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DRAFT TANZANIA STANDARD

Municipal and industrial wastewater: General tolerance limits

TANZANIA BUREAU OF STANDARDS

Municipal and industrial wastewaters: General tolerance limits

0 Foreword

Municipal and industrial wastewater are important point source potential pollutants. They are frequently viewed by much of the public as being responsible for most of the water pollution problems in the country. They generally contribute oxygen demanding substances, suspended matter, pathogens and many specific chemicals, including heavy metals. The pollutants are capable of causing a wide variety of problems in watercourses or downstream uses. Effluents disposed of on land may seep into aquifers and pollute s groundwater. The problems associated with municipal and industrial wastewater pollution include damage to marine life, wildlife resources, habitat loss and human health (environmental degradation). Thus, to ensure sustained water quality and healthy aquatic ecosystems and human health in general, monitoring of effluents and compliance to the standards and to the regulations is of paramount importance. In this regard, monitoring against standards prove to be important component of a sound environmental management programme.

In Tanzania, environmental pollution resulting from municipal and industrial discharges is growing fast. In urban areas, the rapidly growing population, urbanization and high rate of industrial growth are, responsible for increasing waste discharges. Both land and water bodies within and around urban centers and those in which small-scale mining activities are being carried out are increasingly threatened as they continue to receive wastewater laden with hazardous pollutants.

Generally, the effluents of municipal and industrial origin are discharged into water bodies and municipal sewers and treatment facilities. The effluents are varied and complex and the degree of their pollution effect upon the aforementioned systems depend on the constituents of the individual effluent and their corresponding concentrations/loads. The rationale for including permissible limits with regard to physical parameters, organic and inorganic substances as well as microbiological component is based upon their detrimental effect upon human health, aesthetic value, aquatic environment and treatment facilities.

In municipalities, different permissible limits are applied for wastewater which are either discharged into Urban Water Supply and Sanitation Authorities (UWASAs) treatment facilities or directly into the water bodies (receiving waters) after effective treatment.

In the preparation of this Tanzania Standard, considerable assistance was drawn from the following:

Report of the Effluent Standards Committee prepared by Effluents Standards Committee (1977)

Guidelines on Municipal and Industrial Wastewater Standards (Parts I & II), prepared by the National Environment Management Council (1996)

In routine monitoring, different validated test methods may be used as long as they give reliable results. However, in case of disputes, the reference methods prescribed in this Tanzania Standard shall be used.

This Tanzania Standard is subject to periodic revision and amendment from time to time in order to reflect new developments in technology and changing circumstances.

In reporting results of tests or analysis made in accordance with this Tanzania Standard, if the final value, observed or calculated is to be rounded off, it shall be done in accordance with TZS 4 (see clause 2).

1 Scope

1.1 This Tanzania Standard is applicable to effluents discharged from municipal and industrial establishments. The standard prescribes the permissible limits for effluents discharged directly into water bodies.

1.2 The standard does not cover requirements for hazardous effluents such as radioactive materials, hospital wastes and specific industries with established wastewater standard. Restricted and banned chemicals under Rotterdam and Stockholm conventions, which have already been ratified by Tanzania, are shown under annex B of this Tanzania Standard.

1.3 Purpose

The purpose of the standard is to indicate the quality of effluents permitted to be discharged into water bodies. The use thereof is meant to promote a consistent approach towards prevention of water pollution in Tanzania.

In this regard, the wastewater to be discharged into receiving waters should be free from:

a) Substances that will settle in receiving waters forming putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life.

b) Floating debris and other material in amounts sufficient to be noticeable and lead to deterioration of receiving waters.

c) Nutrients in concentrations that promote undesirable growths of algae or aquatic weeds which may lead to secondary harmful effects in the receiving waters.

d) Materials in quantities or concentrations which are toxic or harmful to life.

e) Materials that alone or in combination with other materials will produce colour, turbidity, and odour in sufficient concentration to create a nuisance or adversely affect the aquatic ecosystem.

