



DRAFT TANZANIA STANDARD

Air quality – Specification

draft for stakeholders comments only

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0. Foreword

For Tanzania, rapid development will inevitably also mean rapid industrialization and urbanization. A possible consequence is the deterioration of the precious environment, if proper control is not planned.

This draft Tanzania Standard aims at ensuring that as much as the desire for development, the environment, and life must be protected.

The set of baseline parameters on ambient air quality and emissions given in the standard are based on a number of considerations so as to come out with practical and acceptable limits. The set is not exhaustive, but has been prioritized. In the course of implementation, more parameters may be added to the list when the need to review this Tanzania Standard arises. This will help developers such as industrialists to keep abreast with environmentally friendly technologies.

This draft Tanzania Standard gives two types of limits, viz “guidelines” and “limit levels”. The limit levels, which are binding and may be used for regulatory purposes, are usually measurable in shorter periods averaging time. On the other hand, the “guidelines” are based on studies that indicate safe levels averaged over relatively longer periods and they are mostly derived from WHO Guidelines (2005).

Thus, though one may be within the “limit levels”, long-term exposure guidelines should help one to assess the magnitude of risk of particular air pollutants over longer periods.

The limits given are of general application. However, industry-specific limits for some categories of pollution sources will be prepared as separate standards for the peculiar pollutants characteristics and loads.

In the preparation of this draft Tanzania Standard, considerable assistance was derived from the following sources:

International Register of Potentially Toxic Chemicals – International Environmental Guidelines and Global Conventions Concerning Chemical Substances, prepared by United Nations Environment Programme (UNEP) and published as “*Legal File 1994*”

National Environment Management Council (NEMC) workshop paper on *Developing Environmental Pollution Standards – Air Pollution Standard* prepared by the NEMC in 1996

Environmental Laws of the Czech Republic Vol. 3: *Air and Water Protection Laws* published in 1993

Standards of Performance of New Stationary Sources, US Federal Register, Vol. 39, no. 219 published in 1974.

World Health Organization (Regional Office for Europe), *Air Quality Guidelines* (Third Edition) 2005

This assistance is gratefully acknowledged.

In reporting the results of a test or analysis made in accordance with this draft 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 draft Tanzania Standard gives permissible limits of some common pollutants found in polluted air, namely sulfur dioxide (SO₂), carbon monoxide (CO), dust in terms of suspended particulate matter as TSP, PM₁₀ and PM_{2.5}, oxides of nitrogen (NO, NO₂ and NO_x), hydrocarbons (HCs), Volatile Organic Compounds (VOCs), Ozone (O₃) and particulate lead (Pb). The standard covers both the ambient air and emission sources.

2 References

For the purpose of this draft Tanzania Standard the following references shall apply.

TZS 3: 1979, *Atmospheric conditions for testing*

TZS 4: 2009, *Rounding off numerical values*

TZS 836 – 1: 2011, *Air quality – General considerations – Vocabulary*

TZS 836 – 2: 2011, *Air quality – General considerations – Particle size fraction definitions for health-related sampling*

TZS 837 – 1: 2011, *Air quality – Sampling and test methods – Guidelines for planning the sampling of atmospheric and location of monitoring stations*

TZS 837 – 2: 2011, *Air quality – Sampling and test methods – Sampling of gaseous pollutants*

TZS 837 – 3: 2011, *Air quality – Sampling and test methods – Ambient air-determination of black smoke index*

TZS 837 – 3: 2011, *Air quality - Sampling and test methods – Stationary source emissions – Manual determination of mass concentration of particulate matter*

TZS 837 – 4: 2011, *Air quality – Sampling and test methods – Stationary source emissions – Determination of the mass concentration of sulphur dioxide – Hydrogen peroxide/barium perchlorate/Thorin method*

TZS 837 – 5: 2011, *Air quality – Sampling and test methods – Determination of the mass concentration of nitrogen oxides – Naphthyethediamine photometric method*

TZS 837 – 6: 2011, *Sampling and test methods – Determination of carbon monoxide carbon dioxide and oxygen – Performance characteristics and calibration of automated measuring systems*

TZS 837 – 7: 2011, *Air quality – Sampling and test methods – Road vehicles – Measurement equipment for exhaust gas emissions during inspection or maintenance – Technical specifications*

TZS 837 – 8: 2011, *Air quality – Sampling and test methods – Determination of the particulate lead content of aerosol collected on filter – Atomic absorption Spectrophotometric method*

3 Terminology

For the purpose of this draft Tanzania Standard, the following definitions shall apply:

3.1 ambient air

An outdoor air to which people, plants, animals or material are in normal circumstances exposed.

