Environmental Standards for Industrial Pollution Control in Ethiopia

1. INTRODUCTION

Industrial development can be made compatible with environmental conservation. Hence, industrial pollution and resource degradation need not arise if a framework of sustainable development is appropriately formulated and implemented. Failure to halt further deterioration of environmental quality arising from industrial pollution may jeopardize the health of a large segment of the population with serious political and socio-economic consequences.

The government of the Federal Democratic Republic of Ethiopia has placed a high premium on the environment. It has established the Environmental Protection Authority (EPA) by the proclamation no 9/1995 with statutory responsibility for overall protection of the environment. The Environmental Policy of Ethiopia was formulated and approved by the government in April 1997.

Implementation of the Policy is the next task that needs to be undertaken. Introducing these standards is part of the implementation of the Policy and the environmental pollution abatement strategy contained therein.

Environmental protection measures are only meaningful if the environment to be protected is adequately understood. Neither overprotection nor underprotection of the environment is desirable. Ideally, standards are set based on country specific baseline data and information, which are scanty in the present circumstances. An alternative approach is to adapt the standards of developing countries having similar socio-economic, technological, and climatic conditions.

In the preparation of this document, standards from the following developing countries have been consulted; Bangladesh, Pakistan, India, Jamaica, China, Thailand, Uganda, Nigeria, Zambia, and Kenya. Information was also obtained from development agencies such as The World Bank, United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO), and from other information sources such as the European Union and the United States Environmental Protection Agency.

Where the standards were deemed relevant and appropriate for Ethiopian conditions they have been adopted, where deemed inappropriate they have been modified on the basis of practical experience.

The fact that the majority of people in Ethiopia use the receiving water bodies for drinking, washing and bathing were also considered.

These standards are being introduced to be used throughout the country subject to amendment as more information on the state of pollution is made available. The regional states can establish more stringent standards taking into consideration particular ecological conditions in their localities provided that these present standards are used as the minimum.

The purpose of introducing the standards is to prevent significant industrial pollution by indicating standards which must be observed and by indicating pollution limits beyond which the environment would not tolerate.

The Standards are presented in four parts as follows.

Part 1: Guidance on Interpretation of this Document on Standards

Part 2: Standards for Specified Industrial Sectors

Part 3: General Standards for all other Industrial Effluents

Part 4: Standards for all other Industrial Gaseous Emissions

Part 5: Standards for Noise Limits.

PART 1

GUIDANCE ON INTERPRETATION OF THIS DOCUMENT ON STANDARDS

1. TYPES OF EMISSION

The limit values specified in this document are to apply to the following three types: emission to the atmosphere, emission to water and noise.

2. EMISSIONS TO THE ATMOSPHERE

During Continuous Monitoring:

a) No 24 hour mean value shall exceed the emission limit value.

b) 97% of all 30 minute mean values taken continuously over an annual period shall not exceed 1.2 times the emission limit value.

c) No 30 minute mean value shall exceed twice the emission limit value.

d) For Total Organic Carbon (as C) concentration limits, no hourly average value shall exceed 1.5 times the emission limit value.

During Non-Continuous Monitoring:

e) For flow, no hourly or daily mean value, calculated on the basis of appropriate spot readings, shall exceed the relevant limit value.

f) Mass flow threshold refers to a rate of discharge expressed in units of kg/h, above which concentration the emission limit value applies. Mass flow threshold rates shall be determined on the basis of a single 30 minute measurement (ie. the concentration determined as a 30 minute average shall be multiplied by an appropriate measurement of flow and the result shall be expressed in units of kg/h).

g) Mass flow limits shall be calculated on the basis of the concentration, determined as an average over the specified period, multiplied by an appropriate measurement of flow. No value, so determined, shall exceed the mass flow limit value.

h) For all Total Organic Carbon (as C) concentration limits, the average of all readings in one monitoring exercise shall not exceed the emission limit value and no hourly average value shall exceed 1.5 times the emission limit. At least three readings shall be obtained in each monitoring exercise.

i) For all other parameters, no 30 minute mean value shall exceed the emission limit value.

The concentration and volume flow limits for emissions to the atmosphere shall be achieved without the introduction of dilution air and shall be based on gas volumes under standard conditions of :-

j) In the case of non-combustion gases, a temperature of 273^{0}K, and a pressure of 101.3 KPa without any correction for oxygen or water content.

k) In the case of combustion gases, a temperature 273^{0}K, and a pressure 101.3 KPa of dry gas with 3% oxygen for liquid and gas fuels, 6% oxygen for solid fuels, and 10% oxygen for thermal oxidisers.

3. EMISSIONS TO WATER:

Limit values for emissions to water shall be interpreted in the following way:-

During continuous monitoring:

a) No flow value shall exceed the specified limit.

b) No pH value shall deviate from the specified range.

c) No temperature value shall exceed the limit value.

During Non-Continuous Monitoring:

d) No pH value shall deviate from the specified range.

e) No temperature value shall exceed the limit value.

f) For parameters other than pH, temperature and discharge, eight out of ten consecutive results, calculated as daily mean concentration or mass emission values on the basis of flow proportional composite sampling, shall not exceed the emission limit value. No individual result similarly calculated shall exceed 1.2 times the emission limit value.

g) For parameters other than pH, temperature, and flow, no grab sample value shall exceed 1.2 times the emission limit value.

The daily raw waste load is defined as the average daily mass arising for treatment over any three-month period. Calculations of the removal rates should be based on the differences between the waste loads entering the treatment plant and those discharged following treatment to the receiving water. The amounts removed by treatment (chemical, physical, biological) may be included in the calculation.

4. NOISE

Noise from the source activity, measured at the specified noise sensitive location, shall not give rise to sound pressure levels (Leq, 15 minutes), which exceed the limit value by more than 2 dB(A)

PART 2

STANDARDS FOR SPECIFIED INDUSTRIAL SECTORS

1. INTRODUCTION TO INDUSTRIAL SECTORS

The last issue of the directory of industries in Ethiopia published by the Ministry of Trade and Industry indicates that over three thousand industrial establishments exist in the country. The industries operating in the country vary considerably in terms of process technology, size, nature of product, characteristics of the wastes discharged and the receiving environment.

