

Technical Regulation

Water – Drinking Water

The Board of Directors of The Jordanian Institute of Standards and Metrology (JISM), in its meeting No. 2/2001 dated 8/02/2001, endorsed Standard No. 286/2001 as a “Technical Regulation” to be effective starting from 8/02/2001 based on the authorities assigned to the board by Article (8) Paragraph (B) from the Standards and Metrology Law No. 22/2000

The Jordanian Institute of Standards and Metrology
Hashemite Kingdom of Jordan

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Water – Drinking Water

GIT

The Jordanian Institute of Standards and Metrology
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This Standard replaces the same Standard issued in 1997

Introduction

The Jordanian Institute of Standards and Metrology (JISM) is the national body for metrology in Jordan. Technical committees comprised of representatives of the official parties concerned with the subject of the Standard prepare Jordanian Standards. All parties concerned with the subject of the Standard have the right to express opinions and remarks on this Standard during the period of circulating the final proposal so that Jordanian Standards are compatible with International standards as much as possible, and to remove trade barriers and facilitate the flow of good between countries.

Accordingly, the Technical Committee for Water and Sewage Water No. 16 has amended the Jordanian Standard No. (286/1997) Proposal dealing with Water-Drinking Water and recommended adopting it as a Jordanian Technical Regulation No. (286/2001) based on the Standards and Metrology Law No. 22 for the Year 2000, Article (11) Paragraph (B).

Water – Drinking Water

1. Scope

This Jordanian Standard addresses the standard requirements (conditions) and quality control for drinking water

2. Terminologies & Definitions

For the purposes of this Standard, the following terminologies and definitions shall be used:

2.1

Drinking Water

Water suitable for drinking, household, food industries and ice-making purposes, which meet the requirements and properties, included in this Standard

2.2

Pollution/Contamination

Any excess, whatsoever, in the values (concentration levels) of the physical, chemical, biological or radioactive properties that have a negative effect on human health which makes it not in line with the conditions included in this Standard

2.3

Sanitation/Disinfection

The process of eliminating pathogenic microbes and microbes indicative of contamination by the use of disinfectants such as Chlorine, ClO_2 , Ultraviolet Light or Ozone or any other disinfectants approved by the relevant official institutions.

2.4

Water Distribution Network

All the facilities, equipment and water delivery pipelines starting from the source after the treatment and ending at the meter of the consumer for the public network and at the consumer outlet (faucet) for the private network

2.5

Surface Water

Running water or water in lakes, dams, ponds or other water bodies

2.6

Protected Underground Water

Water found underground that is not exposed to contamination

2.7

Private Water Source

Water sources owned by the private sector

2.8

Public Water Source

Water source owned by the public sector

2.9

Health Survey

Field surveillance to expose the source of contamination

2.10

Total Halogenated Methanes (Total TriHalomethanes)

The group of halogenated methanes concentrates comprising the following compounds: Bromo Dichloromethane, Dibromo Chloromethane, Tribromo Methane, and Trichloro Methane.

2.11

Alpha Radionuclides

Total radioactivity from Alpha radionuclides

2.12

Beta Radionuclides

Total radioactivity from Beta radionuclides

2.13

Curi

A unit of measurement for radioactivity (1 Curi equals the radioactivity resulting from the diffusion of 10×3.7 atom/second)

2.14

Biquarell (Bq)

A unit of measurement for radioactivity (1 Bq equals the radioactivity resulting from one atomic diffusion/second which is equal to 10×2.7 Curi)

2.15

Sevret

The quantity of exposure to radioactivity equal to the biological effect of 1 Gray from Gama Rays

3. Standard Requirements

The following requirements and properties have to be available in Drinking Water

3.1 Physical Properties

The physical properties of drinking water should be as listed in table (1)

Table (1) Physical Properties for Drinking Water

Property	Permissible Level	Maximum Level *
Color	10 True Color Units (TCU)	15 True Color Units (TCU)
Taste	Edible for most people	-
Odor	Acceptable for most people	-
Turbidity	1 NTU	5 NTU
* In the absence of a public water source of better quality		

3.2 Substances and Properties That Affect the Taste of Drinking Water

The substances and properties that has an effect on drinking water should be as illustrated in Table (2)

Table (2)
Substances and Properties That Affect the Taste of Drinking Water

Properties	Symbol	Permissible Level mg/liter	Maximum Level* mg/liter
Hydroxide	pH	6.5-8.5	-
Total Dissolved Solids	TDS	500	1500
Total Hardness	TH	300	500
Chemical Detergents	LAS (MBAS)	0.2	0.5
Ammonium	NH ₄	0.5	0.5
Aluminum	Al	0.1	0.2
Manganese	Mn	0.1	0.2
Iron	Fe	0.3	1.0
Copper	Cu	1.0	1.5
Zinc	Zn	3.0	5.0
Sodium	Na	200	400
Chloride	Cl	200	500
Sulfates	SO ₄	200500	
* In the absence of a public water source of better quality			