3.2 suspended particulate matter

All particulate material which persists in the atmosphere or in a flue gas stream for lengthy periods because the particles are too small in size i.e $\leq 10\mu\text{m}$ to have an appreciable falling velocity.

3.3 black smoke

Is the visible (black) aerosol usually resulting from combustion.

3.4 controlled area

A place or area where rules, regulations and behavioral norms are subject to strict enforcements and scrutiny.

3.5 immission

Is the transfer of pollutants from the atmosphere to a receptor.

3.6 immission limit

Is the highest permissible weight concentration of pollutants contained in the air.

3.7 emission

Discharge of substances into the atmosphere. The point or area from which the discharge takes place is called the "source". The term is used to describe the discharge and the rate of discharge. The term can also be used for noise, heat, etc.

3.8 emission limit

Is the highest permissible quantity of pollutant released into the air from a pollution source, expressed as the concentration of pollutant in relation to one unit of production or to the degree of air pollution caused by these sources (e.g. dark colour of smoke).

NOTE:

1 All the emission limits are valid for concentration expressed for any dry gas under normal atmospheric conditions (see TZS 3: 1979 Atmospheric Conditions for Testing).

2 When emission limits are surpassed, other actions may be called in, e.g. proper land usage/relocation of factories, enforcement of by laws by local authorities (which may give more stringent specifications for emissions), revision of standards and types of fuels to be allowed.

4 Limits

4.1 The following shall apply for the ambient air

Table 1 — Immission limits

	Pollutant	Time weighted Average	Designated Areas			Test methods
			Industrial area	Residential, Urban, Rural & Other area	Controlled areas***	
1.	Sulphur oxides (SO _x);	Annual Average*	80 µg/m ³	60 µg/m ³	15 µg/m ³	ISO 4221-1980
		24 hours**	125 µg/m ³	80 µg/m ³	20 µg/m ³	
		One Hour Instant Peak	500 µg/m ³	500 µg/m ³	500 µg/m ³	
		Instant Peak (10 min)	500 µg/m ³	500 µg/m ³	500 µg/m ³	
2.	Oxides of Nitrogen (NO _x);	Annual Average*	80 µg/m ³	60 µg/m ³	15 µg/m ³	ISO7996:1985
		24 hours**	150 µg/m ³	80 µg/m ³	30 µg/m ³	
		8 hours				
		Instant Peak	940 µg/m ³	500 µg/m ³		
3.	Nitrogen Dioxide	Annual Average	150 µg/m ³	95 µg/m ³		ISO 6768:1998
		Month Average		150µg/m ³		
		24 Hours	100 µg/m ³	190µg/m ³		
		One Hour		380µg/m ³		
		Instant Peak		940µg/m ³		
4.	Suspended particulate matter (SPM)	Annual Average*	360 µg/m ³	140 µg/m ³	70 µg/m ³	ISO 9835:1993
		24 hours**	500 µg/m ³	200 µg/m ³	100 µg/m ³	
		Annual Average****		100 µg/m ³		
		24 hours***	180 µg/m ³	180 µg/m ³		
5.	Respirable particulate matter(RPM) (<10µm)	Annual Average*	70 µg/m ³	50 µg/m ³	50 µg/m ³	ISO 9835:1993
		24 hours**	150 µg/m ³	100 µg/m ³	75 µg/m ³	
6.	Respirable particulate matterPM _{2.5}	Annual Average	35 µg/m ³	35 µg/m ³	35 µg/m ³	ISO 9835:1993
		24 hours	75 µg/m ³	75 µg/m ³	75 µg/m ³	
7.	Particulate Lead (Pb)	Annual Average*	1.0 µg/m ³	0.75 µg/m ³	0.50 µg/m ³	ISO 9855:1993
		24 hours**	1.5 µg/m ³	1.00 µg/m ³	0.75 µg/m ³	
		Month Average		2.5 µg/m ³		
8.	Carbon monoxide (CO)	8 hours**	5.0 mg/m ³	10 mg/m ³	1.0 mg/m ³	ISO 4224:2000
		1 hour	10.0 mg/m ³	10 mg/m ³	2.0 mg/m ³	
		24 hours**				
9.	Non-methane hydrocarbons	instant Peak	800µg/m ³			ISO 12884
10.	Total VOC	8 hour**	6 mg/m ³	6 mg/m ³	6 mg/m ³	ISO16000-6
11.	Ozone	1-Hour	200 µg/m ³	240 µg/m ³	240 µg/m ³	ISO 13964

