 for waste gases from drying of large installations (solvent consumption > 15 tons/year); 75 mg/Nm^3 for coating application processes for large installations (solvent consumption > 15 tons/year); 100 mg/Nm^3 for small installations (solvent consumption < 15 tons/year); if solvent is recovered from emissions and reused, the guideline value is 150 mg/Nm^3

2.3.2.2 Tanning and Leather Finishing[37]

This guideline applies to large scale tanning and leather finishing projects, and specifically to operations related to preliminary treatment of raw hides, tanning processes, post-tanning processes, and finished products manufacturing. Small-scale projects not utilizing Chromium and other chemical tanning agents should achieve the same guideline values with the exception of Chromium (which should not apply to such facilities).

Effluent Levels (for tanning and leather finishing)

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Chemical oxygen demand	mg/l	250
Chloride	mg/l	1,000
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5

[37] Environmental, health, and safety guidelines for tanning and leather finishing. 2007. International Finance Corporation, World Bank Group.

Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenols	mg/l	0.5
Sulfate	mg/l	300
Sulfide	mg/l	1.0
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels (for leather finishing)

Pollutant	Unit	Guideline Value
Upholstery leather	kg of hazardous air pollutant loss per 100 m^2 of leather processed	3.3
Water resistant / specialty leather		2.7
Non-water resistant leather		1.8

2.3.3 Wood Manufacturing

2.3.3.1 Sawmilling and Manufactured Wood Products[38]

This guideline applies to projects such as furniture manufacturing, as well as plants manufacturing glue laminated boards and beams. It includes preservative treatment of timber and timber products.

Effluent Levels (for wood treatment and preservation[a])

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Arsenic	mg/l	0.1
Chemical oxygen demand	mg/l	150
Chromium (total)	mg/l	0.5
Chromium (hexavalent)	mg/l	0.1
Copper	mg/l	0.5
Fluorides	mg/l	5
Oil and grease	mg/l	10
Pesticides (each)	mg/l	0.05

[38] Environmental, health, and safety guidelines for sawmilling and manufactured wood products. 2007. International Finance Corporation, World Bank Group.

pH	S.U.[b]	6-9
Phenols (mono- and dihydric)	mg/l	0.5
Polychlorinated dibenzo-p-dioxins / dibenzo furans	mg/l	0.1
Polycyclic aromatic hydrocarbons (each)	mg/l	0.05
Temperature increase	°C	<3[c]
Total suspended solids	mg/l	50

[a] Process wastewater containing chemical preservatives should be contained as part of closed loop application system

[b] Standard unit

[c] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels (for sawmill facilities)

Parameter	Unit	Guideline Value
Volatile organic compounds	mg/Nm^{3a}	20
Wood dust	mg/Nm^3	50

[a] Milligrams per normal cubic meter at specified temperature and pressure

2.3.3.2 Board and Particle-based Products[39]

This guideline applies to the manufacture of board and particle-based products such as particle-boards, oriented stand board, medium density fiberboard, plywood and glued and laminated products. It also applies to plants that make board from other raw materials such as sugar cane bagasse, straw, and linen.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Chemical oxygen demand	mg/l	150
Formaldehyde	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

[39] Environmental, health, and safety guidelines for board and particle-based products. 2007. International Finance Corporation, World Bank Group.

Air Emission Levels

Parameter	Unit	Guideline Value
Condensable volatile organic compounds	mg/Nm^3 (as Carbon)[a]	130
Formaldehyde	mg/Nm^3	20 (Wood dryers) 5 (Other sources)
Particulate matter PM_{10}[b]	mg/Nm^3	20 (Medium density fiberboard) 20 (Wood dryers) 50 (Other sources)

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

2.3.3.3 Pulp and / or Paper Mills[40]

This guideline applies to pulp and paper manufacturing facilities including wood-based chemical and mechanical pulping, recycled fiber pulping, and pulping based on non-wood raw materials such as bagasse, straw and reed. It does not include production or collection of raw materials.

Effluent Levels[a]

Parameter	Unit	Guideline Value
Bleached kraft pulp, integrated		
5-day Biochemical oxygen demand	kg/ADt[b]	1
Adsorbable organic halogen	kg/ADt	0.25
Chemical oxygen demand	kg/ADt	20
pH	S.U.[c]	6-9
Total nitrogen	kg/ADt	0.2
Total phosphorus	kg/ADt	0.03
Total suspended solids	kg/ADt	1.5
Unbleached kraft pulp, integrated		
5-day Biochemical oxygen demand	kg/ADt	0.7
Chemical oxygen demand	kg/ADt	10
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.2
Total phosphorus	kg/ADt	0.02
Total suspended solids	kg/ADt	1
Sulfite pulp, integrated and non-integrated		
5-day Biochemical oxygen demand	kg/ADt	2
Adsorbable organic halogen	kg/ADt	0.005
Chemical oxygen demand	kg/ADt	30
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.5

[40] Environmental, health, and safety guidelines for pulp and paper mills. 2007. International Finance Corporation, World Bank Group.

Total phosphorus	kg/ADt	0.05
Total suspended solids	kg/ADt	2
Chemi-thermo-mechanical		
5-day Biochemical oxygen demand	kg/Adt	1
Chemical oxygen demand	kg/ADt	5
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.2
Total phosphorus	kg/ADt	0.01
Total suspended solids	kg/ADt	1
Mechanical pulping, integrated		
5-day Biochemical oxygen demand	kg/ADt	0.5
Adsorbable organic halogen	kg/ADt	0.01
Chemical oxygen demand	kg/ADt	5
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.1
Total phosphorus	kg/ADt	0.01
Total suspended solids	kg/ADt	0.5
Recycled fiber, without de-inking, integrated		
5-day Biochemical oxygen demand	kg/ADt	0.15
Adsorbable organic halogen	kg/ADt	0.005
Chemical oxygen demand	kg/ADt	1.5
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.05
Total phosphorus	kg/ADt	0.005
Total suspended solids	kg/ADt	0.15
Recycled fiber, with de-inking, integrated		
5-day Biochemical oxygen demand	kg/ADt	0.2
Adsorbable organic halogen	kg/ADt	0.005
Chemical oxygen demand	kg/ADt	4
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.1
Total phosphorus	kg/ADt	0.01
Total suspended solids	kg/ADt	0.3
Recycled fibre tissue mills		
5-day Biochemical oxygen demand	kg/ADt	0.5
Adsorbable organic halogen	kg/ADt	0.005
Chemical oxygen demand	kg/ADt	4
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.25
Total phosphorus	kg/ADt	0.015
Total suspended solids	kg/ADt	0.4
Uncoated fine paper mills		
5-day Biochemical oxygen demand	kg/ADt	0.25
Adsorbable organic halogen	kg/ADt	0.005
Chemical oxygen demand	kg/ADt	2

pH	S.U.	6-9
Total nitrogen	kg/ADt	0.2
Total phosphorus	kg/ADt	0.01
Total suspended solids	kg/ADt	0.4
Coated fine paper mills		
5-day Biochemical oxygen demand	kg/ADt	0.25
Adsorbable organic halogen	kg/ADt	0.005
Chemical oxygen demand	kg/ADt	1.5
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.2
Total phosphorus	kg/ADt	0.01
Total suspended solids	kg/ADt	0.4
Tissue mills		
5-day Biochemical oxygen demand	kg/ADt	0.4
Adsorbable organic halogen	kg/ADt	0.01
Chemical oxygen demand	kg/ADt	1.5
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.25
Total phosphorus	kg/ADt	0.015
Total suspended solids	kg/ADt	0.4
Fiber preparation, non-wood		
5-day Biochemical oxygen demand	kg/ADt	2
Chemical oxygen demand	kg/ADt	30
pH	S.U.	6-9
Total nitrogen	kg/ADt	0.5
Total phosphorus	kg/ADt	0.05
Total suspended solids	kg/ADt	2

