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EAST AFRICAN STANDARD

Wastewater discharged on land and into water bodies — Specification

EAST AFRICAN COMMUNITY

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards. XXXXXX.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 075, *Wastewater*

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

Introduction

The purpose of the standard is to indicate the quality of wastewater permitted to be discharged on land and into water bodies. The use thereof is meant to promote a consistent approach towards prevention of water pollution in the region. In this regard, the wastewaters to be discharged on land and into water bodies should be free from:

a) Substances that will settle in receiving water bodies or land 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 or land.

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.

Wastewater from all municipal and industrial establishments including but not limited to the listed below;

(1) The pulp and paper facilities.

(2) The oil and gas industry from exploration, production, refining and retail. It includes natural and petroleum gas, fuel oils, petrochemicals, lubricants, petroleum and other by-products

(3) Pharmaceutical, agrochemical, iron and steel manufacturing, metal smelting, radioactive materials/wastes, tannery, textile, mining, processing, packaging materials, cosmetic, food and beverage and hospital waste

(4) Wastewater principally derived from households, business buildings, institutions, etc. which may or may not contain surface runoff, groundwater or storm water

Wastewater discharged on land and into water bodies— Specification

1 Scope

This working draft east African standard specifies the requirements of wastewater discharged on land and into water bodies from municipal and industrial activities.

The standard does not cover requirements for hazardous effluents that are classified as restricted substances which should be evaluated under relevant international agreements, conventions and protocols.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6107, Water quality — Vocabulary

ISO 5815-2:2003, Water quality — Determination of biochemical oxygen demand after n days (BODn) — Part 2: Method of undiluted samples

ISO 11923:1997, Water quality — Determination of suspended solids by filtration through glass-fibre filters

ISO 7027-1, Water quality — Determination of turbidity— Part 1: Quantitative methods

ISO 10301:1997, Water quality — Determination of highly volatile halogenated hydrocarbons — Gas-chromatographic methods

ISO 6468:1996, Water quality — Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes — Gas chromatographic method after liquid-liquid extraction

ISO 7875-1, Water quality — Determination of surfactants — Part 1: Determination of anionic surfactants by measurement of the methylene blue index (MBAS)

ISO 10523, Water quality — Determination of pH

ISO/TC 15923-2, Water quality — Determination of selected parameters by discrete analysis systems — Part 2 — Chromium (VI), fluoride, total alkalinity, total hardness, calcium, magnesium, iron, iron (II), manganese and aluminium with photometric detection

ISO 12846, Water quality — Determination of mercury — method using atomic absorption spectrometry (AAS) with and without enrichment

ISO 17294-2, Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) — Part 2: Determination of selected elements including uranium isotopes

ISO 8288, Water quality — Determination of cobalt, nickel, copper, zinc, cadmium and lead — Flame atomic absorption spectrometric methods

ISO 15923-1, Water quality — Determination of selected parameters by discrete analysis systems — Part 1 — Ammonium, nitrate, nitrate, chloride, orthophosphate, sulphate and silicate with photometric detection

ISO 11732, Water quality — Determination of ammonium nitrogen — method by flow analysis (CFA and FIA) and spectrometric detection

ISO 11732, Water quality — Determination of dissolved sulphides — Photometric method using methylene blue

ISO 15705, Water quality — Determination of the chemical oxygen demand index (ST-COD) — Small- scale sealed- tube method

ISO 5663: 1984, Water quality — Determination of Kjeldahl nitrogen — Method after mineralization with selenium

ISO 6222: 1999, Water quality — Enumeration of culturable micro-organisms — Colony count by inoculation in a nutrient agar culture medium

ISO 6703, Water quality — Determination of cyanide — Part 1: Determination of total cyanide

ISO 24513:2019, Service activities relating to drinking water supply, wastewater and storm water systems — Vocabulary

ISO 6777: 1984, Water quality — Determination of nitrite — Molecular absorption spectrometric method

ISO 7393-2, Water quality — Determination of free chlorine and total chlorine — Part 2: Colorimetric method using N, N-dialkyl-1,4-phenylenediamine, for routine control purposes