Presently there are eight major sectors in which most of industrial activity within Ethiopia falls. These sectors are the following:

a) Tanning and the production of leather goods;

b) The manufacture of textiles;

c) Extraction of mineral ores, the production of metals and metal products;

d) The processing of food products including beverages, meat and meat products;

e) The manufacture of cement and cement products.

f) Preservation of wood and the manufacture of wood products including furniture;

g) The production of pulp, paper and paper products;

h) The manufacture and formulation of chemical products including pesticides.

The following section details emission limit values for discharges to the receiving water in the case of effluents and to the atmosphere for gaseous emissions from manufacturing plants.

2. TANNING AND LEATHER FINISHING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 200 mg/l, whichever is less
COD	500 mg/l
Suspended solids	50 mg/l
Total ammonia (as N)	30 mg/l
Total nitrogen (as N)	80% removal or 60 mg/l, whichever is less
Total phosphorus (as P)	80% removal or 10 mg/l, whichever is less
Oils, fats, and grease	15 mg/l
Mineral oils at oil trap or interceptors	20 mg/l
Chromium (as total Cr)	2 mg/l
Chromium (as Cr VI)	0.1 mg/l
Chlorides (as Cl)	1000 mg/l
Sulphides (as S)	1 mg/l
Phenols	1 mg/l

Limit Values for Emissions to Air

Parameter	Limit value
Total particulates	50 mg/Nm^3
Volatile organic carbons	75 g/m^2 product produced
Total hydrogen sulphide, sulphides and mercaptans (as S)	5 ppm v/v
Ammonia	40 ppm v/v
Acid vapours (as HCl)	30 mg/Nm^3

3. THE MANUFACTURE AND FINISHING OF TEXTILES

Limit Values for Discharges to Water

Parameter	Limit Values
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 50 mg/l, whichever is less
Total nitrogen (as N)	80% removal or 40 mg/l, whichever is less
COD (mg O_2 /l)	80% removal or 150 mg/l, whichever is less
Total phosphorus (as P)	80% removal or 10 mg/l, whichever is less
Suspended solids	30
Total ammonia (as N)	20
Oils, fats & grease	20
Phenols	1
Mercury (as Hg)	0.001
Nickel (as Ni)	2
Cobalt (as Co)	1
Lead (as Pb)	0.5
Antimony (as Sb)	2
Tin (as Sn)	5
Chromium (as Cr VI)	0.1
Chromium (as total Cr)	1
Arsenic (as As)	0.25
Cadmium (as Cd)	1
Zinc (as Zn)	5
Copper (as Cu)	2
Mineral oils (Interceptors)	20
Benzene, toluene & xylene (combined)	1
Mineral oils (Biological Treatment)	5
Organochlorine pesticides (as Cl)	0.03
Mothproofing agents (as Cl)	0.003
Organophosphorus pesticides (as P)	0.003
Adsorbable organic halogen compounds (AOX)	5
Sulphide (as S)	2

Limit Values for Emissions to Air

Parameter	Limit value (mg/Nm^3)
Particulate matter	50
Volatile organic carbons (as C)	50
(excluding formaldehyde)	
Formaldehyde	20
Isocyanates (as NCO)	0.1

4. PRODUCTION AND PROCESSING OF IRON AND STEEL

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
Suspended solids	20 mg/l
Mineral oils	20 mg/l
Cadmium (as Cd)	1 mg/l
Mercury (as Hg)	0.01 mg/l
Lead (as Pb)	0.5 mg/l
Zinc (as Zn)	5 mg/l
Chromium (as Cr VI)	0.1 mg/l
Chromium (as total Cr)	1 mg/l
Nickel (as Ni)	2 mg/l

Limit Values for Emissions to Air

Parameter	Limit value
Particulate matter	50 mg/Nm^3
Hydrogen fluoride (as HF)	5 mg/Nm^3
Mercury (as Hg)	0.05 mg/Nm^3
Lead (as Pb)	0.5 mg/Nm^3
Zinc (as Zn)	10 mg/Nm^3
Chromium (as total Cr)	0.5 mg/Nm^3
Nickel (as Ni)	0.5 mg/Nm^3
Cadmium (as Cd)	0.05 mg/Nm^3
NO_x (as NO_2)	1000 mg/Nm^3
SO_x (as SO_2)	800 mg/Nm^3
Dioxins as International Toxicity Equivalent(I-TEQ)	1 ng/Nm^3

5. METAL WORKING, PLATING AND FINISHING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	5.5 – 9.5
Suspended Solids	25 mg/l
Mineral Oil	20 mg/l
Fluoride (as F)	50 mg/l
Phosphorus (as P)	10 mg/l
Arsenic (as As)	0.2 mg/l
Cadmium (as Cd)	0.5 mg/l
Cyanide (as free CN)	0.5 mg/l
Chromium (as Cr VI)	0.1 mg/l
Chromium (as total Cr)	1 mg/l
Copper (as Cu)	2 mg/l
Lead (as Pb)	0.5 mg/l
Mercury (as Hg)	0.01 mg/l
Nickel (as Ni)	1 mg/l
Silver (as Ag)	1 mg/l
Zinc (as Zn)	1 mg/l
Total Metals	15 mg/l
Trichloroethane	0.1 mg/l
Trichloroethylene	0.1 mg/l

Limit Values for Emissions to Air

Substance	Limit values
Particulate matter	10 mg/Nm^3
Hydrogen fluoride (as HF)	5 mg/Nm^3
Mercury (as Hg)	0.05 mg/Nm^3
Lead (as Pb)	0.5 mg/Nm^3
Zinc (as Zn)	10 mg/Nm^3
Chromium (as total Cr)	0.5 mg/Nm^3
Nickel (as Ni)	0.5 mg/Nm^3
Cadmium (as Cd)	0.05 mg/Nm^3
NO_x (as NO_2)	300 mg/Nm^3
SO_x (as SO_2)	300 mg/Nm^3
Dioxins as International Toxicity Equivalent (I-TEQ)	1 ng/Nm^3