[a] Effluent values represent annual average values and are applicable to direct discharges of treated effluents to surface waters; daily average values should not be greater than 2.5 times the annual average values

[b] Air dried metric ton

[c] Standard unit

Air Emission Levels

Parameter	Type of Mill	Unit	Guideline Value
Nitrogen oxides (as Nitrogen dioxide)	Kraft, bleached	kg/ADt[a]	1.5 for hardwood pulp
			2 for softwood pulp
	Kraft, unbleached integrated	kg/ADt	1.5 for hardwood pulp
			2 for softwood pulp
	Sulfite, integrated and non-integrated	kg/ADt	2

Sulfur dioxide (as Sulfur)	Kraft, bleached	kg/ADt	0.4
	Kraft, unbleached integrated		0.4
	Sulfite, integrated and non-integrated		1
Total reduced sulfur compounds (as Sulfur)	Kraft, bleached	kg/ADt	0.2
	Kraft, unbleached integrated		0.2
Total suspended particulates	Kraft, bleached	kg/ADt	0.5
	Kraft, unbleached integrated		0.5
	Sulfite, integrated and non-integrated		0.15

[a] Air dried metric ton

2.3.3.4 Printing[41]

This guideline applies to printing facilities and the main printing technologies including lithography / offset, gravure / rotogravure, flexography, screen, and letterpress printing. It does not apply to plateless printing such as digital color printing machines, or electrostatic, magnetic or thermal devices.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	30
Adsorbable organic halogens	mg/l	1
Aluminum	mg/l	3
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	150
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide	mg/l	0.2
Iron	mg/l	3
Lead	mg/l	1
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Silver	mg/l	0.5
Temperature increase	°C	<3[b]
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	0.5

[a] Standard unit

[41] Environmental, health, and safety guidelines for printing. 2007. International Finance Corporation, World Bank Group.

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Isocyanates	mg/Nm^{3}[a]	0.1[b]
Nitrogen oxides	mg/Nm^{3}	100-500[c]
Particulates	mg/Nm^{3}	50[d]
Volatile organic halogens	mg/Nm^{3}	100[e,f]
		20[e,g]
		75[e,h]
		100[e,i]

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] As 30 minute mean for contained sources, excluding particulates; from all processes / activities using Isocyanates

[c] As 30 minute mean for contained sources; from turbines, reciprocating engines or boilers used as volatile organic compounds abatement equipment

[d] As 30 minute mean for contained sources; from all processes / activities

[e] Calculated as Total carbon

[f] Heatset web offset printing with 15-25 tons/year solvent consumption

[g] Heatset web offset printing with >25 tons/year solvent consumption

[h] Publication rotogravure with >25 tons/year solvent consumption

[i] Other rotogravure, flexography, rotary screen printing, laminating, or varnishing units (>15 tons/year solvent consumption); rotary screen on textile / card board (>30 tons/year solvent consumption

2.3.4 Chemicals Manufacturing

2.3.4.1 Large Volume Inorganic Compounds Manufacturing and Coal Tar Distillation[42]

This guideline applies to chemical manufacturing projects, and covers the production of large volume inorganic compounds, including ammonia, acids (nitric, hydrochloric, sulfuric, hydrofluoric, phosphoric acid), chlor-alkali (e.g. chlorine, caustic soda, soda ash), carbon black, and coal tar distillation (naphthalene, phenathrene, anthracene).

Effluent Levels

Parameter	Unit	Guideline Value
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Ammonia Plants		
Ammonia	mg/l	10[c]
Total suspended solids	mg/l	30

[42] Environmental, health, and safety guidelines for large volume inorganic compounds manufacturing and coal tar distillation. 2007. International Finance Corporation, World Bank Group.

Nitric Acid Plants		
Ammonia	mg/l	10
Nitrates	mg/l	25
Total suspended solids	mg/l	30
Sulfuric Acid Plants		
Fluoride	mg/l	20
Total phosphorus	mg/l	5
Total suspended solids	mg/l	30
Phosphoric Acid Plants		
Fluoride	mg/l	20
Total phosphorus	mg/l	5
Total suspended solids	mg/l	30
Hydrofluric Acid Plants		
Fluorides	kg/ton HF[d]	1
Suspended solids	kg/ton HF	1
	mg/l	30
Chlor-alkali / Hydrochloric Acid Plants		
Adsorbable organic halogens	mg/l	0.5
Chemical oxygen demand	mg/l	150
Chlorine	mg/l	0.2
Mercury	mg/l	0.05
	g/ton chlorine	0.1
Sulphides	mg/l	1
Total suspended solids	mg/l	20
Soda Ash Plants		
Ammonia	mg/l	10
Phosphorus	kg/ton	0.2
Suspended solids	kg/ton	270
Total suspended solids	mg/l	30
Carbon Black Plants		
Chemical oxygen demand	mg/l	100
Total suspended solids	mg/l	20
Coal Tar Distillation Plants		
5-day Biochemical oxygen demand	mg/l	35 (monthly average) 90 (daily maximum)
Anthracene, Naphthalene and Phenanthrene (each)	µg/l	20 (monthly average) 60 (daily maximum)
Total suspended solids	mg/l	50 (monthly average) 160 (daily maximum)

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

[c] Load based guideline: 0.1 kg/ton of product

[d] Hydrofluoric acid

Air Emission Levels

Parameter	Unit	Guideline Value
Ammonia Plants		
Ammonia	mg/Nm^3[a]	50
Nitrogen oxides	mg/Nm^3	300
Particulate matter PM_{10}[b]	mg/Nm^3	50
Nitric Acid Plants		
Ammonia	mg/Nm^3	10
Nitrogen oxides	mg/Nm^3	300
Nitrous oxide	mg/Nm^3	800
Sulfuric Acid Plants		
Hydrogen sulfide	mg/Nm^3	5
Nitrogen oxides	mg/Nm^3	200
Sulfur dioxide	mg/Nm^3	450 (2 kg/ton acid)
Sulfur trioxide	mg/Nm^3	60 (0.075 kg/ton acid)
Phosphoric / Hydrofluoric Acids Plants		
Fluorides (gaseous as Hydrogen fluoride)	mg/Nm^3	5
Particulate matter PM_{10} / Calcium fluoride	mg/Nm^3	50 (0.10 kg/ton phosphate rock)
Chlor-alkali / Hydrochloric Acid Plants		
Chlorine gas	mg/Nm^3	1 (partial liquefaction) 3 (complete liquefaction)
Hydrogen chloride	mg/Nm^3	20
Mercury	mg/Nm^3	0.2 (annual average emission of 1 g/ton chlorine)
Soda Ash Plants		
Ammonia	mg/Nm^3	50
Hydrogen sulfide	mg/Nm^3	5
Nitrogen oxides	mg/Nm^3	200
Particulate matter PM_{10}	mg/Nm^3	50
Carbon Black Plants		
Carbon monoxide	mg/Nm^3	500
Nitrogen oxides	mg/Nm^3	600
Particulate matter PM_{10}	mg/Nm^3	30
Sulfur dioxide	mg/Nm^3	850
Volatile organic compounds	mg/Nm^3	50
Coal Tar Distillation Plants		
Particulate matter PM_{10}	mg/Nm^3	50
Tar fume	mg/Nm^3	10
Volatile organic compounds	mg/Nm^3	50

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

2.3.4.2 Petroleum-based Polymers Manufacturing[43]

This guideline applies to petroleum-based polymer manufacturing where monomers are polymerized and finished into pellets or granules for subsequent industrial use.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	25
Adsorbable organic halogens	mg/l	0.3
Benzene	mg/l	0.05
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	150
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Lead	mg/l	0.5
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenol	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	°C	<3[b]
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	30
Vinyl chloride	mg/l	0.05
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Acrylonitrile	mg/Nm^{3a}	5 (15 from dryers)
Ammonia	mg/Nm^3	15
Dioxin / Furans	ng TEQ^b/Nm^3	0.1
Formaldehyde	mg/m^3	0.15
Heavy metals (total)	mg/Nm^3	1.5
Hydrogen chloride	mg/Nm^3	10

[43] Environmental, health, and safety guidelines for petroleum-based polymers manufacturing. 2007. International Finance Corporation, World Bank Group.

