



EMDC 1(5081) P3

DRAFT TANZANIA STANDARD

**TITLE: TOLERANCE LIMITS FOR INDUSTRIAL EFFLUENTS DISCHARGED INTO
WATER BODIES – PULP AND PAPER MILLS**

FOR STAKEHOLDER'S COMMENTS ONLY

0. Foreword

Pulp and Paper are manufactured from raw materials containing cellulose fibres, usually wood, recycled paper or agricultural residuals such as bagasse and wheat/rice straw. The main steps in pulp and paper manufacturing are raw material preparation (such as wood debarking and chipping); pulp making, pulp bleaching; paper manufacturing and fibre recycling. Pulp mills and Paper mills may exist separately or as integrated operations. The manufacture of pulp for papermaking employs chemical (sulphate/kraft, sulphite) and/or mechanical (thermomechanical, chemimechanical, chemithermalmechanical) processes to obtain the cellulosic fibres from the respective raw material. The chemical pulping process that is currently used in Tanzania is known as kraft (sulphate) pulping whereby woodchips are cooked with caustic soda in steam heated vessels. The fibrous brown stock is then washed with water to separate the cellulose (kraft pulp) from dissolved lignin, extractives and other binding materials (black liquor) which is sent to the chemical recovery system regenerate the chemicals and steam for electric power production. Kraft pulp is brown in colour and maybe used as such or bleached prior to being used in the production of a variety of high strength packaging paper and board.

Paper is made from unbleached or bleached pulp, highly diluted in water to disperse individual fibres which are uniformly spread onto a moving forming device (wire part the of the paper machine) which also removes water from the paper sheet. Chemical additives are added to impart specific paper properties. The wet sheet passes through a press section and then steam-heated cylinders for final drying.

Paper is used not only in its obvious applications in the packaging, printing and publishing industry but also used in a variety of other specialty areas such as newsprint, coloured writing papers, cardboards, wrapping and production of paperbags. .

Traditionally, the pulp and paper industry have been large users of water. Nowadays, strenuous efforts are being made to decrease the water usage, as any treatment of the effluent is made easier if the volume is decreased. Also, by intensive recirculation and reuse of liquid waste streams within the mill, the amounts of contaminants can be reduced in the effluent.

The effluents from pulp and paper mills are discharged into water bodies such as rivers. 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 the preparation of this Tanzania Standard, considerable assistance was drawn from the:

1. Pollution Prevention and Abatement Handbook; World Bank Group, 1989;
2. Report on Ecological & Environmental Factors in Paper Industry, Volume-IV, National And International Regulatory Standards for Water & Air Quality Monitoring; Prepared by Indian Central Pulp & Paper Research Institute,

In reporting results of tests or analyses 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

This Tanzania standard prescribes the applicable limits to effluents discharged from the pulp and paper mills directly into water bodies. It covers Integrated Pulp and Paper Facilities using unbleached Kraft Pulp and Integrated Pulp and Paper Facilities Recycled Fiber Without Deinking

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 4: 1979, *Rounding off numerical values*

TZS 1932:2016: *Water quality — Determination of the chemical oxygen demand index (ST-COD) — Small-scale sealed-tube method.*

TZS 861: Part 1 – *Gravimetric method: Water quality – Determination of trace elements using atomic absorption spectrometer with graphite furnace.*

TZS 861: Part 2 – *Electrometric method (ISO 10523) Water quality – Determination of trace elements using atomic absorption spectrometer with graphite furnace:*

TZS 861: Part 5 – *Kjeldahl method: Water quality – Determination of trace elements using atomic absorption spectrometer with graphite furnace.*

TZS 861: Part 6 – *Colorimetric-ascorbic acid method (ISO 15681): Water quality – Determination of trace elements using atomic absorption spectrometer with graphite furnace*

TZS 861: Part 7 / ISO 8288) – *Flame atomic absorption spectrometry: Water quality – Determination of trace elements using atomic absorption spectrometer with graphite furnace*

TZS 1932:2016: *Water quality — Determination of the chemical oxygen demand index (ST-COD) — Small-scale sealed-tube method.*

TZS 1930:2016: *Water quality — Determination of biochemical oxygen demand after n days (BOD_n) Part 2: Method for Undiluted samples.*

APHA standard methods: 4110 B. *Ion chromatography with chemical suppression of eluant conductivity.*

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

3. Terminology

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

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 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.