ISO 7887: 1994, Water quality — Examination and determination of colour

ISO 15586: 2003, Water quality — Determination of trace elements using atomic absorption spectrometer with graphite furnace

ASTM D5907-13, *Standard test methods for filterable matter (total dissolved solids) and non-filterable matter (total suspended solids) in water*

ISO 5667-10, Water quality — Sampling — Part 10: Guidance on sampling of waste water

American Public Health Association (APHA) Standard Methods for the Examination of Water and Wastewater

3 Terms and definitions

For the purposes of this document, the following terms and definitions given in ISO 6107 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
absorbable organic halide (AOX)
amount of chloride, bromide, fluoride or iodide bound to dissolved or suspended organic material

3.2
hazardous wastes
any discarded material containing substances known to be toxic, mutagenic, carcinogenic, or teratogenic to humans or other life forms; ignitable, corrosive, explosive, or highly reactive alone or with other materials.

3.3
monitoring
long term programmed process of sampling, measurement and subsequent recording, reporting or signalling, or both, of various wastewater characteristic with the aim of assessing compliance with specified standards.

3.4
treatment facilities
an arrangement of devices and structures, excluding septic tanks, constructed for the purpose of treatment of wastewaters for domestic, commercial or industrial sources, or combination thereof.

3.5
wastewater
water discharged after being used, or produced by a process, and which is of no further immediate value to that process

3.6
water pollution
an impairment of the suitability of water from some considered purpose.

3.7
validated method
any analytical procedure employed for specific test that has been confirmed by recognized authority.

3.8
municipal wastewater
wastewater from residential settlements, commercial. institutional and public facilities, which originates predominantly from toilets, bathrooms and kitchens. It may include domestic wastewater from industry facilities and pretreated industrial wastewater.

3.9
industrial wastewater
wastewater generated from industrial processes

3.10
active ingredient
Active ingredients relate to major chemical groups used in the formulation of pesticides (insecticides, fungicides, herbicides & rodenticides) and pharmaceuticals

3.11
colour
absorption of light at a specific wavelength in a filtered wastewater sample.

3.12
crude oil
oil produced from a reservoir after any associated gas and/or water has been removed, often simply referred to as ‘crude’.

3.13
exploration
The search for oil and gas in the subsurface geological formation, which includes aerial, geophysical and geochemical surveys, core testing, and drilling of wells.

3.14
natural occurring radioactive materials (NORM'S)
those materials that contain radioactive elements found naturally in the earth's environment. Examples of these radioactive elements are the ^{238}U, ^{235}U, ^{232}Th series and their respective decay daughter, as well as ^{40}K.

3.15
oily waste
waste mainly composed of a mixture of oil, solids and water, with the occasional presence of other contaminants.

3.16
onshore
refers to the development of oil fields and gas deposits on land.

3.17
production
phase of petroleum activities that deals with bringing the well fluids to the surface and separating them, storing, gauging, and otherwise preparing the product for the pipeline.

4 Requirements

4.1 General requirements

4.1.1 Wastewater shall be treated prior to discharge; dilution is not an acceptable treatment option;

4.1.2 Discharging of wastewaters on land and into water bodies shall ensure that:

i. Wastewater quality specified in this standard is achieved consistently

ii. Discharge of municipal and industrial wastewater close to a water supply source and recreational areas shall be in consultation with local authorities

4.2 Specific requirements

4.2.1 Physical and chemical requirements

Wastewaters shall comply with the requirements given in Table 1 when tested in accordance with the methods prescribed therein

Table 1 — Physical and chemical requirements for municipal and industrial wastewaters

S/N	Parameter	Requirements	Test method
i.	BOD_5, at 20ºC, mg/L, max.	50	ISO 5815-2
ii.	COD, mg/L, max.	100	ISO 15705
iii.	Colour, TCU, max	300	ISO 7887
iv.	pH	5 – 9	ISO 10523
v.	temperature change, ºC	ambient ±5	Annex A
vi.	Oil and grease, mg/L, max	10	ISO 9377-2
vii.	Total Suspended Solids	80	ISO 11923