Mercury	mg/Nm^3	0.2
Nitrogen oxides	mg/Nm^3	300
Particulate matter PM_{10}[c]	mg/Nm^3	20
Sulfur oxides	mg/Nm^3	500
Vinyl chloride	g/t s-PVC[d] g/t e-PVC[e]	80 500
Volatile organic compounds	mg/Nm^3	20

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Toxicity equivalence factor

[c] Particulate matter 10 micrometers or less in diameter

[d] Grams per ton suspension polyvinylchloride

[e] Grams per ton emulsion polyvinylchloride

2.3.4.3 Coal Processing[44]

This guideline applies to the processing of coal into gaseous or liquid chemicals, including fuels, and the production of synthetic gas through various gasification processes and its subsequent conversion into liquid hydrocarbons, methanol, or other oxygenated liquid products, and well as the direct hydrogenation of coal into liquid hydrocarbons.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	30
Ammonia	mg/l	5
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	150 (40 cooling water)
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Cobalt	mg/l	0.5
Copper	mg/l	0.5
Cyanides	mg/l	0.5
Heavy metals (total)	mg/l	3
Iron	mg/l	3
Lead	mg/l	0.5
Manganese	mg/l	2
Mercury	mg/l	0.02
Nickel	mg/l	1
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenol	mg/l	0.5
Sulphide	mg/l	1
Total nitrogen	mg/l	10

[44] Environmental, health, and safety guidelines for coal processing. 2007. International Finance Corporation, World Bank Group.

Total phosphorus	mg/l	2
Total suspended solids	mg/l	35
Vanadium	mg/l	1
Zinc	mg/l	1

[a] Standard unit

Air Emission Levels

Parameter	Unit	Guideline Value
Coal Preparation Plant		
Conveying, storage and preparation gas opacity	%	10
Pneumatic coal cleaning equipment opacity	%	10
Pneumatic coal cleaning equipment particulate	mg/Nm^{3a}	40
Thermal dryer gas opacity	%	20
Thermal dryer particulate	mg/Nm^3	70
Overall		
Ammonia	mg/Nm^3	30
Carbonyl sulfide + Carbon disulfide	mg/Nm^3	3
Heavy metals (total)	mg/Nm^3	1.5
Hydrogen sulfide	mg/Nm^3	10
Mercury	mg/Nm^3	1
Nitrogen oxides	mg/Nm^3	200-400[b]
Particulate matter PM_{10}[c]	mg/Nm^3	30-50[b]
Sulfur dioxide	mg/Nm^3	150-200
Volatile organic compounds	mg/Nm^3	150

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Lower value for plants of >100 MW thermal equivalent, higher value for plants of <100 MW thermal equivalent

[c] Particulate matter 10 micrometers or less in diameter

2.3.4.4 Nitrogenous Fertilizer Production[45]

This guideline applies to facilities that produce ammonia-based nitrogenous fertilizers, including ammonia, urea, nitric acid, ammonium nitrate, calcium ammonium, nitrate, ammonium sulfate and mixed nitrogenous fertilizers, such as urea-ammonium sulphate and urea ammonium nitrate liquid fertilizers.

Effluent Levels

Parameter	Unit	Guideline Value
pH	S.U.[a]	6-9

[45] Environmental, health, and safety guidelines for nitrogenous fertilizer manufacturing. 2007. International Finance Corporation, World Bank Group.

Temperature increase	°C	<3[b]
Ammonia and Nitric Acid Plants		
Ammonia	mg/l	5
Total nitrogen	mg/l	15
Total suspended solids	mg/l	30
Urea Plants		
Ammonia (prill / granulation)	mg/l	5
Urea (prill / granulation)	mg urea/l	1
Ammonium Nitrate / Calcium Ammonium Nitrate Plants		
Ammonium nitrate	mg/l	100
Ammonia	mg/l	5
Total nitrogen	mg/l	15
Total suspended solids	mg/l	30

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Ammonia Plants		
Ammonia	mg/Nm^{3a}	50
Total nitrogen	mg/Nm^3	300
Total suspended solids	mg/Nm^3	50
Nitric Acid Plants		
Ammonia	mg/Nm^3	10
Nitrogen oxides	mg/Nm^3	200
Nitrous oxide	mg/Nm^3	800
Particulate matter PM_{10}[b]	mg/Nm^3	50
Urea / Urea Ammonium Nitrate Plants		
Ammonia (prill / granulation)	mg/Nm^3	50
Particulate matter PM_{10}	mg/Nm^3	50
Urea (prill / granulation)	mg/Nm^3	50
Ammonium Nitrate / Calcium Ammonium Nitrate Plants		
Ammonia	mg/Nm^3	50
Particulate matter PM_{10}	mg/Nm^3	50

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

2.3.4.5 Phosphate Fertilizer Manufacturing[46]

This guideline applies to facilities that produce phosphoric acid, single super-phosphate, triple super-phosphate, and compound (nitrogen / phosphorus / potassium) fertilizers.

Effluent Levels

Parameter	Unit	Guideline Value
Ammonia	mg/l	10
Cadmium	mg/l	0.1
Fluorides	mg/l	20
	kg/ton NPK[a]	0.03
	kg/ton Phosphorus oxide	2
Heavy metals (total)	mg/l	10
pH	S.U.[b]	6-9
Total nitrogen	mg/l	15
Total phosphorus	mg/l	5
Total suspended solids	mg/l	50

[a] Nitrogen, Phosphorus, Potassium

[b] Standard unit

Air Emission Levels

Parameter	Unit	Guideline Value
Phosphoric Acid Plants		
Fluorides (gaseous as Hydrogen fluoride)	mg/Nm^{3a}	5
Particulate matter PM_{10}[b]	mg/Nm^3	50
Phosphate Fertilizer Plants		
Ammonia	mg/Nm^3	50
Fluorides (gaseous as Hydrogen fluoride)	mg/Nm^3	5
Hydrogen chloride	mg/Nm^3	30
Nitrogen oxides	mg/Nm^3	500 (nitro-phosphate unit) 70 (mix acid unit)
Particulate matter PM_{10}	mg/Nm^3	50

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

2.3.4.6 Pesticides Formulation, Manufacturing and Packaging[47]

This guideline applies to the synthesis, optimization of the active ingredients, processing development (manufacturing), and the formulation and packaging of pesticides from these

[46] Environmental, health, and safety guidelines for phosphate fertilizer manufacturing. 2007. International Finance Corporation, World Bank Group.