6. BASE METAL AND IRON ORE MINING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	25 mg/l
COD	150 mg/l
Suspended solids	50 mg/l
Mineral oils	20 mg/l
Cadmium (as Cd)	0.5 mg/l
Mercury (as Hg)	0.01 mg/l
Arsenic (as As)	0.25 mg/l
Cyanide (as CN)	1 mg/l
Iron (as Fe)	5 mg/l
Lead (ad Pb)	0.5 mg/l
Zinc (as Zn)	3 mg/l
Copper (as Cu)	2 mg/l
Nickel (as Ni)	2 mg/l
Chromium (as Cr VI)	0.1 mg/l
Chromium (as total Cr)	1 mg/l
Total metals	15 mg/l

Limit Values for Emissions to Air

Parameter	Limit value
Particulate matter	50 mg/l
Silica	15 mg/l
SO_2 (mg/Nm^3)	1000 mg/l
Nickel (as Ni)	5 mg/l
Iron (as Fe)	10 mg/l
Copper (as Cu)	20 mg/l
Sulphuric acid (as H_2SO_4)	50 mg/l
Nitric acid (as HNO_3)	50 mg/l
Ammonia (as NH_3)	300 mg/l
Arsine	5 mg/l
Dioxins as International Toxicity Equivalent (I-TEQ)	1 ng/Nm^3

7. MALTING, BREWING, DISTILING, PRODUCTION OF WINES AND OTHER ALCOHOLIC LIQUOURS

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 60 mg/l, whichever is less
COD	90% removal or 250 mg/l, whichever is less
Suspended solids	50 mg/l
Total ammonia (as N)	20 mg/l
Total nitrogen (as N)	80% removal or 40 mg/l, whichever is less
Total phosphorus (as P)	80% removal or 5 mg/l, whichever is less
Oils, fats, and grease	15 mg/l
Mineral oils at the oil trap or interceptor	20mg/l

Limit Values for Emissions to Air

Parameter	Limit value (mg/Nm^3)
Total Particulates (at a mass flow of 0.5 kg/h or above)	100
Hydrogen chloride (as HCl) (at a mass flow of 0.3 kg/h or more)	30

8. MANUFACTURE OF DAIRY PRODUCTS

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 60 mg/l, whichever is less
COD	90% removal or 250 mg/l, whichever is less
Suspended solids	50 mg/l
Total ammonia (as N)	15 mg/l
Total nitrogen (as N)	80% removal or 40 mg/l, whichever is less
Total phosphorus (as P)	80% removal or 5 mg/l, whichever is less
Oils, fats, and grease	15 mg/l
Mineral oils at the oil trap or interceptor	20 mg/l

Limit Values for Emissions to Air

Parameter	Limit value ($mg/Nm^{3)}$
Total particulates (at a mass flow of 0.5 kg/h or above)	100
Hydrogen chloride (as HCl), at a mass flow of 0.3 kg/h or more	30

9. FRUIT AND VEGETABLE PROCESSING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 60 mg/l, whichever is less
COD	90% removal or 250 mg/l, whichever is less
Suspended solids	50 mg/l
Total ammonia (as N)	20 mg/l
Total nitrogen (as N)	80% removal or 40 mg/l, whichever is less
Total phosphorus (as P)	80% removal or 5 mg/l, whichever is less
Oils, fats, and grease	15 mg/l
Mineral oils at the oil trap or interceptor	20mg/l

Limit Values for Emissions to Air

Parameter	Limit value (mg/Nm^3)
Total Particulates (at a mass flow of 0.5 kg/h or above)	100
Hydrogen chloride (as HCl) (at a mass flow of 0.3 kg/h or more)	30

10. MANFACTURE OF SUGAR

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 60 mg/l, whichever is less
COD	90% removal or 250 mg/l, whichever is less
Suspended solids	50 mg/l
Total ammonia (as N)	15 mg/l
Total nitrogen (as N)	80% removal or 40 mg/l, whichever is less
Total phosphorus (as P)	80% removal or 5 mg/l , whichever is less
Oils, fats, and grease	15 mg/l
Mineral oils at the oil trap or interceptor	20 mg/l

Limit Values for Emissions to Air

Substance	Limit value
Total particulates (at a mass flow of 0.5 kg/h or above)	100 mg/Nm^3
Hydrogen chloride (as HCl) (at a mass flow of 0.3 kg/h or more)	30 mg/Nm^3

11. SLAUGHTERING MEAT PROCESSING AND RENDERING

Limit Values for Discharges to Water from Slaughtering and Meat Processing Plants

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 80 mg/l, whichever is less
COD	90% removal or 250 mg/l, whichever is less
Suspended Solids	80 mg/l
Total ammonia (as N)	20 mg/l
Total nitrogen (as N)	80% removal or 40 mg/l, whichever is less
Total phosphorus (as P)	80% removal or 5 mg/l, whichever is less
Oils, fats, and grease	15 mg/l
Mineral oils at the oil trap or interceptor	20 mg/l
Total coliform bacteria (number per 100ml)	400 mg/l

Limit Values for Emissions to Air from Slaughtering and Meat Processing Plants

Parameters	Limit value (mg/Nm^3)
Total particulates (at a mass flow of 0.5 kg/h or above)	100
Hydrogen chloride (as HCl) (at a mass flow of 0.3 kg/h or more)	30

Limit Values for Emissions to Air from Rendering Plants

Substance	Limit value
Total particulates	100 mg/Nm^3
Ammonia	50 ppm v/v
Amines	5 ppm v/v
Hydrogen sulphide, and mercaptans	5 ppm v/v