2 Normative references

The following standards contain provisions, which, through reference in this text, constitute provisions of this Tanzania Standard.

All standards are subject to revision, and parties to agreements based on this Tanzania Standard are required to investigate the possibility of applying the most recent editions of the standards below:

TZS 861: 2006, *Municipal and industrial wastewaters test methods*
TZS 861: 2006 Part 10, *Municipal and industrial wastewater sampling methods*

TZS 4: 1979, *Rounding off numerical values*

EMDC 1 (4668) TZS 90: 1980, *Water, sewerage and industrial effluents – Glossary of terms*

American Public Health Association (APHA), 1989, *Standard methods for the examination of water and wastewater*

ISO 6222: 1999, *Water quality – Microbiological methods*

EMDC 1 (4664) ISO 6468: 1996, *Water quality – Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes – Gas Chromatographic method after Liquid -Liquid extraction*

EMDC 1 (4665) ISO 7875 – 1: 1996, *Determination of surfactants – Part 1: Determination of anionic surfactants by measurement of the methylene blue index*

ISO 7887: 1994, *Water quality – Examination and determination of color – Section 3: Determination of true color using optical instruments*

EMDC 1 (4666) ISO 10301: 1997, *Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods*

EMDC 1 (4667) ISO 15586: 2003, Water quality – *Determination of trace elements using atomic absorption spectrometer with graphite furnace*

EMDC 1 (4669) **ISO 5815-1**: Water quality — Determination of biochemical oxygen demand after n days (BOD_n) Part 1: Dilution and seeding method with allylthiourea addition.

EMDC 1 (4670) ISO 10530 Water Quality – Determination of dissolved sulfide – Photometric method using methylene blue

EMDC 1 (4671) ISO 15705: Water quality — Determination of the chemical oxygen demand index (ST-COD) — Small-scale sealed-tube method.

3 Definitions of terms and phrases

For the purpose of this Tanzania Standard, and the normative references, unless the context specifically indicates otherwise, the following terms and phrases shall have the meanings respectively ascribed to them by this section.

Other general terms related to effluents are found in TZS 90 (see clause 2).

3.1 Biochemical Oxygen Demand (BOD)

The mass concentration of dissolved oxygen consumed under specified conditions by the biological oxidation of organic and/or inorganic matter in wastewater.

3.2 Chemical Oxygen Demand (COD)

The mass concentration of oxygen equivalent to the amount of dichromate consumed by dissolved and suspended matter when a sample of wastewater is treated with that oxidant under defined conditions.

3.3 effluent

Water or wastewater discharged from a containing space such as treatment plant, industrial process, lagoon, etc.

3.4 hazardous wastes

Any discarded material containing substances know to be toxic, mutagenic, carcinogenic, or teratogenic to humans or other life forms; ignitable, corrosive, explosive, or highly reactive alone or with other materials.

3.5 industrial effluents

Liquid wastes from industrial processes and operations.

3.6 kjeldahl nitrogen

The concentration of organic nitrogen and ammoniacal nitrogen in a wastewater sample, determined after mineralization. It does not include nitrate and nitrite nitrogen and does not necessarily include all organically bound nitrogen.

3.7 monitoring

The long term programmed process of sampling, measurement and subsequent recording, reporting or signaling, or both, of various wastewater characteristic with the aim of assessing compliance with specified standards.

3.8 municipal effluent

Liquid wastes from domestic processes and other non-industrial operations (e.g. institutional, commercial).

3.9 organic nitrogen

The difference between the nitrogen contents of a sample derived from the determination of Kjeldahl nitrogen and ammoniacal nitrogen.

3.10 pollution

The introduction by man, directly or indirectly, of substances or energy into the environment resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems, and impair or interfere with amenities and other legitimate uses of the environment.

3.11 receiving water

A perennial body of water, stream or watercourse receiving the discharged effluent.

3.12 suspended solids

Solids that either float on the surface of, or in suspension in water, sewage or other liquids and which are removable by laboratory filtering or centrifuging under specified conditions.