[47] Environmental, health, and safety guidelines for pesticides formulation, manufacturing and packaging. 2007. International Finance Corporation, World Bank Group.

active ingredients. Pesticide groups include insecticides, herbicides, fungicides, acaricides (or miticides), nematicides, and rodenticides.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	30
Active ingredients (each)	mg/l	0.05
Adsorbable organic halogens	mg/l	1
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Chemical oxygen demand	mg/l	150
Chlorinated organics	mg/l	0.05
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Mercury	mg/l	0.01
Nitrorganics	mg/l	0.05
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenol	mg/l	0.5
Total phosphorus	mg/l	2
Total suspended solids	mg/l	10-20[b]
Zinc	mg/l	2

[a] Standard unit

[b] Lower value for pesticide manufacturing, higher value for pesticide formulation

Air Emission Levels

Parameter	Unit	Guideline Value
Ammonia, gaseous inorganic chlorine compounds	mg/Nm^{3a}	30
Bromines, Cyanides, Fluorines, Hydrogen sulfide	mg/Nm^3	3
Chloride	mg/Nm^3	5
Chlorine	mg/Nm^3	3
Particulate matter PM_{10}[b]	mg/Nm^3	20, 5[c]
Total organic carbon	mg/Nm^3	50
Volatile organic compounds	mg/Nm^3	20

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

[c] Applicable where very toxic compounds are present

2.3.4.7 Oleochemicals Manufacturing[48]

This guideline applies to manufacturing facilities that produce fatty acids, glycerin, and biodiesel using fats and oils from vegetable and animal sources.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	40
Chemical oxygen demand	mg/l	150
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total nitrogen	mg/l	30
Total phosphorus	mg/l	5
Total suspended solids	mg/l	50

[a] Standard unit

Air Emission Levels

Parameter	Unit	Guideline Value
Volatile organic compounds	mg/Nm^{3a}	100

[a] Milligrams per normal cubic meter at specified temperature and pressure

2.3.4.8 Pharmaceuticals and Biotechnology Manufacturing[49]

This guideline applies to the production of active pharmaceutical ingredients and secondary processing, including intermediates, formulation, blending, and packaging, and related activities and research such as biotechnology research and production. Actual parameters for effluent levels and air emission levels applicable to individual plants are to be determined on a case specific basis reflecting project-specific risks and potential impacts.

Effluent Levels

Parameter	Unit	Guideline Value
1,2-Dichloroethane	mg/l	0.1
5-day Biochemical oxygen demand	mg/l	30
Acetates (each)[a]	mg/l	0.5
Acetonitrile	mg/l	10.2
Active ingredient (each)	mg/l	0.05
Adsorbable organic halogen	mg/l	1
Amines (each)[b]	mg/l	102
Ammonia	mg/l	30

[48] Environmental, health, and safety guidelines for oleochemicals manufacturing. 2007. International Finance Corporation, World Bank Group.

[49] Environmental, health, and safety guidelines for pharmaceuticals and biotechnology manufacturing. 2007. International Finance Corporation, World Bank Group.

Arsenic	mg/l	0.1
Benzene	mg/l	0.02
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	150
Chlorobenzene	mg/l	0.06
Chloroform	mg/l	0.013
Chromium (hexavalent)	mg/l	0.1
Dimethyl sulfoxide	mg/l	37.5
Isobutyraldehyde	mg/l	0.5
Isopropanol	mg/l	1.6
Isopropyl ether	mg/l	2.6
Ketones (each)[c]	mg/l	0.2
Mercury	mg/l	0.01
Methanol / Ethanol (each)	mg/l	4.1
Methyl cellosolve	mg/l	40.6
Methylene chloride	mg/l	0.3
n-Heptane	mg/l	0.02
n-Hexane	mg/l	0.02
o-Dichlorobenzene	mg/l	0.06
Oil and grease	mg/l	10
pH	S.U.[d]	6-9
Phenol	mg/l	0.5
Tetrahydrofuran	mg/l	2.6
Toluene	mg/l	0.02
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	10
Xylenes	mg/l	0.01

[a] n-Amyl acetate, n-Butyl acetate, Ethyl acetate, Isopropyl acetate, Methyl formate

[b] Including Diethylamine and Triethylamine

[c] Including Acetone, Methyl isobutyl ketone

[d] Standard unit

Air Emission Levels

Parameter	Unit	Guideline Value
Active ingredient (each)	mg/Nm^{3a}	0.15
Ammonia	mg/Sm^{3b}	30
Arsenic	mg/Sm^3	0.05
Benzene, Vinyl chloride, Dichloroethane (each)	mg/Nm^3	1
Bromides (as Hydrogen bromide)	mg/Sm^3	3
Chlorides (as Hydrogen chloride)	mg/Sm^3	30
Ethylene oxide	mg/Sm^3	0.5
Hazardous air pollutants	kg/year	900-1,800[c]
Mutagenic substance	mg/Sm^3	0.05

Particulate matter PM_{10}[d]	mg/Nm^3	20
Total Class A[e]	mg/Nm^3	20[f]
Total Class B[g]	mg/Nm^3	80[h]
Total organic carbon	mg/Nm^3	50
Volatile organic compounds	mg/Nm^3	20-150[i] 50[j]

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Milligrams per standard cubic meter at specified temperature and pressure

[c] Process-based annual mass limit

[d] Particulate matter 10 micrometers or less in diameter

[e] Class A compounds are those that may cause significant harm to human health and the environment

[f] Applicable when total Class A compounds exceed 100 g/year

[g] Class B compounds are organic compounds of less environmental impact than Class A compounds

[h] Applicable when total Class B compounds, expressed as Toluene, exceed the lower of 5 tons/year or 2 kg/hour

[i] Facilities with solvent consumption >50 tons/year

[j] Waste gases from oxidation plants

2.3.5 Manufacture of Glass and Ceramics

2.3.5.1 Glass, and Glass and Mineral Fibre Manufacturing[50]

This guideline applies to glass, glass fibre or mineral fibre manufacturing plants. Extraction of raw materials is covered by the guideline for Construction Materials Extraction.

Effluent Levels

Parameter	Unit	Guideline Value
Antimony	mg/l	0.3
Arsenic	mg/l	0.1
Boric acid	mg/l	2
Chemical oxygen demand	mg/l	130
Fluorides	mg/l	5
Lead	mg/l	0.1
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total suspended solids	mg/l	30

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

[50] Environmental, health, and safety guidelines for glass manufacturing. 2007. International Finance Corporation, World Bank Group.

Air Emission Levels

Parameter		Unit	Guideline Value
Arsenic		mg/Nm^{3a}	1
Cadmium		mg/Nm^3	0.2
Fluorides		mg/Nm^3	5
Hydrogen chloride		mg/Nm^3	30
Lead		mg/Nm^3	5
Nitrogen oxides		mg/Nm^3	1,000
Other heavy metals (total)		mg/Nm^3	5[b]
Particulates	Natural gas Other fuels	mg/Nm^3	100[c] 50[c]
Sulfur dioxide		mg/Nm^3	700-1,500[d]

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] 1 mg/Nm^3 for Selenium

[c] Where toxic metals are present, not to exceed 20 mg/Nm^3; to achieve dust emissions of 50 mg/Nm^3 installation of secondary treatments (bag fillers or electrostatic precipitators) is necessary

[d] 700 mg/Nm^3 for natural gas firing, 1,500 mg/Nm^3 for oil firing

2.3.5.2 Ceramic Tile and Sanitary Ware Manufacturing[51]

This guideline applies to ceramic tile and sanitary ware manufacturing projects.

Effluent Levels (for ceramic tile)

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Cadmium	mg/l	0.1
Chromium (total)	mg/l	0.1
Cobalt	mg/l	0.1
Copper	mg/l	0.1
Lead	mg/l	0.2
Nickel	mg/l	0.1
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total suspended solids	mg/l	50
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

[51] Environmental, health, and safety guidelines for ceramic tile and sanitary ware manufacturing. 2007. International Finance Corporation, World Bank Group.

Air Emission Levels (for ceramic tile)

Parameter	Unit	Guideline Value
Cadmium	mg/Nm^3[a]	0.2
Hydrogen chloride	mg/Nm^3	30
Hydrogen fluoride	mg/Nm^3	5
Lead	mg/Nm^3	0.5
Nitrogen oxides	mg/Nm^3	600[b]
Particulate matter PM_{10}[c]	mg/Nm^3	50[d]
Sulfur dioxide	mg/Nm^3	400[b]
Total organic carbon	mg/Nm^3	20

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Kiln operations

[c] Particulate matter 10 micrometers or less in diameter

[d] Dryer and kiln stacks

2.3.6 Manufacture of Construction Materials

2.3.6.1 Cement and Lime Manufacturing[52]

This guideline applies to cement and lime manufacturing projects. Extraction of raw materials, which is a common activity associated with cement manufacturing projects, is covered in the guideline for Construction Materials Extraction.