Table 1. Continued

		8 hour (instant Peak)	100 µg/m ³	100 µg/m ³	100 µg/m ³	
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And any other parameter as may be prescribed by the Authority from time to time.

Legend

- a) Values at Standard Temperature and Pressure (STP)
- b) Conversion factors from ppm to mg/m³ and mg/m³ to ppm are stipulated under the annex A
- c) * [Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.]
- d) [** 24 hourly/8 hourly values should be met 98 % of the time in a year. However, 2 % of the time, it may exceed but not on two consecutive days.]
- e) Whenever and wherever two consecutive values exceed the limit specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations.
- f) * the 24-hour limit may not be exceeded more than three times in one year;
- g) ** 24-hour limit may not be exceeded more than three times in one year micrograms/m³
- h) *** Not to be exceeded more than once per year average concentration
- i) Where measured components results from a combustion process, 10 % excess oxygen will be included. Excess air above 10 % will result in dilution of pollutants
- j) The Regulatory Authority may, for purpose of compliance, correct the concentration for humidity (to account for location by location variation)

Table 2 — Ambient air quality at property boundary for general pollutants

	Pollutant	Time weighted average	Property boundary
1	Suspended Particulate matter (SPM)	Annual average*	50 µg/m ³
		24 hours**	70 µg/m ³
2.	Oxides of Nitrogen (NO _x);	Annual average*	80 µg/m ³
		24 hours**	150 µg/m ³
3.	Sulphur oxides (SO _x);	Annual average*	50 µg/m ³
		24 hours**	125 µg/m ³

NOTE

- a) For residential premises in designated industrial areas, the above standards do not apply.
- b) For industries in designated residential areas, standards for residential areas shall apply.

4.2 The following limits shall apply for emission sources.

Table 3 — Emission limits

Pollutant	Guideline	Limit Level	Test Method
Sulphur oxides* SO _x	Large Combustion Plants (LCP) using solid fuel with thermal effect of: 50 to 100 MWth	Yearly average of: 850 mg/m ³	ISO 4221
	100 to 300 MWth	200 mg/m ³	
	> 300 MWth	200 mg/m ³	
	LCP using liquid fuel with thermal effect of: 50 to 100 MWth	850 mg/m ³	
	100 to 300 MWth	400 to 200 mg/m ³ (linear decrease)	
	> 300 MWth	200 mg/m ³	
	LCP using gaseous fuel	35 mg/m ³	
	LCP using low calorific gases from gasification of refinery residues, coke oven gas, blast-furnace gas	800 mg/m ³	
Carbon monoxide, CO	Liquid fuel combustion with heat output exceeding 5MW.	Not to exceed 175 mg/m ³	ISO 4224
	Solid fuel combustion with the heat output of 50MW and above	Not to exceed the level of 250 mg/m ³	
Hydrocarbon (as Total Organic Carbon)		Not to exceed 20 mg/m ³	ISO 12884
Dust	Inert dust	Not to exceed 250mg/m ³ (24h mean value)	ISO 12141
Nitrogen Oxides* NO _x	LCP using solid fuel with thermal effect of: 50 to 500 MWth	Yearly average of: 600 mg/m ³	ISO 7996
	>500 MWth	500 mg/m ³	
	LCP using liquid fuel with thermal effect of: 50 to 500 MWth	450 mg/m ³	
	>500 MWth	400 mg/m ³	
	LCP using liquid fuel with thermal effect of: 50 to 500 MWth	300 mg/m ³	
	>500 MWth	200 mg/m ³	