12. TIMBER PRESERVATION

Limit Values for Discharges to Water

Constituent Group or Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
COD	80% removal or 150 mg/l, whichever is less
Suspended solids	100 mg/l
Oils, fats, and grease	10 mg/l
Chromium (as total Cr)	1 mg/l
Chromium (as Cr VI)	0.1 mg/l
Phenols	1 mg/l
Arsenic (as As)	0.5 mg/l
Copper (as Cu)	3 mg/l
Organohalogens	0.1 mg/l
Polycyclic aromatic hydrocarbons (PAH's)	0.05 mg/l
Fluorides	50 mg/l
Pesticides (each)	0.1 mg/l
Pentachlorophenol	0.1 mg/l
Mineral oils at the oil trap or interceptor	20 mg/l

13. MANUFACTURE OF FERTILIZERS

13.1 PHOSPHATE FERTILIZER PLANTS

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
Suspended solids	50 mg/l
Phosphorous (as P)	5 mg/l
Fluorides (as F)	50 mg/l
Cadmium (as Cd)	1 mg/l

Limit Values for Emissions to Air

Parameter		Limit value
Fertilizer Plant		
	Total Particulates	100 mg/Nm^3
	Fluorides (as HF)	10 mg/Nm^3
Sulphuric Acid Plant		
	Sulphur Dioxide (as SO_2)	2 kg/t acid
	Sulphur Trioxide (as SO_3)	0.15 kg/t acid
Phosphoric acid plant		
	Total Particulates	100 mg/Nm^3
	Fluorides (as HF)	10 mg/Nm^3

13.2. NITROGENOUS FERTILIZERS

Ammonium Sulphate Plant

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
Total nitrogen (as N)	150 mg/l
BOD_5 at 20◦C	50 mg/l
Suspended solids	50 mg/l
Phosphorous (as P)	10 mg/l
Phenols	1 mg/l
Total heavy metals	1 mg/l

Ammonia Production

Limit Values for Emissions to Air

Parameter	per tonne of NH_3 produced
Nitrous oxides (as NO_2)	1.3 kg
Sulphur oxides (as SO_2)	0.1 kg
Carbon dioxide (as CO_2)	500 kg
Carbon monoxide (as CO)	` 0.03 kg

Fertilizer Plant

Limit Values for Emission to air

Parameter	Concentration mg/Nm^3
Total particulates	100
Ammonia	50
Amines	5

14. PULP AND PAPER

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 50 mg/l, whichever is less
COD	75% removal or 300 mg/l, whichever is less
Total phosphorus (as P)	90% removal or 5 mg/l, whichever is less
Total nitrogen (as N)	90% removal or 30 mg/l, whichever is less
Suspended solids	50 mg/l
Adsorbable organic halogen compounds(AOX)	7.5 mg/l
Oils, fats, and greases	15 mg/l
Mineral oil at the oil trap or interceptors	20 mg/l

Limit Values for Emissions to Air

Parameter	Limit value
Total particulates	150 mg/Nm^3
Hydrogen sulphide (as H_2S)	15 mg/Nm^3
Sulphur dioxide (as SO_2)	800 mg/Nm^3
Total sulphur	
Sulphite mills	2 kg/ton ADP*
Kraft and other mills	1.5 kg/ton ADP*
Chlorine	20 mg/Nm^3
Nitrous oxide (as NO_2)	
Natural gas	100 mg/Nm^3
Liquid fuels	150 mg/Nm^3
Solid fuels	300 mg/Nm^3
Volatile organic carbon compounds	20 mg/Nm^3
Smoke	2 units of Ringlemann shade

15. CEMENT MANUFACTURING

Limit Values for Discharges to Water

Parameter	Limit Value
pH	6 – 9
BOD_5 at 20◦C	25 mg/l
COD	150 mg/l
Total phosphorus (as P)	5 mg/l
Suspended solids	50 mg/l
Mineral oils at the oil trap or interceptor	20 mg/l

Limit Values for Emissions to Air

Parameter	Limit value
Total particulates	150 mg/Nm^3
Sulphur dioxide (as SO_2)	1000 mg/Nm^3
Nitrous oxide (as NO_2)	2000 mg/Nm^3

16. PERTOCHEMICAL MANUFACTURING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 50 mg/l, whichever is less
COD	75% removal or 200 mg/l, whichever is less
Total phosphorus (as P)	90% removal or 5 mg/l, whichever is less
Total nitrogen (as N)	90% removal or 30 mg/l, whichever is less
Suspended solids	50 mg/l
Oils, Fats, and Greases	15 mg/l
Chromium (as total Cr)	1 mg/l
Chromium (as Cr VI)	0.1 mg/l
Phenols	1 mg/l
Copper (as Cu)	1 mg/l
Benzene	0.1 mg/l
Vinyl chloride	0.1 mg/l
Sulphide	1 mg/l

Limit Values for Emissions to Air

Parameter	Limit value
Total particulates	50 mg/Nm^3
Nitrous oxides (as NO_2)	500 mg/Nm^3
Sulphur dioxide (as SO_2)	800 mg/Nm^3
Hydrogen chloride (as HCl)	20 mg/Nm^3
Benzene	5 mg/Nm^3 0.1 ppb at plant fence
1,2-Dichloroethane	5 mg/Nm^3 1 ppb at plant fence
Vinyl chloride	5 mg/Nm^3 0.4 ppb at plant fence
Chlorine	20 mg/Nm^3
Ammonia (as NH_3)	15 mg/Nm^3

17. PESTICIDE MANUFACTURING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 50 mg/l, whichever is less
COD	75% removal or 200 mg/l, whichever is less
Total phosphorus (as P)	90% removal or 5 mg/l, whichever is less
Total nitrogen (as N)	90% removal or 30 mg/l, whichever is less
Suspended solids	20 mg/l
Oils, fats, and greases	15 mg/l
Chromium (as total Cr)	1 mg/l
Chromium (as Cr VI)	0.1 mg/l
Phenols	1 mg/l
Copper (as Cu)	1 mg/l
Mercury (as Hg)	0.01 mg/l
Active ingredient (each)	0.05 mg/l

Limit Values for Emissions to Air

Parameter	Limit value (mg/Nm^3)
Total particulates	10
Volatile organic carbon compounds	50
Hydrogen chloride (as HCl)	20
Chlorine (or chloride)	5