Effluent Levels

Parameter	Unit	Guideline Value
pH	S.U.[a]	6-9
Temperature increase	°C	<3[b]
Total suspended solids	mg/l	50

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels (for cement manufacturing)

Parameter	Unit	Guideline Value
Cadmium + Thallium	mg/Nm^3[a]	0.05
Dioxins / Furans	mg TEQ[b]/Nm^3	0.1
Dust (other point sources including clinker cooling, cement grinding)	mg/Nm^3	50
Hydrogen chloride	mg/Nm^3	10
Hydrogen fluoride	mg/Nm^3	1

[52] Environmental, health, and safety guidelines for cement and lime manufacturing. 2007. International Finance Corporation, World Bank Group.

Mercury	mg/Nm^3	0.05
Nitrogen oxides	mg/Nm^3	600
Particulate matter PM_{10}[c] (existing kilns)	mg/Nm^3	100
Particulate matter PM_{10} (new kiln system)	mg/Nm^3	30
Sulfur dioxide	mg/Nm^3	400
Total metals[d]	mg/Nm^3	0.5
Total organic carbon	mg/Nm^3	10

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Toxicity equivalence factor

[c] Particulate matter 10 micrometers or less in diameter

[d] Total metals are Arsenic, Lead, Cobalt, Chromium, Copper, Manganese, Nickel, Vanadium, and Antimony

Air Emission Levels (for lime manufacturing)

Parameter	Unit	Guideline Value
Dust	mg/Nm^{3a}	50
Sulfur dioxide	mg/Nm^3	400
Nitrogen oxides	mg/Nm^3	500
Hydrogen chloride	mg/Nm^3	10

[a] Milligrams per normal cubic meter at specified temperature and pressure

2.3.7 Metal, Machinery and Electronics

2.3.7.1 Base Metal Smelting and Refining[53]

This guideline applies to base metal smelting and refining of lead, zinc, copper, nickel, and aluminum. It does not include the mining and concentration of the raw materials.

Effluent Levels (for nickel, copper, lead, zinc and aluminum smelting and refining)

Parameter	Unit	Guideline Value
Aluminum	mg/l	0.2
Arsenic	mg/l	0.05
Cadmium	mg/l	0.05
Chemical oxygen demand	mg/l	50
Copper	mg/l	0.1
Fluoride	mg/l	5
Hydrocarbons	mg/l	5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.1
pH	S.U.[a]	6-9

[53] Environmental, health, and safety guidelines for base metal smelting and refining. 2007. International Finance Corporation, World Bank Group.

Temperature increase	°C	<3[b]
Total suspended solids	mg/l	20
Zinc	mg/l	0.2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels (for nickel, copper, lead, zinc and aluminum smelting and refining – varying by metal type / smelting process)

Parameter	Unit	Guideline Value
Acid mists / gases	mg/Nm^{3a}	50
Ammonia	mg/Nm^3	5
Arsine	mg/Nm^3	0.5
Carbon monoxide and carbonyls	mg/Nm^3	5
Chlorine	mg/Nm^3	0.5
Dioxins	ng TEQ^b/m^3	0.1-0.5
Dust	mg/Nm^3	1-5
Hydrogen chloride	mg/Nm^3	5
Hydrogen fluoride	mg/Nm^3	0.5
Mercury	mg/Nm^3	0.02
Nitrogen oxides	mg/Nm^3	100-300
Polyfluorinated hydrocarbons	anode effects/ cell /day	0.1
Sulfur dioxide	mg/Nm^3	< 50-200
Total fluoride	mg/Nm^3	0.8
Total organic carbon	mg/Nm^3	5-50
Volatile organic compounds / solvents	mg/Nm^3	5-15

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Toxicity equivalence factor

2.3.7.2 Integrated Steel Mills[54]

This guideline applies to the manufacture of pig iron and raw or low-alloy steel from iron ore and iron-based alloys. It is applicable to the manufacture of metallurgical coke, primary iron and steel production in blast and basic oxygen furnaces, scrap metal recycling in the electric arc furnace process, the production of semi-finished products, and hot and cold rolling activities. It does not include extraction of raw materials and further processing of the semi-finished products into finished products.

[54] Environmental, health, and safety guidelines for integrated steel mills. 2007. International Finance Corporation, World Bank Group.

Effluent Levels

Parameter	Unit	Guideline Value
Ammonia	mg/l (as Nitrogen)	5
Cadmium	mg/l	0.01
Chemical oxygen demand	mg/l	250
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanides (free)	mg/l	0.1
Cyanides (total)	mg/l	0.5
Fluoride	mg/l (as Fluorine)	5
Iron	mg/l	5
Lead	mg/l	0.2
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenol	mg/l	0.5
Polycyclic aromatic hydrocarbons	mg/l	0.05
Sulfides	mg/l	0.1
Temperature increase	°C	<3[b]
Tin	mg/l	2
Total nitrogen	mg/l	30
Total phosphorus	mg/l	2
Total suspended solids	mg/l	35
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Ammonia	mg/Nm^{3a}	30
Benzo(a)pirene	mg/Nm^3	0.1
Cadmium	mg/Nm^3	0.2
Carbon monoxide	mg/Nm^3	100 (electric arc furnace)
		300 (coke oven)
Chromium	mg/Nm^3	4
Fluoride	mg/Nm^3	5
Hydrogen chloride	mg/Nm^3	10
Hydrogen fluoride	mg/Nm^3	10
Hydrogen sulfide	mg/Nm^3	5

Lead	mg/Nm^3	2
Nickel	mg/Nm^3	2
Nitrogen oxides	mg/Nm^3	500
		750 (coke oven)
Oil mist	mg/Nm^3	15
Particulate matter PM_{10}[b]	mg/Nm^3	20-50[c]
Polychlorinated dibenzodioxin and dibenzofuran	ng TEQ[d]/m^3	0.1
Sulfur dioxide	mg/Nm^3	500
Tar fume	mg/Nm^3	5
Volatile organic compounds	mg/Nm^3	20

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

[c] Lower value where toxic metals are present

[d] Toxicity equivalence factor

2.3.7.3 Foundries[55]

This guideline applies to foundry projects casting ferrous (iron and steel) and nonferrous (primarily aluminum, copper, zinc, lead, tin, nickel, magnesium, and titanium) metals. It addresses sand casting, including the preparation and regeneration of molding sand, and the high- and low-pressure die casting of aluminum, zinc, and magnesium. It does not cover further processing of the semi-finished products.

Effluent Levels

Parameter	Unit	Guideline Value
Aluminum	kg/ton	0.02[a]
Ammonia	mg/l (as Nitrogen)	5
Cadmium	mg/l	0.01
Chemical oxygen demand	mg/l	125
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Fluoride	mg/l (as Fluorine)	5
Iron	mg/l	5
Lead	mg/l	0.2
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[b]	6-9
Phenol	mg/l	1
Temperature increase	°C	<3[c]
Tin	mg/l	2
Total suspended solids	mg/l	35
Zinc	mg/l	0.5

[55] Environmental, health, and safety guidelines for foundries. 2007. International Finance Corporation, World Bank Group.