	(TSS), mg/L, max		
viii.	Turbidity, NTU	30	ISO 7027-1
ix.	Total dissolved solids, mg/L, max	1500	ASTM D5907-13
x.	Dissolved oxygen ,mg/L , min	3	ISO 17289
xi.	Electrical conductivity, µs/cm, max	2500	ISO 7888

4.2.2 Limits for Inorganic parameters

Municipal and industrial wastewaters shall comply with the requirements given in Table 2 when tested in accordance with the methods prescribed therein.

Table 2 — Maximum Inorganic limits for municipal and industrial wastewaters

S/N	Parameter	Maximum limits for municipal (mg/L)	Maximum limits for industrial (mg/L)	Test method
i.	Aluminium (as Al)	NA	2	ISO/TS 15923
ii.	Arsenic (As)	NA	0.01	ISO 17294-2
iii.	Barium (Ba)	NA	1.5	ISO 17294-2
iv.	Cadmium (Cd)	NA	0.01	ISO 8288
v.	Chromium (total)	NA	1.0	ISO 17294-2
vi.	Chromium (VI)	0.05	0.05	ISO/TS 15923
vii.	Chlorides (Cl^-)	250	250	ISO 15923-1
viii.	Cobalt (Co)	NA	1.0	ISO 8288
ix.	Copper (Cu)	1.0	1.0	ISO 8288
x.	Fluorides (F^-)	4	4	ISO/TS 15923
xi.	Iron	NA	3.5	ISO/TS 15923
xii.	Lead (Pb)	NA	0.01	ISO 8288
xiii.	Manganese	NA	1	ISO/TS 15923
xiv.	Mercury (Hg)	NA	0.001	ISO 12846
xv.	Nickel (Ni)	NA	0.5	ISO 8288
xvi.	Nitrates (NO_3-N)	10	10	ISO 15923-1
xvii.	Nitrites (NO_2)	1.0	1.0	ISO 6777
xviii.	Total Nitrogen	20	20	ISO 5663
xix.	Ammonium nitrogen	5	5	ISO 11732
xx.	Phosphorus Total (as P)	5	5	ISO 17294-2
xxi.	Selenium (Se)	NA	0.02	ISO 5663
xxii.	Silver (Ag)	NA	0.1	ISO 15586
xxiii.	Sulphate (SO_4^{2-})	500	500	ISO 15923-1

xxiv.	Sulphides (S^-)	1	1	ISO 10530
xxv.	Tin (Sn)	NA	2.0	ISO 17294-2
xxvi.	Total Kjeldahl Nitrogen (as N)	10	10	ISO 5663
xxvii.	Vanadium	NA	1.0	ISO 17294-2
xxviii.	Zinc (Zn)	NA	5.0	ISO 8288
xxix.	Cyanide	NA	0.05	ISO 6703
xxx.	Residual chlorine	0.5 (for the systems disinfecting with chlorine)	0.5	ISO 7393-2

NOTE: for the cases where municipal establishments contain a mixture of domestic and industrial wastewater, the parameters requirements under the column of industrial wastewater in Table 2 applies

4.2.3 Microbiological limits

The municipal and industrial wastewaters shall comply with the requirements given in Table 3 when tested in accordance with the methods prescribed therein.

Table 3 — Maximum microbiological limits for municipal and industrial wastewaters

S/N	Microorganisms	Maximum limits for municipal and industrial wastewater (counts/100mL)	Test method
i.	Total coliform organisms	10 000 (1000 for the systems disinfecting with chlorine)	ISO 6222
ii.	E- coli	400 (100 for the systems disinfecting with chlorine)	
iii.	Faecal Coliform	1 000 (400 for the systems disinfecting with chlorine)	

4.2.4 Natural occurring radioactive materials (NORM'S)

The wastewater discharged on land and into water bodies from any oil and gas, mining and processing of the radioactive material shall comply with the requirements given in the Table 4

