Contents

STANDARDS FOR SPECIFIED INDUSTRIAL SECTORS

NOT FOR CITATION

This guidelines is still under development and shall be binding after consensus is reached between the Environmental Protection Authority and the Environmental Units of Competent Sectoral Agencies

Acronyms

AOX	Absorbable organic halogen compounds
BOD	Biological oxygen demand
COD	Chemical oxygen demand
I-TEQ	International toxicity equivalent
Kg/t	kilograms per tonne
Kg/h	kilograms per hour
mg/l	milligrams per litre
mg/Nm^3	milligrams per meter cubed under normal pressure and temperature
ng/Nm^3	nanograms per meter cubed under normal pressure and temperature
OU	Odour unit
PAH's	polycyclic aromatic hydrocarbons
PCB's	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofuran
ppm	parts per million
ppb	parts per billion
TDS	Total dissolved solids
v/v	Volume per volume
VOCs	Volatile organic carbon
µc/ml	micro cymene per milliliter

Glossary

BOD_5 at 20^0C	The amount of oxygen used in biological oxidation at the end of the fifth day following the incubation of a sample in the dark at 20^0 C.
COD	A measure of the amount of oxygen required to oxidize the organic and inorganic matter in waste water using a chemical oxidizing agent.
Heavy metals	Any metallic chemical element that has a high density and is toxic or poisonous at low concentrations
Kjeldahl method	The determination of organic nitrogen for the purpose of calculating the protein contents in both human food and animal food.
mg/Nm^3	milligrams per meter cubed under normal pressure and temperature i.e. under a pressure of 760mm of Hg and a temperature of 20^0C.
Odour	Organoleptic attributes perceptible by the olfactory organs on shifting certain volatile substances.
Odour unit (OU)	amount of odorant present in one cubic meter of odorous gas under a normal atmospheric pressure and a temperature of 20^0C.
Rendering plant	A plant which receives segregated animal wastes for processing them into useful products.

1. TANNING AND LEATHER FINISHING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ˚C
pH	6 – 9
BOD_5 at 20˚C	200 mg/l
COD	500 mg/l
Suspended solids	50 mg/l
Total ammonia (as N)	30 mg/l
Total nitrogen (as N)	60 mg/l
Total phosphorus (as P)	10 mg/l
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

2. 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	50 mg/l
Total nitrogen (as N)	40 mg/l
COD (mg O_2 /l)	150 mg/l
Total phosphorus (as P)	10 mg/l
Suspended solids	30 mg/l
Total ammonia (as N)	20 mg/l
Oils, fats & grease	20 mg/l
Phenols	1 mg/l
Mercury (as Hg)	0.001 mg/l
Nickel (as Ni)	2 mg/l
Cobalt (as Co)	1 mg/l
Lead (as Pb)	0.5 mg/l
Antimony (as Sb)	2 mg/l
Tin (as Sn)	5 mg/l

Chromium (as Cr VI)	0.1 mg/l
Chromium (as total Cr)	1 mg/l
Arsenic (as As)	0.25 mg/l
Cadmium (as Cd)	1 mg/l
Zinc (as Zn)	5 mg/l
Copper (as Cu)	2 mg/l
Mineral oils (Interceptors)	20 mg/l
Benzene, toluene & xylene (combined)	1 mg/l
Mineral oils (Biological Treatment)	5 mg/l
Organochlorine pesticides (as Cl)	0.03 mg/l
Mothproofing agents (as Cl)	0.003 mg/l
Organophosphorus pesticides (as P)	0.003 mg/l
Adsorbable organic halogen compounds (AOX)	5 mg/l
Sulphide (as S)	2 mg/l

Limit Values for Emissions to Air

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

3. 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

4. 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

5. 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	60 mg/l
COD	250 mg/l
Suspended solids	50 mg/l
Total ammonia (as N)	20 mg/l
Total nitrogen (as N)	40 mg/l
Total phosphorus (as P)	5 mg/l
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

6. MANFACTURE OF SUGAR

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ˚C
pH	6 – 9
BOD_5 at 20˚C	60 mg/l
COD	250 mg/l
Suspended solids	50 mg/l
Total ammonia (as N)	15 mg/l
Total nitrogen (as N)	40 mg/l
Total phosphorus (as P)	5 mg/l
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

7. 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	80 mg/l
COD	250 mg/l
Suspended Solids	80 mg/l
Total ammonia (as N)	20 mg/l
Total nitrogen (as N)	40 mg/l
Total phosphorus (as P)	5 mg/l
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

8. 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

9. PESTICIDE MANUFACTURING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ˚C
pH	6 – 9
BOD_5 at 20˚C	50 mg/l
COD	200 mg/l
Total phosphorus (as P)	5 mg/l
Total nitrogen (as N)	30 mg/l
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

10.PESTICIDE FORMULATION

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ˚C
pH	6 – 9
COD	250 mg/l
Total phosphorus (as P)	5 mg/l
Total nitrogen (as N)	30 mg/l
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

11. PHARMACEUTICAL MANUFACTURING

Limit Values for Discharges to Water

Parameter	Limit Value
Temperature	40 ˚C
pH	6 – 9
BOD_5 at 20˚C	50 mg/l
COD	250 mg/l
Total phosphorus (as P)	5 mg/l
Total nitrogen (as N)	30 mg/l
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)	
Class I	20
Class II	100
Class III	300

12.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	50 mg/l
COD	250 mg/l
Total Phosphorus (as P)	5 mg/l
Total Nitrogen (as N)	30 mg/l
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

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
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

Substance	Empirical Formula	Class
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