[a] Aluminum smelting and casting

[b] Standard unit

[c] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Amines	mg/Nm^3[a]	5[b]
Carbon monoxide	mg/Nm^3	200[c]
		150[d]
Chloride	mg/Nm^3	5[e]
Chlorine	mg/Nm^3	5[f]
Copper and compounds	mg/Nm^3	5-20[g]
Fluoride	mg/Nm^3	5[h]
Hydrogen sulfide	mg/Nm^3	5
Lead, cadmium and their compounds	mg/Nm^3	1-2[i]
Nickel, Cobalt, Chromium, Tin and their compounds	mg/Nm^3	5
Nitrogen oxides	mg/Nm^3	400[j]
		120[c]
		150[k]
Oil Aerosol / mist	mg/Nm^3	5
Particulate matter PM_{10}[l]	mg/Nm^3	20[m]
		50[n]
Polychlorinated dibenzodioxin and dibenzofuran	ng TEQ[p]/m^3	0.1
Sulfur dioxide	mg/Nm^3	400[c]
		50[p]
		120[q]
Volatile organic compounds	mg/Nm^3	20[c]
		30
		15[r]

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Non-ferrous metal melting (aluminum)

[c] Non-ferrous metal melting (shaft furnaces)

[d] Cold box molding and core making shop

[e] Furnace emissions where chloride flux is used

[f] Thermal sand reclamation systems and solvent based investment foundry coating, shelling, and setting operation

[g] Higher value applicable to copper and its alloy producing processes

[h] Furnace emissions where fluoride flux is used

[i] Higher value applicable to non-ferrous metal foundries from scrap

[j] Ferrous metal melting (maximum emissions level considered on best available technology base and based on cokeless cupola furnaces)

[k] From thermal sand reclamation systems / regeneration units

[l] Particulate matter 10 micrometers or less in diameter

[m] Particulate matter emissions when toxic metals are present

[n] Particulate matter emissions when toxic metals are not present

[o] Ferrous metal melting (cupola furnaces)

[p] Toxicity equivalence factor

[q] Maximum emissions level considered on best available technology base and based on cold blast cupola furnaces

[r] Ferrous metal melting (electric arc furnaces); cupola furnaces may have higher emissions levels (up to 1,000 mg/Nm^3)

2.3.7.4 Metal, Plastic and Rubber Products Manufacturing[56]

This guideline applies to material processing operations common to industries engaged in the manufacture of metal, plastic, and rubber products. It does not include extraction or production of raw materials (metals, plastics, and rubber), metal casting, or synthesis of thermoplastic polymers or additives.

Effluent Levels

Parameter	Unit	Guideline Value
Aluminum	mg/l	3
Ammonia	mg/l	10
		20 (electroplating)
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanides (free)	mg/l	0.2
Cyanides (total)	mg/l	1
Fluorides	mg/l	20
Iron	mg/l	3
Lead	mg/l	0.2
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenols	mg/l	0.5
Silver	mg/l	0.2
Sulfide	mg/l	1
Temperature increase	°C	<3[b]
Tin	mg/l	2
Total nitrogen	mg/l	15

[56] Environmental, health, and safety guidelines for metal, plastic, rubber products manufacturing. 2007. International Finance Corporation, World Bank Group.

Total phosphorus	mg/l	5
Total suspended solids	mg/l	50
		25 (electroplating)
Volatile organic halogens	mg/l	0.1
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Ammonia	mg/Nm^3[a]	50
Hydrogen chloride	mg/Nm^3	10
Nitrogen oxides	mg/Nm^3	350
Particulate matter PM_{10}[b] (metal surface treatments)	mg/Nm^3	5
Particulate matter PM_{10} (plastic processing)	mg/Nm^3	3
Total organic carbon (rubber vulcanization)	mg/Nm^3	80
Volatile halogenated hydrocarbons (metal surface treatments)	mg/Nm^3	20
Volatile organic compounds (metal and plastic coating)	mg/Nm^3	100 (up to 15 tons/year solvent consumption)
		75 (more than 15 tons/year solvent consumption)
		50 (drying processes)
Volatile organic compounds (rubber conversion)	mg/Nm^3	20[c]
Volatile organic compounds (surface cleaning)	mg/Nm^3	20-75[d]

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

[c] Facilities with solvent consumption greater than 15 tons/year

[d] 20 mg/Nm^3 for waste gases from surface cleaning using volatile organic compounds classified as carcinogenic, mutagenic or toxic to reproduction; 75 mg/Nm^3 for waste gases from other surface cleaning

2.3.7.5 Semiconductors and Other Electronics Manufacturing[57]

This guideline applies to semiconductors and other electronics manufacturing projects. It does not include information about the extraction of raw materials, assembly of general components, manufacturing of screens for the assembly of internal components within the plastic structure, or production of standard connectors.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Adsorbable organic halogens	mg/l	0.5
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	160
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Fluoride	mg/l	5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Selenium	mg/l	1
Silver	mg/l	0.1
Temperature increase	°C	<3[b]
Tin	mg/l	2
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Acetone	mg/Nm^{3a}	150
Ammonia	mg/Nm^3	30

[57] Environmental, health, and safety guidelines for semiconductors and electronics manufacturing. 2007. International Finance Corporation, World Bank Group.

Arsine and arsenic compounds	mg/Nm^3	0.5
Hydrogen chloride	mg/Nm^3	10
Hydrogen fluoride	mg/Nm^3	5
Inorganic hazardous air pollutants[b]	mg/Nm^3	0.42
Organic hazardous air pollutants[b]	mg/Nm^3	20
Phosphine	mg/Nm^3	0.5
Volatile organic compounds[c]	mg/Nm^3	20

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Industry-specific hazardous air pollutants include: Antimony compounds, Arsenic compounds, Arsine, Carbon tetrachloride, Catechol, Chlorine, Chromium compounds, Ethyl acrilate, Ethylbenzene, Elthylene glycol, Hydrochloric acid, Hydrofluoric acid, Lead compounds, Methanol, Methyl isobutyl ketone, Methylene chloride, Nickel compounds, Perchloroethylene, Phosphine, Phosphorus, Toluene, 1,1,1-trichloroethane, Trichloroethylene (phased-out), and Xylenes

[c] Applicable to surface cleaning processes

2.4 Waste Management

2.4.1 Solid Waste Management Facilities[58]

This guideline applies to projects dedicated to the management of municipal solid waste and industrial waste including waste receipt, unloading, processing, and storage; landfill disposal; physico-chemical and biological treatment; and incineration projects. Industry-specific waste management activities (e.g. medical waste) are covered in the relevant industry guidelines.

Effluent Levels (for landfills)

Parameter	Unit	Guideline Value			
		Hazardous Waste Landfills		Municipal Solid Waste Landfills	
		Daily Max.	Monthly Average	Daily Max	Monthly Average
5-day Biochemical oxygen demand	mg/l	220	56	140	37
Ammonia	mg/l	10	4.9	10	4.9
Aniline	mg/l	0.024	0.015	-	-
Arsenic	mg/l	1.1	0.54	-	-
α-Terpineol	mg/l	0.042	0.019	0.033	0.016
Benzoic acid	mg/l	0.119	0.073	0.12	0.071
Chromium (total)	mg/l	1.1	0.46	-	-
Naphthalene	mg/l	0.059	0.022	-	-
p-Cresol	mg/l	0.024	0.015	0.025	0.014
pH	S.U.[a]	6-9	6-9	6-9	6-9
Phenol	mg/l	0.048	0.029	0.026	0.015
Pyridine	mg/l	0.072	0.025	-	-
Total suspended solids	mg/l	88	27	88	27

[58] Environmental, health, and safety guidelines for waste management facilities. 2007. International Finance Corporation, World Bank Group.

