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Zambian Standard *(*First Revision*)*

DRINKING WATER QUALITY - Specification

ZAMBIA BUREAU OF STANDARDS

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ZAMBIA BUREAU OF STANDARDS

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TECHNICAL COMMITTEE RESPONSIBLE

The preparation of this Zambian Standard has been undertaken by the Water and Environmental Pollution Technical Committee (TC4/7), upon which the following organizations were represented:

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TABLE OF CONTENTS

FOREWORD

This Zambian Standard has been prepared by the Technical Committee on Water and Environmental Pollution (TC4/7), in accordance with the procedures of the Bureau.

The Standard is the first revision of ZS 190: 1990. The revision of the standard was necessitated by the observation during implementation of the original standard, that some of the specifications needed to be reviewed in order to safeguard the quality of drinking water.

Reference has been made to the following publications in preparation of this Standard:

WHO Guidelines for drinking water quality, 2nd Edition, published by the World Health Organisation.

SSA 409:1984 Bottled and un-bottled drinking water, published by the Saudi Arabian Standards Organization.

Circulation No. 3 of 1989, Guidelines for drinking water, published by the Department of Water Affairs, Ministry of Lands, Water and Natural Resource.

COMPLIANCE WITH A STANDARD DOES NOT OF ITSELF CONFER IMMUNITY FROM LEGAL OBLIGATIONS.

ZAMBIA BUREAU OF STANDARDS

ZAMBIAN STANDARD

DRINKING WATER QUALITY - Specification

0. INTRODUCTION

0.1 The Local Administration and Public Health Acts of the Laws of Zambia specify that water for public consumption must be potable. However, generally potable water should not necessarily be pure as the presence of certain minerals in suitable concentrations is actually desirable to health.

0.2 Some of the numerous substances that are found in natural water supplies include the following:

i) Suspended matter: bacteria, viruses, protozoans, algae, clay, colloids, silt and various other inorganic and organic matter.

ii) Dissolved matter: dissolved gases, inorganic and organic substances.

Some of these substances listed above may be desirable and some may not depending on the use for which the water is going to be put and the quantities of such substances in the water.

0.3 Natural water undergoes purification or treatment in order for it to be rendered safe and satisfactory for use by the public. Hygienic and aesthetic considerations necessitate the limiting of undesirable substances in water being considered for public supply.

0.4 "The situation, construction, operation and supervision of water supply, its reservoirs and its distribution system shall be such that they exclude any possible pollution of the water"

1. SCOPE

This Zambian Standard prescribes requirements for potable drinking water suitable for human consumption.

2. NORMATIVE REFERENCES

The following Standards are referred to in this Zambian Standard. Parties to agreements based on this standard are hence encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ZS ASM D1126: Standard Test Method for Hardness in Water
SM 2160 B (Standard Method for the examination of water and waste water): Determination of Taste
ZS 191: Vocabulary for water quality.
ZS 276: Methods of sampling for water quality.

ZS 312: Water Quality – Part 1- Determination of Odour
ZS 312: Water Quality – Part 3 - Determination of Sulphide
ZS 312: Water Quality – Part 13- Determination of Nitrite
ZS 312: Water Quality – Part 15- Determination of Pesticides
ZS 312: Water Quality – Part 19- Determination of Dissolved solids
ZS 312: Water Quality – Part 20- Determination of Detergents
ZS ISO 5961: Water Quality - Determination of Cadmium
ZS ISO 5666: Water Quality - Determination of Mercury
ZS ISO 6058: Water Quality - Determination of Calcium
ZS ISO 6333: Water Quality - Determination of Manganese
ZS ISO 6439: Water Quality - Determination of Phenol index
ZS ISO 6703-1: Water Quality - Determination of Total cyanide– Part 1
ZS ISO 7027: Water Quality - Determination of Turbidity
ZS ISO 7393-1: Water Quality - Determination of Free chlorine– Part 1
ZS ISO 7887: Water Quality - Determination of Colour
ZS ISO 7888: Water Quality- Determination of Electrical conductivity
ZS ISO 7980: Water Quality- Determination of Calcium and magnesium
ZS ISO 7890-2: Water Quality- Determination of Nitrate– Part 2
ZS ISO 8288: Water Quality- Determination of Cobalt, nickel, copper, zinc, cadmium and lead
ZS ISO 9174: Water Quality- Determination of Chromium
ZS ISO 9297: Water Quality- Determination of Chloride
ZS ISO 9390: Water Quality- Determination of Borate
ZS ISO 9696: Water Quality – Measurement of Gross Alpha Activity in non saline water
ZS ISO 9697: Water Quality – Measurement of Gross Beta Activity in non saline water
ZS ISO 9964-1: Water Quality- Determination of sodium
ZS ISO 9965: Water Quality- Determination of Selenium
ZS ISO 10359-1: Water Quality- Determination of Fluoride – Part 1
ZS ISO 10523: Water Quality- Determination of pH
ZS ISO 10566: Water Quality- Determination of Aluminium
ZS ISO 11885: Water Quality- Determination of 33 elements
ZS ISO 11969: Water Quality- Determination of Arsenic

3. DEFINITIONS

For the purpose of this Zambian Standard the definitions given in ZS 191 shall apply.