3.13 treatment facilities

An arrangement of devices and structures, excluding septic tanks, constructed for the purpose of treatment of wastewater for domestic, commercial or industrial sources, or combination thereof.

3.14 total dissolved solids

Total Dissolved Solids (TDS) are solids in water that can pass through a filter. TDS is a measure of the amount of material dissolved in water.

3.15 total phosphorus

The sum of all forms of phosphate normally present in wastewater, including orthophosphates, polyphosphates, metaphosphates, pyrophosphates and organic phosphates, expressed on terms of concentration of P (Phosphorus).

3.16 wastewater

Water discharged after being used, or produced by a process, and which is of no further immediate value to that process.

3.17water pollution

The impairment of the suitability of water from some considered purpose.

3.18 validated method

Any analytical procedure employed for specific test that has been confirmed by recognized authority.

4 Requirements

The permissible limits for municipal and industrial wastewater shall be as shown in table 1.

Table 1 – Permissible limits

Table 1.1 – Physical parameters

Parameter	Limits	Test method
BOD_5 at 20 ^oC mg/L	30	TZS 861: Part 3 /**ISO 5815**– Five-day BOD method
COD in mg/L	60	TZS 861: Part 4 – Dichromate digestion method
Colour TCU	50	ISO 7887: 1994, Water quality – Examination and determination of colour – Section 3: Determination of true color using optical instruments
pH range	6.5-9.0	TZS 861: Part 2 /**ISO 10523**– Electrometric method
Temperature range ^oC	20-35	See annex A
Temperature change ^0C	± 3	
Total Suspended Solids (TSS) mg/L	100	TZS 861: Part 1 – Gravimetric method
Turbidity NTU	30	APHA Standard methods: 2130 B. Nephelometric method
Total Dissolved Solids	1200	ISO 11923

Table 1.2 – Inorganic parameters

Parameter	Limit (mg/L max)	Test method
Aluminium (as Al)	2.0	TZS 861: Part 7 /**ISO 8288**– Direct nitrous oxide-Acetylene flame atomic absorption spectrometry
Arsenic (As)	0.01	TZS 861: Part 8 / **ISO 11885**– Manual hydride generation - Atomic absorption spectrometry
Barium (Ba)	1.5	TZS 861: Part 7 / **ISO 8288**– Direct nitrous oxide-Acetylene flame atomic absorption spectrometry **()**
Cadmium (Cd)	0.01	TZS 861: Part 7 / **ISO 8288**– Flame atomic absorption spectrometry
Chromium (total)	1.0	TZS 861: Part 7 / **ISO 8288**– Flame atomic absorption spectrometry
Chromium VI	0.05	TZS 861: Part 9 – Colorimetric method
Chlorides (Cl^-)	200	APHA Standard Methods: 4110 B. Ion chromatography with chemical suppression of eluant

		conductivity
Cobalt (Co)	1.0	TZS 861: Part 7 /**ISO 8288**– Flame atomic absorption spectrometry
Copper (Cu)	0.5	TZS 861: Part 7 / **ISO 8288**- Flame atomic absorption spectrometry
Fluorides (F^-)	4	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Iron	5.0	TZS 861: Part 7 / **ISO 8288**– Flame atomic absorption spectrometry
Lead (Pb)	0.01	TZS 861: Part 7 / ISO 8288)– Flame atomic absorption spectrometry
Manganese	5.0	TZS 861: Part 7 / **ISO 8288**– Flame atomic absorption spectrometry
Mercury (Hg)	0.001	TZS 861: Part 10 – Cold-vapor atomic absorption spectrometry
Nickel (Ni)	0.5	TZS 861: Part 7 / **ISO 8288**– Flame atomic absorption spectrometry
Nitrates (NO_3^-)	45	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Nitrites	1.0	ISO 6777
Total Nitrogen	10	ISO 5663
Ammonium nitrogen	5	
Phosphorus Total (as P)	5	TZS 861: Part 6 / **ISO 15681**– Colorimetric-ascorbic acid method
Selenium (Se)	0.02	TZS 861: Part 8 / **ISO 11885**– Manual hydride generation - Atomic absorption spectrometry
Silver (Ag)	0.1	TZS 1929 / ISO 15586: 2003, Water quality – Determination of trace elements using atomic absorption spectrometer with graphite furnace
Sulphate (SO_4^{2-})	500	APHA Standard Methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Sulphides (S^-)	1	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Tin (Sn)	2.0	TZS 861: Part 7 / **ISO 8288**– Flame atomic absorption spectrometry
Total Kjeldahl Nitrogen (as N)	15	TZS 861: Part 5 – Kjeldahl method
Vanadium	1.0	TZS 1929 / ISO 15586: 2003, Water quality – Determination of trace elements using atomic absorption spectrometer with graphite furnace
Zinc (Zn)	5.0	TZS 861: Part 7 – Flame atomic absorption spectrometry
Cyanide	0.05	ISO 6703
Total residue chlorine	0.2	ISO 7393-2