18. PESTICIDE FORMULATION

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
COD	75% removal or 250 mg/l, whichever is less
Total phosphorus (as P)	90% removal or 5 mg/l, whichever is less
Total nitrogen (as N)	90% removal or 30 mg/l, whichever is less
Suspended solids	30 mg/l
Oils, fats, and greases	15 mg/l
AOX	2 mg/l
Organochlorines	0.1 mg/l
Nitroorganics	0.1 mg/l
Pyrethroids	0.1 mg/l
Phenoxy compounds	0.1 mg/l
Active ingredient	0.05 mg/l
Arsenic (as As)	0.2 mg/l
Chromium (as total Cr)	1 mg/l
Chromium (as Cr VI)	0.1 mg/l
Phenols	1mg/l
Copper (as Cu)	2 mg/l
Mercury (as Hg)	0.01 mg/l

Limit Values for Emissions to Air

Parameter	Limit value (mg/Nm^3)
Total Particulates	10
Volatile organic carbon compounds	50
Hydrogen chloride (as HCl)	20
Chlorine (or chloride)	5

19. PHARMACEUTICAL MANUFACTURING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6 – 9
BOD_5 at 20◦C	90% removal or 50 mg/l, whichever is less
COD	75% removal or 250 mg/l, whichever is less
Total phosphorus (as P)	90% removal or 5 mg/l, whichever is less
Total nitrogen (as N)	90% removal or 30 mg/l, whichever is less
Suspended solids	30 mg/l
Oils, fats, and greases	15 mg/l
Absorbable organic halogen compounds (AOX)	2 mg/l
Organochlorines	0.1 mg/l
Active ingredient (each)	0.05 mg/l
Arsenic (as As)	0.2 mg/l
Chromium (as total Cr)	1 mg/l
Chromium (as Cr VI)	0.1 mg/l
Phenols	1 mg/l
Copper (as Cu)	2 mg/l
Mercury (as Hg)	0.01 mg/l

Limit Values for Emissions to Air

Parameter	Limit value (mg/Nm^3)
Total particulates	50
Active ingredients	0.2
Organic compounds (Listed in Annex 1, p.36)	
Class I	20
Class II	100
Class III	300

20. PRINTING AND SURFACE COATING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ◦C
pH	6.5 – 10
BOD_5 at 20◦C	90% removal or 50 mg/l, whichever is less
COD	75% removal or 250 mg/l, whichever is less
Total Phosphorus (as P)	90% removal or 5 mg/l, whichever is less
Total Nitrogen (as N)	90% removal or 30 mg/l, whichever is less
Suspended Solids	50 mg/l
Oils, Fats, and Greases	15 mg/l
Cadmium (as Cd)	0.2 mg/l
Chromium (as total Cr)	1 mg/l
Chromium (as Cr VI)	0.1 mg/l
Copper (as Cu)	1 mg/l
Silver (as Ag)	1 mg/l
Zinc (as Zn)	5 mg/l

Limit Values for Emissions to Air from Surface Coating

The emissions to air from surface coating operations come from the evaporation of organic solvents in the coatings. These consist primarily of Volatile Organic Components listed in annex.I

Solvent use or consumption		Concentration (mg/Nm^3)
Less than 15 tonnes per annum	Class I	50
	Class II	200
	Class III	300
Greater than 15 tonnes per annum	Class I	20
	Class II	100
	Class III	300

PART 3

GENERAL STANDARDS FOR ALL OTHER INDUSTRIAL EFFLUENTS

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1. EFFLUENT DISCHARGES TO INLAND WATERS

This section details the standards which shall be applied to all effluents discharged to inland waters, other than those from specific sectors previously dealt with under Part 2 of this document.

Parameter	Emission Limit Value (mg/l)
pH	6 – 9
Temperature	40°C
Biochemical oxygen demand (BOD_5) at 20°C	80
Chemical oxygen demand (COD)	250
Suspended solids (SS)	100
Total dissolved solids (TDS)	3000
Total kjeldahl nitrogen (as N)	80
Total ammonia (as N)	30
Ammonia (as free ammonia)	5
Nitrate (as N)	20
Dissolved phosphorus (as P)	5
Total phosphate (as P)	10
Fats, oils and grease	20
Aluminium (as Al)	0.2
Arsenic (as As)	0.25
Barium (as Ba)	10
Boron (as B)	5
Cadmium (as CD)	1
Chromium (as total Cr)	2
Chromium (as Cr Vi)	0.5
Cobalt (as Co)	1
Copper (as Cu)	2
Cyanide (as CN)	0.5
Iron (as Fe)	10
Lead (as Pb)	0.5
Magnesium (as Mg)	100
Manganese (as Mn)	5
Mercury (as Hg)	0.001
Nickel (as Ni)	3
Selenium (as Se)	1
Silver (as Ag)	1
Tin (as Sn)	5
Zinc (as Zn)	5
Total heavy metals (combined)	15

Parameter	Emission Limit Value (mg/l)
Calcium (as Ca)	100
Chloride (as Cl)	1000
Chlorine (total residual, as Cl)	1.5
Fluoride (as F)	20
Sulphide (as S)	2
Sulphate (SO4)	1000
1,1,1-Trichloroethane	0.5
1,1,2-Dichloroethyelene	0.2
1,1,2-Trichloroethane	0.06
1,2-Dichloroethane	0.04
1,3-Dichloropropene	0.2
Dichloromethane	0.2
Cis-1,2-dichloroethylene	0.4
Tetrachloroethylene	0.1
Tetrachloromethane	0.02
Tricholoroethylene	0.3
Polychlorinated Biphenyls (PCB's)	0.003
Polycyclic Aromatic Hydrocarbons (as benzene)	0.1
Absorbable Organic Halogen Compounds (AOX)	2
Dioxins	0.002
Benzene	0.2
An-ionic detergents (as MBAS)	15
Pesticides, herbicides, fungicides and insecticides	0.1
Phenolic Compounds (as C_6H_5OH)	1
Formaldehyde	1
Total coliform bacteria (numbers per 100 ml)	400
Alpha emitters	10^{-7} μc/ml
Beta emitters	10^{-6} μc/ml