4. NON-INJURIOUS CONSTITUENTS OF DRINKING WATER

4.1 General

Parameters that do not pose a risk to human health are addressed under Clause 4.

4.2 Requirements

4.2.1 General physical and chemical characteristics

Drinking water shall comply with the general physical and chemical requirements as given in table 1.

Table 1: General Physical Characteristics of Drinking Water

Parameters	**Maximum permissible limit**	**Method of test**
Odour	Unobjectionable to most consumers	ZS 312 Part 1
Colour (True colour units or TCU)	15	ZS ISO 7887
Taste	Unobjectionable to most consumers	SM 2160B
pH	6.5 - 8.0	ZS ISO 10523
Hardness (total) as Calcium carbonate $CaCO_3$ (mg/litre)	500	ZSASTM D1126
Dissolved solids (total)mg/l	1 000	ZS 312 Part 19
Turbidity (NTU)	5	ZS ISO 7027
Conductivity (µs/cm)	1,500	ZS ISO 7888

4.2.2 Non-toxic chemical substances

Drinking water shall comply with the following specifications for non-toxic chemical substances as given in table 2.

Table 2: Non-Toxic Chemical Substances in Drinking Water

Substance	Maximum permissible limit (mg/litre)	Method of test
Calcium (Ca)	200	ZS ISO 6058
Chloride (Cl^-)	250	ZS ISO 9297
Chlorine residue	0.2-0.5	ZS ISO 7393 Part 1
Copper (Cu)	1.0	ZS ISO 8288
Iron (Fe)	0.3	ZS ISO 11885
Magnesium (Mg)	150	ZS ISO 7980
Sulphate (SO^{2-}_4)	400	ZS 312 Part 3
Zinc (Zn)	3	ZS ISO 8288
Phenolic compounds (as phenol)	0.002	ZS ISO 6439
Detergents (alkyl benzene sulphonate)	1.0	ZS 312 Part 20
Sodium	200	ZS ISO 9964 Part 1

4.2.3 Total residual chlorine

4.2.3.1 The total residual chlorine in treated drinking water shall be sufficient for complete elimination of all micro-organisms. Drinking water shall have residual chlorine concentration as outlined in table 2 upon receipt by the consumer.

4.2.3.2 The amount of chlorine residue shall be increased during epidemic cases or special cases according to instructions from the Ministry of Health.

NOTE: In case of water treatment with ozone, saturated iodine solution, ultraviolet rays or by any other treatment other than with chlorine, the treatment shall be sufficient to eliminate all the micro-organisms. Treated water shall comply with the microbiological requirements in table 5.

5. INJURIOUS CONSTITUENTS OF DRINKIG WATER

5.1 General

Parameters that pose a risk to human health are addressed under Clause 5.

5.2 Requirements

5.2.1 Specific toxic chemical substances

Drinking water shall comply with the specifications for toxic chemicals as given in table 3**.**

Table 3: Toxic Chemical Substances in Drinking Water

Substance	**Maximum permissible limit (mg/litre)**	**Method of test**
Aluminium (Al)	0.2	ZS ISO 10566
Arsenic (As)	0.01	ZS ISO 11969
Cadmium	0.003	ZS ISO 5961
Barium	0.7	ZS ISO 11885
Chromium (Cr)	0.05	ZS ISO 9174
Cobalt(Co) (mg/litre)	0.5	ZS ISO 8288
Cyanide (CN^-)	0.01	ZS ISO 6703-1
Fluoride (F^-)	1.5	ZS ISO 10359 Part 1
Lead (Pb)	0.01	ZS ISO 8288
Mercury (Hg)	0.001	ZS ISO 5666
Manganese (Mn)	0.1	ZS ISO 6333
Nitrates (NO_{-3} -N)	10	ZS ISO 7890 Part 3
Nitrite (NO_{-2} –N)	1.0	ZS 312: Part 13
Selenium (Se)	0.01	ZS ISO 9965
Silver (Ag)	0.05	ZS ISO 11885

5.2.2 Pesticides

The maximum permissible limits of pesticides if present in drinking water shall be as outline in table 4.