Table 1.3 – Organic parameters

Parameter	Limit (mg/l max)	Test method
1, 1, 2 - Trichloroethane	0.06	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
1,1,1 - Trichloroethane	3.0	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
1,2 – Dichloroethylene	0.2	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
1,2 - Dichloroethane	0.04	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
1,3 - Dichloropropene	0.2	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
Alkyl benzene sulfonate (ABS)	0	TZS 1407 / ISO 7875 – 1: 1996, Determination of surfactants – Part 1: Determination of anionic surfactants by measurement of the methylene blue index (MBAS)
Aromatic nitrogen containing compounds (e.g., aromatic amines)	0.001	APHA standard methods 6410: Liquid-liquid extraction GC/MS method
cis-1,2 - Dichloroethylene	0.4	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
Dichloromethane	0.2	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
Oil and grease (fatty maters and hydrocarbons)	10	APHA standard methods 5520
Organochlorine pesticides (Cl)	0	**TZS 1403:2016 /** GC ECD (ISO 6468: 1996, Water quality – Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes – Gas chromatographic method after liquid-liquid extraction)
Other aromatic and/or aliphatic hydrocarbons not used as pesticides	0.05	**TZS 1403:2016 /** GC ECD (ISO 6468: 1996, Water quality – Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes – Gas chromatographic method after liquid-liquid extraction)
Pesticides other than organochlorines	0.01	**TZS 1403:2016 /** GC ECD (ISO 6468: 1996, Water quality – Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes – Gas chromatographic method after liquid-liquid extraction)

Parameter	Limit (mg/l max)	Test method
Phenols	0.002	**TZS 1403:2016 /** GC ECD (ISO 6468: 1996, Water quality – Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes – Gas chromatographic method after liquid-liquid extraction)
Tetrachloroethylene	0.1	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
Tetrachloromethane	0.02	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
Trichloroethylene	0.3	TZS 861 / GC ECD (ISO 10301: 1997, Water quality – Determination of highly volatile halogenated hydrocarbons – Gas chromatographic methods)
PCBs	0.003	**TZS 1403:2016 /** ISO 6468

Table 1.4 – Microbiological parameters

Parameter	Limit (counts/100mL)	Test method
Total coliform organisms	10,000	ISO 6222:1999, Microbiological methods
E- coli	400	ISO 6222:1999, Microbiological methods
Fecal Coliform	1,000	ISO 6222:1999, Microbiological methods

5 Compliance with specified effluent limits

Discharging of wastewater in water bodies should ensure that

a) Effluent quality described in table 1 is achieved consistently;

b) Monitoring should be done by sampling in accordance with TZS 861(Part 10): 2006, – *Sampling methods*;

c) Effluent shall be treated onsite prior to discharge, dilution is not synonymous to treatment;

d) Effluents are not discharged in close proximity to water supply sources and recreational areas.