3.5 industrial effluents

Liquid wastes from institutional, commercial and industrial processes and operations.

3.6 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.

3.7 receiving water

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

3.8 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.

3.9 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. Privately owned wastewater treatment facilities which treat predominantly industrial waste shall be excluded.

3.10 wastewater

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

3.11 water pollution

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

3.12 Absorbable Organic Halide (AOX)

The amount of chloride, bromide or iodide bound to dissolved or suspended organic material.

3.13 colour

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

3 Requirements

The main parameters to be regulated for control of wastewater quality for the pulp and paper industry are flow, biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), pH, total suspended solids (TSS), absorbable organic halides (AOX), Total Nitrogen and Total Phosphate. The following two Table summarizes the wastewater release standards from different Pulp and Paper facilities:

Table 1 - Effluent Standards for Integrated Pulp and Paper Facilities—using Unbleached Kraft Pulp.

Parameter	Limits	Units	Test method
Flow a	80	m ³ /ADt	
pH	6-9		TZS 861: Part 2 – Electrometric method (ISO 10523)
TSS	11	kg/ADt	TZS 861: Part 1 – Gravimetric method
COD	11	kg/ADt	FTZS 1932:2016
BOD ₅	4	kg/ADt	FTZS 1930:2016
Total N	0.15	kg/ADt	TZS 861: Part 5 – Kjeldahl method
Total P	0.01		TZS 861: Part 6 – Colorimetric-ascorbic acid method (ISO 15681)
Colour	Not to cause significant change in receiving water body		ISO 7887: 1994, Water quality – Examination and determination of colour – Section 3: Determination of true color using optical instruments
Temperature range	20-35	°C	
TDS	873		ISO 11923
Sulphides (S)	0.07	kg/ADt	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Sulphate (SO ₄ ²⁻)	36.4	kg/ADt	APHA Standard Methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity

Fluoride	0.29	kg/ADt	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Chloride	14.5	kg/ADt	APHA Standard Methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
NO ₃	3.5	kg/ADt	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
NH ₄	0.36	kg/ADt	ISO 11905
Pb	0.00072	kg/ADt	TZS 861: Part 7 / ISO 8288)– Flame atomic absorption spectrometry

Table 2 —Effluent Standards for Integrated Pulp and Paper Facilities—Recycled Fiber, without Deinking

Parameter	Limits	Units	Test method
Flow	80	m ³ /ADt	
pH	6-9		TZS 861: Part 2 – Electrometric method (ISO 10523)
TSS	0.11	kg/ADt	TZS 861: Part 1 – Gravimetric method
COD	1.09	kg/ADt	FTZS 1932:2016
BOD ₅	0.11	kg/ADt	FTZS 1930:2016
AOX	0.004	kg/ADt	
Total N	0.04	kg/ADt	TZS 861: Part 5 – Kjeldahl method
Total P	0.004	kg/ADt	TZS 861: Part 6 – Colorimetric-ascorbic acid method (ISO 15681)
True colour	Not to cause significant change in receiving water body		
Temperature range	20-35	°C	See annex A
TDS	873		ISO 11923
Sulphides (S)	0.07	kg/ADt	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Sulphate (SO ₄ ²⁻)	36.36	kg/ADt	APHA Standard Methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Flouride	0.29	kg/ADt	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
Chloride	14.5	kg/ADt	APHA Standard Methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
NO ₃	3.5	kg/ADt	APHA standard methods: 4110 B. Ion chromatography with chemical suppression of eluant conductivity
NH ₄	0.36	kg/ADt	ISO 11905
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N.B Conversion from mg/L to kg/ADt

The formula:

$$X \text{ in kg/ADt} \times 1000 = \frac{y \text{ in mg/L}}{(\text{vol. of flow})}$$

Where:

X unknown units

Y is the limit value for respective parameter in the revised general waste water standard

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Annex A

Depth temperature measurement

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. 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:

$$\Delta T = \left[\frac{(T' - t)(T' - V \circ)}{K} \right] \times \left[1 + \frac{(T' - t)(T' + V \circ)}{K} \right] + L$$

Where:

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

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