2. CONTROLLED APPLICATION OF EFFLUENTS TO LAND

Parameter	Emission Limit Value (mg/l)
PH	5.5 – 9 pH units
Biochemical oxygen demand (BOD_5) at 20°C	500
Total dissolved solids (TDS)	2100
Fats, oils and grease	30
Arsenic (as As)	0.25
Barium (as Ba)	10
Boron (as B)	5
Cadmium (as CD)	1
Chromium (as total Cr)	2
Chromium (as hexavalent Cr)	0.5
Cobalt (as Co)	1
Copper (as Cu)	2
Cyanide (as Cn)	0.5
Lead (as Pb)	0.5
Manganese (as Mn)	5
Mercury (as Hg)	0.001
Nickel (as Ni)	3
Selenium (as Se)	1
Silver (as Ag)	1
Tin (as Sn)	5
Zinc (as Zn)	5
Total Heavy Metals (Combined)	15
Chloride (as Cl)	1000
Fluoride (as F)	20
Sulphate (SO_4)	1000

PART 4

GENERAL STANDARDS FOR ALL OTHER GASEOUS EMISSION

1. APPLICABILITY

These standards for emission limits from stationary sources represent maximum allowable levels of pollutant from a site, process, stack, vent, etc. with the objective of achieving a desired air quality.
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2. PARTICULATE MATTER

2 .1. TOTAL DUST

The dust emissions contained in waste gas may not exceed a mass flow of 2 kg/h and a mass concentration of 100 mg/Nm^3.

2 .2.INORGANIC PARTICULATE MATTER

The concentration of neither of the following chemicals in Class I shall exceed 0.5 mg/Nm ^{3}, the concentration of the total of the chemicals in Class II shall not exceed 10mg/Nm^3, and the concentration of the total of chemicals in Class III shall not exceed 20 mg/Nm^3.

Class	Substance
I	Mercury and its compounds, as Hg
	Thallium and its compounds, as Tl
II	Lead and its compounds, as Pb
	Cobalt and its compounds, as Co
	Nickel and its compounds, as Ni
	Selenium and its compounds, as Se
	Tellurium and its compounds, as Te
III	Antimony and its compounds, as Sb
	Chromium and its compounds, asCr
	Easily soluble cyanides (e.g. NaCN), as CN
	Easily soluble fluorides (e.g. NaF), as F
	Copper and its compounds, as Cu
	Manganese and its compounds, as Mn
	Vanadium and its compounds, as V
	Tin and its compounds, as Sn

3. EMISSION LIMIT VALUES FOR INORGANIC GASEOUS SUBSTANCES

The concentration of the total of the following inorganic gaseous chemicals in Class I shall not exceed 5 mg/Nm^3, that of those in Class II shall not exceed 30 mg/Nm^3 and that of those in Class IV shall not exceed 3500 mg/Nm^3.

Class	Parameter	Mass concentration per substance
I	Arsine	
	Cyanogen chloride	
	Phosgene	
	Phosphine	
II	Bromine and its gaseous compounds, as HBr	
	Chlorine	
	Hydrocyanic acid	
	Fluorine and its gaseous compounds, as HF	
	Hydrogen sulphide	
III	Ammonia	
	Gaseous inorganic compounds of chlorine, unless included in class I or class II, as HCl	
IV	Sulphur oxides (sulphur dioxide and sulphur trioxide), as SO_2	
	Nitrogen oxides (nitrogen monoxide and nitrogen dioxide), as NO_2	

4. EMISSION LIMIT VALUES FOR ORGANIC GASEOUS SUBSTANCES

Organic substances, which are categorized into classes I, class II and class III in Annex 1, shall not exceed the following mass concentrations:

Class	Mass concentration
I	50 mg/Nm^3
II	200 mg/Nm^3
II	300 mg/Nm^3

5. CARCINOGENIC SUBSTANCES

The concentration of the total of the following chemicals in Class I shall not exceed 0.5 mg/Nm ^{3}, that of those in Class II shall not exceed 5 mg/Nm ^{3}, and that of those in Class III shall not exceed 10 mg/Nm^3.

5.1. Carcinogenic Chemicals

Class	Parameter
I	Arsenic and its compounds, as As
	Benzo(a)pyrene
	Cadmium and its compounds, as Cd
	Water-soluble compounds of cobalt, as Co
	Chromium(VI) compounds, as Cr
II	Acrylamide
	Acrylonitrile
	Dinitrotoluenes
	Ethylene oxide
	Nickel and its compounds, as Ni
	4-vinyl-1,2-cyclohexene-diepoxy
III	Benzene
	Bromoethane
	1,3-Butadiene
	1,2-Dichloroethane
	1,2-Propylene oxide (1,2-epoxy propane)
	Styrene oxide
	o-Toluidine
	Trichloroethene
	Vinyl chloride

5 .2. CARCINOGENIC FIBRES

The following concentrations of carcinogenic fiber dust listed hereunder may not be exceeded in waste gas emissions.

Fibre type	Number/m^3
Asbestos fibres (e.g. chrysotile, crocidolite, amosite),	$1x10^4$ fibres/m^3
Biopersistent ceramic fibres (e.g. consisting of aluminium silicate, aluminium oxide, silicon carbide, potassium titanate)	$1.5x10^4$ fibres/m^3
Biopersistent mineral fibres	$5x10^4$ fibres/m^3

6. MUTAGENIC SUBSTANCES

For mutagenic substances or preparations, a mass concentration below 0.5 mg/Nm³ shall not be exceeded.