Zinc	mg/l	0.535	0.296	0.2	0.11

[a] Standard unit

Air Emission Levels (from incinerators)

Parameter	Unit	Guideline Value[a]
Cadmium	mg/m^3	0.05-0.1 (0.5-8 hour average)
Carbon monoxide	mg/m^3	50-150
Hydrochloric acid	mg/m^3	10
Hydrogen fluoride	mg/m^3	1
Mercury	mg/m^3	0.05-0.1 (0.5-8 hour average)
Nitrogen oxides	mg/m^3	200-400 (24 hour average)
Polychlorinated dibenzodioxin and dibenzofuran	ng TEQ^b/m^3	0.1
Sulfur dioxide	mg/m^3	50 (24 hour average)
Total metals	mg/m^3	0.5-1 (0.5-8 hour average)
Total suspended particulates	mg/m^3	10 (24 hour average)

[a] Applicable to both municipal solid waste and hazardous waste incinerators

[b] Toxicity equivalence factor

Incinerator bottom ash and other solid residue from industrial or medical hazardous wastes should be treated and disposed as hazardous waste unless it can be demonstrated to be not hazardous.

2.4.2 Wastewater Treatment Facilities[59]

This guideline applies to centralized wastewater treatment facilities receiving wastewater from residential, commercial and industrial users. Guideline values are applicable to treated sewage and contaminated storm water before being discharged to surface waters.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5

[59] Pollution prevention and abatement handbook. 1998. Toward cleaner production. World Bank Group in collaboration with United Nations Environment Programme and the United Nations Industrial Development Organization.

Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Fluoride	mg/l	20
Heavy metals (total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	°C	<3[b]
Total coliform bacteria	100 ml	400
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Biosolids and Sludge Disposal[60]

Sludge from wastewater treatment facilities can be dewatered and disposed of to a landfill or through incineration. Where sludge has been demonstrated to have sufficiently low levels of toxic and microbial constituents, solids can be applied to land as a soil amendment material or used in agriculture as a fertilizer. The following guideline values should apply.

Parameter	Unit[a]	Guideline Value
Arsenic	mg/kg	75
Cadmium	mg/kg	85
Chromium (total)	mg/kg	3,000
Copper	mg/kg	4,300
Lead	mg/kg	840
Mercury	mg/kg	57
Molybdenum	mg/kg	75
Nickel	mg/kg	420
Selenium	mg/kg	100
Total coliform bacteria	g[b]	1,000
Zinc	mg/l	7,500

[60] Use and disposal of sewage sludge. 2006. Title 40 Code of Federal Regulations Part 503, United States Environmental Protection Agency.

[a] Dry weight

[b] Per gram of total solids (dry weight)

2.5 Water Supply

2.5.1 Potable Water Treatment Facilities[61]

This guideline applies to the operation of centralized potable water treatment facilities sourcing water from rivers, lakes, reservoir or groundwater aquifer and treating through water purification. Water quality of potable water supply systems should meet applicable national drinking water standards[62]. Sludge from water purification should be evaluated on a case-by-case basis to establish whether if constitutes a harmful or non-harmful waste and managed accordingly. Sludge from water treatment facilities can be dewatered and disposed of to a landfill.

2.6 Infrastructure and Service Development

2.6.1 Shipping[63]

This guideline applies to the operation and maintenance of ships used for the transport of bulk cargo, and goods. Cargo handling, vessel repair and maintenance, and other in-port activities are covered under the guideline for Ports and Harbors, while issues specific to the transfer and storage of bulk fuels are covered in the guideline for Crude Oil and Petroleum Product Terminals. Vessels engaged in national traffic should conform to environmental performance requirements as specified by the Department of Marine Administration, Myanmar Ministry of Transport. Vessels engaged in international routes should additionally comply with environmental requirements set out in international regulations, primarily effluent standards for oil and grease and sewage as described in Annex I and IV of MARPOL, emissions standards for ozone depleting substances, and maritime diesel engine emissions and shipboard incinerator emissions described in Annex VI of MARPOL.

2.6.2 Ports, Harbors and Terminals[64]

This guideline applies to commercial ports, harbors and terminals for cargo and passenger transfer, and covers all aspects of onshore operations including cargo handling, chemical and petroleum storage and handling, embarking and disembarking of passengers, ship support services (e.g. electricity, fuel), waste and wastewater; and waterside operations including ship berthing, maintenance dredging, and vessel repair and maintenance (i.e. in dry dock). Given the nature of port operations there are few stationary effluent discharges (e.g. wastewater and storm water). Discrete point source sanitary wastewater and storm

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[61] Pollution prevention and abatement handbook. 1998. Toward cleaner production. World Bank Group in collaboration with United Nations Environment Programme and the United Nations Industrial Development Organization.

[62] National Drinking Water Quality Standards Myanmar. 2014. Ministry of Health, The Republic of the Union of Myanmar.

[63] Environmental, health, and safety guidelines for shipping. 2007. International Finance Corporation, World Bank Group.

[64] Environmental, health, and safety guidelines for ports, harbors and terminals. 2007. International Finance Corporation, World Bank Group.

water should achieve the following source effluent levels and general air emissions guidelines shall apply.

Effluent Levels

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

2.6.3 Health Care Facilities[65]

This guideline applies to a diverse range of facilities and activities involving general hospitals and small inpatient primary care hospitals, as well as outpatient, assisted living, and hospice facilities. Ancillary facilities may include medical laboratories and research facilities, mortuary centers, and blood banks and collection services.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Cadmium	mg/l	0.05
Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (total)	mg/l	0.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Oil and grease	mg/l	15
pH	S.U.[a]	6-9
Phenols	mg/l	0.5
Polychlorinated dibenzodioxin and dibenzofuran	ng[b]/l	0.1
Temperature increase	°C	<3[c]
Total coliform bacteria	100 ml	400
Total suspended solids	mg/l	50

[a] Standard Unit

[b] Nanogram

[65] Environmental, health, and safety guidelines for health care facilities. 2007. International Finance Corporation, World Bank Group.

[c] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels (for hospital waste incineration facilities)

Parameter	Unit	Guideline Value
Antimony, Arsenic, Lead, Chromium, Cobalt, Copper, Manganese, Nickel, Vanadium	mg/Nm^{3a}	0.5
Cadmium + Thallium	mg/Nm^3	0.05
Carbon monoxide	mg/Nm^3	50
Hydrogen chloride	mg/Nm^3	10
Hydrogen fluoride	mg/Nm^3	1
Mercury	mg/Nm^3	0.05
Nitrogen oxides	mg/Nm^3	200-400[b]
Polychlorinated dibenzodioxin and dibenzofuran	ng/Nm^{3c} TEQ[d]	0.1
Sulfur dioxide	mg/Nm^3	50
Total organic carbon	mg/Nm^3	10
Total particulate matter	mg/Nm^3	10

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] 200 mg/m^3 for new plants or for existing plants with a nominal capacity exceeding 6 tons per hour, 400 mg/m^3 for existing incinerators with a nominal capacity of 6 tons per hour or less

[c] Nanograms per normal cubic meter at specified temperature and pressure

[d] Toxicity equivalence factor

2.6.4 Tourism and Hospitality Development[66]

This guideline applies to tourism and hospitality facilities, including hotels, resorts and other accommodation and catering facilities. Wastewater discharges should be managed through conventional treatment to achieve the indicated guideline values for discharge of sanitary water.

Effluent Levels

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Chemical oxygen demand	mg/l	250
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2

[66] Environmental, health, and safety guidelines for tourism and hospitality development. 2007. International Finance Corporation, World Bank Group.

Total suspended solids	mg/l	50

[a] Standard unit

2.6.5 Railways[67]

This guideline applies to activities typically conducted by rail infrastructure operators dedicated to passenger and freight transportation, including rail operations, covering construction and maintenance of rail infrastructure as well as operation of rolling stock, such as locomotives and railcars; and locomotive maintenance facilities, including engine services, and other mechanical repair and maintenance of locomotives and railcars. Process effluents from railway maintenance facilities involving metals machining, cleaning, and plating and finishing processes, including painting, should comply with the following levels applicable to treated effluent.