Table 4: Pesticide Limits in Drinking Water

Pesticide	Maximum permissible limit (µg/litre)	Method of test
Aldrin/dieldrin	0.01	ZS 312 Part 15
Chlordane	0.3	
2,4-D	30	
DDT	1.0	
Endonsulfan	2	
Endrin	0.2	
Heptachlor and heptachlor epoxide	0.1	
Hexachlorobenzene	0.01	
Lindane (Gamma BHC)	3.0	
Methoxychlor	30	
Toxaphene	5	

NOTE.
Corresponding chemical names of the pesticides in table 4 are given in annex A.

5.2.4 Trihalomethanes

The concentration of trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane and tribromomethane) shall not exceed 30 µg/litre when tested in accordance with ZS 312 Part 18.

5.2.5 Chemical substances which indicate pollution

Considerable variations in the amount of the following chemical substances in drinking water from the prevailing quantities in the water source area shall indicate presence of pollution: organic matter, albuminoid nitrogen, nitrates, hydrogen sulphide, dissolved oxygen, free carbon dioxide, phosphate, ammonia and nitrite.

5.2.6 Microbiological Requirements

Coliforms in piped supply and un-piped supplies of drinking water shall not exceed the limits given in table 5.

Table 5: Microbiological Requirements of Piped and Un-Piped Drinking Water

Type of Drinking Water	**Maximum permissible limit in 100 ml**		**Remarks**
1. Piped Water Supplies	**Faecal Coliforms**	**Coliform organisms**	
Treated water entering the distribution system	0	0	In any one sample
Untreated water entering the distribution system	0	3	In any one sample
	0	0	In any two consecutive samples
	0	0	0 in 95 percent of yearly samples
	0	20	In an occasional sample but not in consecutive samples
Water in the distribution system	0	10	In any two consecutive samples
	0	20	In an occasional sample but not in consecutive samples
2. Un-Piped Water Supplies			
	0	20	In any two consecutive samples
	0	50	In an occasional sample but not in consecutive samples
Emergency supplies of water	0	0	

5.2.7 Biological characteristics

Drinking water shall be completely free from insects and their ova or cyst, their vesicles or parts, and free from amoeba, algae, mould and parasites.

5.2.8 Radioactive Requirements

The levels of radioactive constituents of drinking water shall not be more than the limits given in table 6.

Table 6: Radioactive Requirements for Drinking Water

Substance	Maximum permissible limit (Bq/litre)	Method of test
Gross alpha activity	0.1	ZSISO 9696
Gross beta activity	1	ZSISO 9697

6. SAMPLING

Representative samples shall be drawn according to sampling schemes designed in accordance with ZS 276.

7. TESTING AND CONFORMITY TO THE STANDARD

The drinking water shall conform to this standard if it meets all the requirements prescribed in this standard.

ANNEX A
(Informative)

CHEMICAL NAMES FOR PESTICIDES MENTIONED IN THIS STANDARD

Common name	Chemical name
Aldrin	1,2,3,4,10,10-hexachloro-1,4,4a-5,8,8a-hexahydro-endo-1,4-exo-5,8-dimethanonaphthalene
Chlordane	1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene
2,4-D	(2,4-dichlorophenoxy) acetic acid
o,p'-DDT	1,1,1-trichloro-2-(o-chlorophenyl) -2-(p-chlorophenyl)-ethane
p,p'-DDT	1,1,1-trichloro-2,2-bis(p-chlorophenyl) ethane
Dieldrin	1,2,3,4,10-10-hexachloro-exo-6,7-epoxy-,4a,5,6,-7,8,8a-octahydro-1,4-endo,exo-5,8-dimethano- naphthalene
Endosulfan (Alpha and beta)	6,7,8,9,10,10-hexachloro-exo-6, 7-epoxy-4a,5,6,-7,8,8a-Octahydro-1,4-endo, exo-5,8-dimethano naphthalene
Endrin	1,2,3,4,10,10-hexachloro-6,7-epoxy -1,4,4a,5,6,7,8,8a-octahydro-endo-5,8-dimethanonaphthalene
Heptachlor	1,4,5,6,7,8,8-heptachloro-3a,4,7, 7a-tetrahydro-4,7-methanoindene
Hexachlorobenzene	Same name
Lindane (gamma BHC)	1,2,3,4,5,6-a,a,e,e,e-hexachloro-cyclohexane
Methoxychlor	2,2,-bis(p-methoxyphenyl)-1,1,1-trichloroethane
Toxaphene (camphechlor)	Approximately $C_{10}H_{10}Cl_8$

NOTES:

1. “p,p'-DDT” is the pure technical form of DDT which is transformed into a family of closely related partial degradation and re-arrangement compounds (o,p'-DDT, DDD, DDE and others) in the environment.

2. Toxaphene (camphechlor)is a mixture of chlorinated camphenes