Table 4 — Limits for natural occurring radioactive materials (NORM'S)

S/N	Parameter	Maximum Limit (Bq/g) or (Bq/l)	Test method
i.	^{238}U	1	ISO 13169

ii.	^{235}U	1	ISO 13169
iii.	^{232}Th	1	ISO 4722
iv.	^{226}Ra	10	ISO 22908
v.	^{222}Rn	10	ISO 13164-2
vi.	^{228}Ra	10	ISO 22908
vii.	^{224}Ra	10	ISO 13165-3
viii.	^{208}Tl	10	ISO 17294

NOTE: For onshore disposal of the NORM, permissible limits is < 50Bq/g but it should be in unpopulated and desert areas.

4.2.5 Limits for organic parameters

The municipal and industrial wastewater discharged on land and into water bodies shall comply with the requirements given in Table 5 when tested in accordance with the methods prescribed therein.

Table 5 — Maximum organic limits for municipal and industrial wastewaters

S/N	Parameter	Maximum limits for municipal wastewater (mg/L)	Maximum limits for industrial wastewater (mg/L)	Test method
i.	Active ingredients (each)	0.05	0.05	(APHA,)/ ISO 9562
ii.	Adsorbable Organic Halides (AOX)	1	1	(APHA,)/ ISO 15302
iii.	Benzene	NA	0.05	ISO 6468: ISO 7875
iv.	Benzo (a) pyrene	NA	0.05	(APHA, /ISO17993
v.	Detergents	15	15	**(APHA, /** ISO 2271
vi.	Dioxins/Furans (Total)	NA	0.00005	(APHA, / ISO 13914
vii.	Ethylbenzene	NA	0.05	ISO 10301
viii.	Fats Oils & Grease	10	10	ISO 9377
ix.	Nitro organic Compounds (each)	0.05	0.05	(APHA,)/ ISO 11733 (to be checked)
x.	Organochlorine pesticides (each)	NA	0.05	ISO 6468: 1996.
xi.	Organophosphorus pesticides (each)	NA	0.05	(APHA,)
xii.	Phenols	NA	0.5	ISO 6468/1SO 14402/6439
xiii.	Phenoxy Compounds (each)	NA	0.05	ISO 6468/1SO 14402/6439
xiv.	Polycyclic Aromatic Hydrocarbons (each)	0.05	0.05	(APHA, / ISO 28540
xv.	Pyrethroids (each)	NA	0.05	(APHA,)
xvi.	Toluene	NA	0.05	(APHA, / ISO 17943
xvii.	Total chlorocarbons	0.05	0.05	(APHA,)
xviii.	Total Hydrocarbons	NA	0.05	(APHA, / ASTM D7678
xix.	Total Organic Carbon	50	50	(APHA,)/ ASTM D7573/ ASTM D4839
xx.	Trichloroethane	0.05	0.05	(APHA, / ISO 17943
xxi.	Trichloroethylene	0.05	0.05	(APHA,)/ ISO 17943
xxii.	Vinyl Chloride	NA	0.05	(APHA, / ISO 17943
xxiii.	Xylene	NA	0.05	(APHA, / ISO 17943

NOTE: for the cases where municipal establishments contain a mixture of domestic and industrial wastewater, the parameters requirements under the column of industrial wastewater in Table 5 applies

5 Sampling

Sampling shall be done in accordance with ISO 5667-10.

Annex A
(normative)

Depth temperature measurement

A.1 General

Depth temperature required for limnological studies may be measured with a reversing thermometer, thermophone, or thermistor. The thermistor is most convenient and accurate; however, higher cost may preclude its use.

A.2 Procedure

Calibrate any temperature measurement devices with 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.

A.3 Calculation

The temperature change shall be calculated as follows:

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

Where:

ΔT correction to be added algebraically to uncorrected reading,

T’ uncorrected reading at reversal,

t temperature at which thermometer is read

Vo volume, of small bulb end of capillary up to 0ºC 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 ∆T from any values of T’ and t.