SO_x to be reported as SO₂
* NO_x to be reported as NO₂

Pollutant	Guideline	Limit Level	Test Method
Lead	Not to exceed 5 tonne/year of lead or lead compounds (measured as elemental lead) by a stationary source	0.15 µg/m ³	ISO 9855
Sulphur Oxides, SO _x *	Annual mean of 40 – 60 µg/m ³ (0.05-0.08 mg/kg) or 24 – hour average 100 µg/Nm ³ (0.129 mg/kg)	Daily average of hourly values shall not exceed 0.1 mg/kg 0.5 mg/m ³ for 10 minutes	ISO 4221 ISO 6767
Carbon monoxide, CO	Aims at preventing carboxyhaemoglobin levels exceeding 2.5-3% in non-smoking people.	1. A maximum permitted exposure of 100mg/m ³ for periods not exceeding 15 minutes. 2. Time-weighted exposures at the following levels: <ul style="list-style-type: none"> ▪ 100 mg/m³ for 15 minutes ▪ 60 mg/m³ for 30 minutes; ▪ 30 mg/m³ for 60 minutes ▪ 10 mg/m³ for 8 hours. or Daily average of hourly values shall not exceed 10mg/kg and average of hourly values in eight consecutive hours shall not exceed 20 mg/kg.	ISO 4224 ISO 8186
Black smoke	40 to 60 µg/m ³ (0.05-0.08 mg/kg)	Daily average of hourly values shall not exceed 0.10 µg/m ³ and hourly values shall not exceed 0.20 µg/m ³	ISO 9835
Suspended Particulate Matters (PM 10)	60 to 90 µg/m ³ (0.077 – 0.116 mg/kg)	Daily average of hourly values shall not exceed 0.10 µg/m ³ and hourly values shall not exceed 0.20 µg/m ³	ISO 9835
Nitrogen dioxide; NO _x	Annual mean of 0.1 µg/m ³	150 µg/m ³ for 24-hours average value 120µg/m ³ for 8 hours	ISO 6768 and ISO 7996
Lead	Annual mean of 0.5 – 1.0 µg/m ³	1.5µg/m ³ for 24 – hours average value	ISO 9855
Ozone	Annual mean of 10 – 100 µg/m ³	120 µg/m ³ for 8 – hours average value	ISO 13964

Annex A

* Sox to be reported as SO₂

Guideline on conversion factors

A.1 ppm to mg/m³ – air

The conversion between ppm and mg/m³ is dependent on both the molecular weight of the substance and the temperature at which the conversion is made. The assumption is that the pollutant behaves as an ideal gas and as such, 1 mole of the substance occupies 22.4 litres at standard temperature (273K) and pressure (101.3 kPa). This is consistent with normalised concentrations, and it is therefore not normally necessary to take account of the temperature or pressure difference in the conversion. However, when converting ppm to mg/m³ at actual discharge conditions, it is important to take account of the necessary factors.

To convert from ppm to mg/m³, the following formula should be used:

$$\text{mg/m}^3 = \text{ppm} \times (\text{MW}/22.4) \times (273/T) \times (P/101.3)$$

Where

MW is the molecular weight of the substance (in grams)
T is the temperature at which the conversion is to be made (degrees Kelvin)
P is the pressure at which the conversion is to be made (kPa)

A.2 mg/m³ to ppm – air

To convert from mg/m³ to ppm, the following formulae should be used:

$$\text{ppm} = \text{mg/m}^3 \times (22.4/\text{MW}) \times (T/273) \times (101.3/P)$$

Annex B

List of Abbreviations.

kPa= Kilo Pascal

MW= Megawatt

Ppm= Parts per million

STP= Standard Temperature and Pressure

MW= Megawatt

MWth= Megawatt-thermal

WHO= World Health Organization

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