7. EMISSION LIMITS FROM COMBUSTION SOURCES

Parameter	Limit value
Total particulates	
Coal	500 mg/Nm^3
Fuel oil	250 mg/Nm^3
Gas	50 mg/Nm^3
Nitrogen oxides (as NO_2)	
Coal	700 mg/Nm^3
Fuel oil	1000 mg/Nm^3
Gas	400 mg/Nm^3
Sulphur oxides (as SO_2)	
Coal	4300 mg/Nm^3
Fuel oil	5100 mg/Nm^3
Gas	100 mg/Nm^3
Carbon monoxide	150 mg/Nm^3
Smoke	2 units on the Ringleman scale

8. STANDARDS FOR MOTOR VEHICLE EXHAUST

Parameter	Maximum permissible limit		Measuring method
Smoke	2 units on the Ringlemann Scale during engine acceleration mode.		To be compared with Ringlemann Chart at a distance of 6 meters or more.
Carbon Monoxide	New Vehicles. 4.5 % of the exhaust volume	Used Vehicles. 6 % of the exhaust volume	Under idling conditions: Non dispersive infrared detection through gas analyzer.

9. HIGHLY ODOUROUS SUBSTANCES

Where an installation is likely to emit highly odourous substances during normal operation or operational malfunctions, appropriate emission control measures shall be applied, e.g. enclosure of all or part of the installation, operation under negative pressure with off gasses directed to appropriate odour abatement technologies. Adequate provision shall be made for raw materials and products to ensure minimization of odorous emissions.

Highly odourous waste gasses shall be fed to waste gas purification installations, which are appropriate for abatement of the odorous substance.

When defining the abatement requirements for individual cases, particular consideration shall be given to waste gas volume and mass flow of highly odourous substances, local propagation conditions, the duration of emission, and the distance of the installations from the nearest existing or planed residential area.

If it is not possible to identify or quantify the odorous properties of an emission based upon the amount or properties of substances contained in the emission, e.g. total quantity of amines or hydrogen sulphide, the odour characteristics of the off gas shall be established through olfactometry. For odour figures above 100,000 OU/Nm^3 it is possible to reach odour reduction values of more than 99% through utilizing waste purification facilities such as biological or chemical scrubbers or biofilters.

PART 5

STANDARDS FOR NOISE LIMITS

1. NOISE STANDARDS TO BE APPLIED WHERE PEOPLE LIVE OR WORK

The generation of excessive noise in the community can have undesirable effects on the population. It can cause annoyance and disturbance to people at work or during leisure activities, disturbance to sleep and possibly a deleterious effect on general physical and mental well-being. All people are not equally sensitive to the disturbing aspects of noise. There is a small but significant minority which is more sensitive than others.

The objective of these standards is to minimize the amount of noise to which people, living or working, are exposed.

The sensitivity to noise is usually greater at night-time than it is during the day, by about 10dB(A). The upper limits of noise permitted are the following:

		Limits in dB (A) Leq	
Area Code	**Category of area**	**Day time[1]**	**Night time[2]**
A	Industrial area	75	70
B	Commercial area	65	55
C	Residential area	55	45

1: Day time reckoned to be between 6.00 am to 9.00p.m

2: Night time reckoned to be between 9.00p.m. to 6.00am

2. VIBRATION AND AIR OVERPRESSURE IN MINING AND QUARRYING

In the case of quarrying and mining operations, the peak particle vibration level of 12 mm/sec, measured in any three mutually orthogonal directions at a receiving location when blasting occurs at a frequency of once per week or less. For more frequent blasting, the peak particle vibration level should not be exceeded 8 mm/sec. These levels are for low frequency vibrations, i.e., less than 40 Hertz.

Blasting should not give rise to air overpressure values at sensitive locations which are in excess of 125 dB (Lin) max peak.

3. NOISE STANDARDS FOR MOTOR VEHICLES

Every motor vehicle needs to conform to the following noise standards.

Vehicle Type	**Maximum Permissible Noise Levels, dB(A) at 7.5 metres from the source**
Two wheelers (petrol-driven)	80
Three wheelers, all petrol-driven passenger cars and two wheeler diesel driven cars.	82
Passenger or light commercial vehicles fitted with diesel engine with gross vehicle weight up to 4000 Kg.	85
Passenger or commercial vehicles with gross vehicle weight above 4000 Kg and up to 12000 Kg.	89
Passenger or commercial vehicles with gross vehicle weight above 12000 Kg.	91

PART 6

ANNEXES

Annex 1

Classification of Organic chemicals

An organic chemical is categorized as follows into one of 3 classes depending on the dosage in mg/kg of body weight that kills 50% of human individuals that have taken it :

Oral lethal dose (LD_{50})

0 - 50 mg/kg - Class I
50 -500 mg/kg - Calss II
500 - 5000 mg/kg - Class III

Substance	Empirical Formula	Class
Acetaldehyde	C_2H_4O	I
Acetone	C_3H_6O	III
Acrylic acid	$C_3H_4O_2$	I
Alkyl alcohols		III
Alkyl lead compounds		I
Formic Acid	CH_2O_2	I
Aniline	C_6H_7N	I
Biphenyl	$C_{12}H_{10}$	I
2-Butanon	C_4H_8O	III
2-Butoxyethanol	$C_6H_{14}O_2$	II
Butyl acetate	$C_6H_{12}O_2$	III
Butyric aldehyde	C_4H_8O	II
Chloracetaldehyde	C_2H_3ClO	I
Chlorbenzene	C_6H_5Cl	II
2-Chlor-1,3-Butadiene	$C_4H_5C_1$	II
Chloroacetic acid	$C_2H_3C_1O_2$	I
Chlorethane	C_2H_5Cl	III
Chlormethane	CH_3Cl	I
2-Chlorpropane	C_3H_7Cl	II
α -Chlortoluene	C_7H_7Cl	I
Cyclohexanon	$C_6H_{10}O$	II
Dibutylether	$C_8H_{18}O$	III
1,2-Dichlorbenzene	$C_6H_4Cl_2$	I
1,4-Dichlorbenzne	$C_6H_4Cl_2$	II
Dichlordifluormethane	CCl_2F_2	III
1,1-Dichlorethane	$C_2H_4Cl_2$	II
1,1-Dichlorethylene	$C_2H_2Cl_2$	I
1,2-Dichlorethylene	$C_2H_2Cl_2$	III
Dichlormethane	CH_2Cl_2	III
Dichlorphenol	$C_6H_4Cl_2O$	I
Diethylamine	$C_4H_{11}N$	I
Diethylether	$C_4H_{10}O$	III