Annex A

Depth temperature measurement

Depth temperature required for limnological studies may be measured with a reversing thermometer, thermophone, or themistor. The thermistor is most convenient and accurate; however, higher cost may preclude its use. Calibrate any temperature measurement devices with TBS–certified thermometer before field use. Make readings with the thermometer or device immersed in water long enough to permit complete equilibration. Report results to the nearest 0.1 or 1.0°C, depending on need.

The thermometer commonly used for depth measurements is of the reversing type. It often is mounted on the sample collection apparatus so that a water sample may be obtained simultaneously. Correct readings of reversing thermometers for changes due to differences between temperature at reversal and temperature at time of reading. Calculate as follows:

$$\Delta T = \left[\frac{(T'-t)(T'-V_o)}{K}\right] \mathrm{X} \left[1+\frac{(T'-t)(T'+V_o)}{K}\right] + L$$

Where:

ΔT	correction to be added algebraically to uncorrected reading,
T'	uncorrected reading at reversal
t	temperature at which thermometer is read
V_o	volume, of small bulb end of capillary up to 0°C graduation
K	constant depending on relative thermal expansion of mercury and glass (usual value of K = 6100), and
L	calibration correction of thermometer depending on T'

If series observations are made it is convenient to prepare graphs for a thermometer to obtain ΔT from any values of T' and t.

Annex B

1. Prior Informed Consent (PICs) as per Rotterdam Convention

Chemicals

2, 4,5-T

Aldrin

Captafol

Chlordane

Chlordimeform

Chlorobenzilate

DDT

Dieldrin

Dinoseb and dinoseb salts

1,2-dibromoethane (EDB)

Fluoroacetamide

HCH (mixed isomers)

Heptachlor

Hexachlorobenzene

Lindane

Mercury compounds, including inorganic mercury compounds, alkyl mercury compound and alkyloxyalkyl and aryl mercury compounds

Pentachlorophenol

Monocrotophos (Soluble liquid formations of the substance that exceed 600 g active ingredient/L)

Methamidophos (Soluble liquid formulations of the substance that exceed 600 g active ingredient/l)

Phosphamidon (Soluble liquid formulations of the substance that exceed 1000g active ingredient/l)

Methyl-parathion (emulsifiable concentrates (EC) with 19.5%, 40%, 50%, 60% active ingredient and dusts containing 1.5%, 2% and 3% active ingredient)

Parathion

Crocidolite

Polybrominated biphenyls (PBB)

Polychlorinated biphenyls (PCB)

Polychlorinated triphenyls (PCT)

Tris (2,3-dibromopropyl phosphate)

2. Eliminated Persistent Organic Pollutants (POPs) as per Stockholm Convention

Aldrin*

Chlordane*

Dieldrin*

Endrin

Heptachlor*

HCB (Hexachlorobenzene)

Mirex

Toxaphene/Camphechlor*

Chlordecone

Decabromodiphenyl ether (commercial mixture, c-decaBDE

Hexabromobiphenyl

Hexabromocyclododecane (HBCDD)

Hexabromodiphenyl ether and heptabromodiphenyl ether (commercial octabromodiphenyl ether)

Hexachlorobenzene (HCB)

Hexachlorobutadiene

Alpha hexachlorocyclohexane

Beta hexachlorocyclohexane

Lindane

Pentachlorobenzene

Pentachlorophenol and its salts and esters

Polychlorinated biphenyls (PCB)

Polychlorinated naphthalenes

Short-chain chlorinated paraffins (SCCPs)

Technical endosulfan and its related isomers

Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial pentabromodiphenyl ether)

3. Restricted Persistent organic pollutants (POPs) as per Stockholm Convention

DDT*/DD

Polychlorinated biphenyls (PCB)

Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride

* These chemicals are also regulated by the Rotterdam Convention

4. Unintentional Persistent Organic Pollutants (POPs) as per Stockholm Convention

Dioxins and Furans (polychlorinated dibenzo-p-dioxins and dibenzofurans, PCDD/PCDF)

Hexachlorobenzene

Polychlorinated biphenyls (PCB)

Hexachlorobutadiene (HCBD)

Pentachlorobenzene

Polychlorinated naphthalenes