Effluent Levels

Parameter	Unit	Guideline Value
Aluminum	mg/l	3
Ammonia	mg/l	10
		20 (electroplating)
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanides (free)	mg/l	0.2
Cyanides (total)	mg/l	1
Fluorides	mg/l	20
Iron	mg/l	3
Lead	mg/l	0.2
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenols	mg/l	0.5
Silver	mg/l	0.2
Sulfide	mg/l	1
Temperature increase	°C	<3[b]
Tin	mg/l	2
Total nitrogen	mg/l	15
Total phosphorus	mg/l	5
Total suspended solids	mg/l	50
		25 (electroplating)

[67] Environmental, health, and safety guidelines for railways. 2007. International Finance Corporation, World Bank Group.

Volatile organic halogens	mg/l	0.1
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

2.6.6 Airports[68]

This guideline applies to the operation of commercial airports. Activities associated with aircraft operators including aircraft maintenance are covered by the Airlines guideline. Airport operations should establish site-specific discharge levels based on the requirements of publicly-operated sewage collection and treatment systems or, if discharged directly to surface waters, discrete point source sanitary wastewater and storm water should achieve the following source effluent levels and general air emissions guidelines shall apply.

Effluent Levels

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

2.6.7 Airlines[69]

This guideline applies to activities typically conducted by passenger and cargo airline operators, including loading and unloading of passengers and cargo; and aircraft maintenance, including engine services, accessory parts overhaul, aircraft washing, aircraft repainting, and testing.

Effluent Levels

Emission and effluents from heavy maintenance facilities should be treated to a level consistent with the following guideline values.

Parameter	Unit	Guideline Value
Aluminum	mg/l	3

[68] Environmental, health, and safety guidelines for airports. 2007. International Finance Corporation, World Bank Group.

[69] Environmental, health, and safety guidelines for airlines. 2007. International Finance Corporation, World Bank Group.

Ammonia	mg/l	10
		20 (electroplating)
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanides (free)	mg/l	0.2
Cyanides (total)	mg/l	1
Fluorides	mg/l	20
Iron	mg/l	3
Lead	mg/l	0.2
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenols	mg/l	0.5
Silver	mg/l	0.2
Sulfide	mg/l	1
Temperature increase	°C	<3[b]
Tin	mg/l	2
Total nitrogen	mg/l	15
Total phosphorus	mg/l	5
Total suspended solids	mg/l	50
		25 (electroplating)
Volatile organic halogens	mg/l	0.1
Zinc	mg/l	2

[a] Standard unit

[b] At the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

Air Emission Levels

Parameter	Unit	Guideline Value
Ammonia	mg/Nm^{3a}	50
Hydrogen chloride	mg/Nm^3	10
Nitrogen oxides	mg/Nm^3	350
Particulate matter PM_{10}[b](metal surface treatments)	mg/Nm^3	5
Particulate matter PM_{10} (plastic processing)	mg/Nm^3	3
Total organic carbon (rubber vulcanization)	mg/Nm^3	80
Volatile halogenated hydrocarbons (metal surface treatments)	mg/Nm^3	20
Volatile organic compounds (metal and	mg/Nm^3	100 (up to 15

plastic coating)		tons/year solvent consumption)
		75 (more than 15 tons/year solvent consumption)
		50 (drying processes)
Volatile organic compounds (rubber conversion)	mg/Nm^3	20[c]
Volatile organic compounds (surface cleaning)	mg/Nm^3	20-75[d]

[a] Milligrams per normal cubic meter at specified temperature and pressure

[b] Particulate matter 10 micrometers or less in diameter

[c] Facilities with solvent consumption greater than 15 tons/year

[d] 20 mg/Nm^3 for waste gases from surface cleaning using volatile organic compounds classified as carcinogenic, mutagenic or toxic to reproduction; 75 mg/Nm^3 for waste gases from other surface cleaning

2.6.8 Roads[70]

This guideline applies to construction, operation and maintenance of large, sealed road projects including associated bridges and overpasses. While roads do not typically give rise to significant point source effluents or air emissions, discrete point source sanitary wastewater and storm water should achieve the following source effluent levels and general air emissions guidelines shall apply. Issues relating to sourcing of construction materials are included in the guideline for Construction Material Extraction, while those related to vehicle service areas are included in the guideline for Retail Petroleum.

Effluent Levels

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

[70] Environmental, health, and safety guidelines for toll roads. 2007. International Finance Corporation, World Bank Group.

2.7 Mining

2.7.1 Construction Materials Extraction[71]

Thus guideline applies to construction materials extraction activities such as aggregates, limestone, slates, sand, gravel, clay, gypsum, feldspar, silica sands, and quartzite, as well as extraction of dimension stone. It addresses stand-alone projects and extraction activities supporting construction, civil works, and cement projects. Construction materials extraction operations do not typically generate point sources or effluents or emissions with the exception of dewatering effluents which may contain suspended solids. Effluent and storm water flows should be managed so as to achieve the following effluent levels. The principle sources of air emission are fugitive dust from earth works and materials handling and transport facilities. Prevention and control of air emissions should be sufficient to achieve the general air emission guideline for ambient air quality.

Effluent Levels

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

[a] Standard unit

2.7.2 Ore and Mineral Extraction[72]

This guideline applies to underground and open-pit mining, alluvial mining, solution mining, and marine dredging. Extraction of raw materials for construction products are addressed in the guideline for Construction Materials and Extraction.

Effluent Levels

Parameter	Unit	Guideline Value
Arsenic	mg/l	0.1
Cadmium	mg/l	0.05
Chemical oxygen demand	mg/l	150
Chromium (hexavalent)	mg/l	0.1
Copper	mg/l	0.3
Cyanide	mg/l	1
Cyanide (free)	mg/l	0.1

[71] Environmental, health, and safety guidelines for construction materials extraction. 2007. International Finance Corporation, World Bank Group.

[72] Environmental, health, and safety guidelines for mining. 2007. International Finance Corporation, World Bank Group

Cyanide (weak acid dissociable)	mg/l	0.5
Iron (total)	mg/l	2
Lead	mg/l	0.2
Mercury	mg/l	0.002
Nickel	mg/l	0.5
pH	S.U.[a]	6-9
Temperature	°C	<3 degree differential
Total suspended solids	mg/l	50
Zinc	mg/l	0.5

[a] Standard unit

Appendix A – Unit Table

Unit	Expression
°C	Scale of measurement for temperature
ADt	Air dried metric ton (weight measurement for selling of pulp and paper)
g/t e-PVC	Grams per ton emulsion polyvinylchloride
g/t s-PVC	Grams per ton suspension polyvinylchloride
HF	Hydrofluoric acid
Hz	Hertz (frequency of electromagnetic waves)
Kg	Kilogram (unit of mass, one thousand milligrams)
l	Litre (volume of one cubic decimeter, a ten centimeter cube)
LAeq (dBA)	Equivalent continuous sound level in decibels
mg	Milligram (unit of mass, one thousandth of a kilogram)
Nm^3	Normal cubic meter at 0°C temperature 100 kilopascal pressure
Sm^3	Standard cubic meter at 15°C temperature and 100 kilopascal pressure
MW	Megawatt (rate of energy conversion or transfer with respect to time)
ng	Nanogram (weight equal to one billionth of a kilogram)
nm	Nanometer (length equal to one billionth of a meter)
NPK	Three-component (nitrogen, phosphorus, and potassium) fertilizers
$PM_{2.5}$	Particulate matter 2.5 micrometers or less in diameter
PM_{10}	Particulate matter 10 micrometers or less in diameter
S.U.	Standard unit (of pH)
TEQ	Toxicity equivalence factor (toxicity of a mixture of dioxins and dioxin-like compounds)
µT	Micro tesla (magnetic flux density)
V/m	Volts per meter (intensity of an electromagnetic field)