Substance	Empirical Formula	Class
Di-(2-ethylhexyl)-phthalate	$C_{24}H_{38}O_4$	II
Diisopropyl ether	$C_6H_{14}O$	III
Dimethylamine	C_2H_7N	I
Dimethyl ether	C_2H_6O	III
N,N-Dimethylformamide	C_3H_7NO	II
2,6-Dimethylheptan-4-on	$C_7H_{14}O$	II
1,4-Dioxan	$C_4H_8O_2$	I
Acetic Acid	$C_2H_4O_2$	II
2-Ethoxyethanol	$C_4H_{10}O_2$	II
Ethyl acetate	$C_4H_8O_2$	III
Ethylacrylate	$C_5H_8O_2$	I
Ethylamine	C_2H_7N	I
Ethylbenene	C_8H_{10}	II
Ethylen glycol	$C_2H_6O_2$	III
Formaldehyde	CH_2O	I
2-Furaldehyde	$C_5H_4O_2$	I
Furfuryl alcohol	$C_5H_6O_6$	II
4-Hydroxy-4-methyl-2-pentanone	$C_6H_{12}O_2$	III
2,2-Iminodiethanol	$C_4H_{11}NO_2$	II
Isopropenylbenzene	C_9H_{10}	II
Isoprophylbenzene	C_9H_{12}	II
Carbon disulphide	CS_2	II
Cresols	C_7H_8O	I
Maleic anhydride	$C_4H_2O_3$	I
2-Methoxyethanol	$C_3H_8O_2$	II
Methyl acetate	$C_3H_6O_2$	II
Methyl acrylate	$C_4H_6O_2$	I
Methylamine	CH_5N	I
Methyl benzoate	$C_8H_8O_2$	III
Methylcyclohexanons	$C_7H_{12}O$	II
Methyl formate	$C_2H_4O_2$	II
Methyl methacrylate	$C_5H_8O_2$	II
4-Methyl-2-pentanone	$C_6H_{12}O$	III
4-Methyl-m-phenylendiisocyanate	$C_9H_6N_2O_2$	I
N-Methylpyrrolidone	C_5H_9NO	III
Naphthaline	$C_{10}H_8$	II
Nitrobenzene	$C_6H_5NO_2$	I
Nitrocresols	$C_7H_7NO_3$	I
Nitrophenols	$C_6H_5NO_3$	I
Nitrotoluene	$C_7H_7NO_2$	I
Olefin hydrocarbons		III
Paraffin hydrocarbons		III
Phenol	C_6H_6O	I

Substance	Empirical Formula	Class
Pinenes	$C_{10}H_{16}$	III
2-Propenal	C_3H_4O	I
Propionaldehyde	C_3H_6O	II
Propionic acid	$C_3H_6O_2$	II
Pyridine	C_5H_5N	I
Styrene	C_8H_8	II
1,1,2,2-Tetrachlorethane	$C_2H_2Cl_4$	I
Tetrachlorethylene	C_2Cl_4	II
Tetrachlormethane	CCl_4	I
Tetrahydrofuran	C_4H_8O	II
Thioalcohols		I
Thioether		I
Toluene	C_7H_8	II
1,1,1-Trichlorethane	$C_2H_3Cl_3$	II
1,1,2-Trichlorethane	$C_2H_3Cl_3$	I
Trichlorethylene	C_2HCl_3	II
Trichlormethane	$CHCl_3$	I
Trichlorphenols	$C_6H_3OCl_3$	I
Triethylamine	$C_6H_{15}N$	I
Trichlorfluormethane	CCl_3F	III
Trimethylbenzenes	C_9H_{12}	II
Vinyl acetate	$C_4H_6O_2$	II
Xylenols (except 2,4-Xylenol)	$C_8H_{10}O$	I
2,4-Xylenol	$C_8H_{10}O$	II
Xylenes	C_8H_{10}	II

Annex 2

Toxicity Equivalent Factor for Dioxins and Furans

There are a total of thirty PCDDs, PCDFs, and PCBs that are currently considered to exhibit dioxin-like toxicity. This raises a problem for toxicity assessments where measurements detect various levels of the different PCDD/PCDF/PCB congeners, each of which has a different potential to elicit dioxin-like effects. Rather than perform thirty individual assessments, scientists have developed the concept of toxicity equivalence to sum the effects of dioxin-like chemicals. Each congener is given a toxicity equivalence factor (TEF) based on its specific ability to elicit dioxin-like effects. The congener 2,3,7,8- tetrachlorodibenzo-p-dioxin is the most toxic of these and is given a toxicity equivalence factor (TEF) of one. Other congeners are given TEFs that are fractions of one. The total toxic equivalence quantity (TEQ) is the sum of all the individual PCDD/PCDF/PCB concentrations multiplied by their specific TEFs.

Substance	Equivalence Factors
2,3,7,8 – Tetrachlorodibenzodioxin (TCDD)	1
1,2,3,7,8 – Pentachlorodibenzodioxin (PeCDD)	0.5
1,2,3,4,7,8 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,7,8,9 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,6,7,8 – Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,4,6,7,8 – Heptachlorodibenzodioxin (HpCDD)	0.01
Octachlorodibenzodioxin (OCDD)	0.001
2,3,7,8 – Tetrachlorodibenzofuran (TCDF)	0.1
2,3,4,7,8 – Pentachlorodibenzofuran (PeCDF)	0.5
1,2,3,7,8 – Pentachlorodibenzofuran (PeCDF)	0.05
1,2,3,4,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,7,8,9 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,6,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
2,3,4,6,7,8 – Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8 – Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9 – Heptachlorodibenzofuran (HpCDF)	0.01
Octachlorodibenzofuran (OCDF)	0.001