3.3 Non-Organic Chemical Substances that has an Effect on Public Health

The non-organic chemical substances that has an effect on public health should be as listed in Table (3)

Table (3)
Non-Organic Chemical Substances that has an Effect on Public Health

Chemical Substance	Symbol	Permissible Level mg/liter
Arsenic	As	0.01
Lead	Pb	0.01
Cyanide	CN	0.07
Cadmium	Cd	0.03
Chrome	Cr	0.05
Barium	Ba	1.5
Selenium	Se	1.5
Boron	B	2.0
Mercury	Hg	0.002
Silver	Ag	0.1
Nickel	Ni	0.07
Antimony	Sb	0.005
Fluoride	Fl	2.0
Nitrite	NO ₂	2.0
Nitrate	NO ₃	50.0 *
* Maximum contamination level of 70 mg/liter is permissible in the absence of a public water source of better quality		

3.4 Organic Pesticides that have an Effect on Human Health

The concentrations of organic pesticides that have an effect on human health should not exceed the values listed in Table (4), and the total concentration should not exceed 100 micrograms / liter.

Table (4) Organic Pesticides that have an Effect on Human Health

Chemical Substance	Symbol	Permissible Level * micrograms/liter
Endrin	Endrin	2.0
Lindane	Lindane	4.0
Heptachlor Epoxide & Heptachlor	Heptachlor Epoxide & Heptachlor	0.03
Aldrin	Aldrin	0.03
Dieldrin	Dieldrin	0.03
2-4 D	2-4 D	90.0
DDT	DDT	2.0
2-4-5T	2-4-5T (2-4-5-TP / Silvex)	9.0
* In the event that testing for the contamination with any other pesticide is necessary, the List of substances included in the instructions of the World Health Organization is to be used as well as the permissible contamination levels and the respective standards		

3.5 Organic Contaminants/Pollutants

The concentrations of organic pollutants should not exceed the values listed in Table (5)

Table (5) Organic Contaminants/Pollutants in Drinking Water

Chemical Substance	Permissible Level * micrograms/liter
Benzene	10.0
Tetrachloro ethylene (PCE)	5.0
Trichloro ethylene (TCE)	5.0
Ethylbenzene	500.0
Xylene	700.0
Toluene	300.0
* In the event that testing for the contamination with any other chemical substance is necessary, the List of substances included in the instructions of the World Health Organization is to be used as well as the permissible contamination levels and the respective standards	

3.6 Byproducts of the Sanitization/Disinfection Process

The concentrations of the byproducts of the sanitation/disinfection process should not exceed the values listed in Table (6)

Table (6) Byproducts of the Sanitization/Disinfection Process

Substance	Symbol	Permissible Level
Free Chloride Surplus		When Chloride is used to disinfect water, the water in the distribution network should contain not less than 0.2 mg/liter of free Chloride surplus and not more than 1 mg/liter 15 minutes after adding the Chloride to the water. Generally speaking, 15 minutes should lapse after the disinfection process before the disinfected water reaches the first consumer
Total TriHalomethanes	TTHM	0.15 mg/liter
Chlorite	ClO ₂	0.8 mg/liter

3.7 Radioactive Materials

The reference level for the radioactive properties of drinking water should be as listed in Table (7)

Table (7) Radioactive Materials in Drinking Water

Radioactive Material	Standard Level for Radioactive Properties *
Alpha Radionuclides excluding ** Radon	0.5 Biquarel/liter
Beta Radionuclides excluding Tritium and Carbon 14	1 Biquarel/liter
* If Alpha & Beta Radionuclides exceeded the reference level for radioactive properties, an investigation of the type and source of the radionuclides should be carried out, as well as an assessment of the health effects, and to measure the level of exposure to radioactive materials so that it does not exceed 0.1 millisvert /year for Beta radionuclids for each element ** Excluded items are not computed under the reference level	

3.8 Microbiological Properties

3.8.1 Bacteria

The 100ml representative water sample has to be free of:

- Fecal Coliform Rods when using the filtration method or any other internationally approved method , and that the number of the Fecal coliform rods is less than 1.1 when using the “Most probable Number” method.
- Heat-Resistant Fecal Coliform rods or E. Coli when using the filtration method or any other internationally approved method , and that the number of the Fecal coliform rods is less than 1.1 when using the “Most probable Number” method.

3.8.2 Parasites

Drinking water has to be free of all stages of the pathogenic parasites and infectious intestinal worms.

3.8.3 Free Living Organisms (Nematodes)

The number of any stage of the stages of the free-living organisms (Nematodes) should not exceed 1 living organism per liter

4. Quality Control

The suitability of water for drinking and its compliance with the adopted health standards have to be verified/checked by the party owning the water project/enterprise, and it is obliged to conduct the necessary laboratory tests and to maintain official records of the results of those tests and to make them available for the governmental control agencies upon request. The tests have to be repeated, at least, according to the frequency explained in the following:

4.1 Microbiological Quality

4.1.1 Bacteriological Quality (Bacteria Indicative of Contamination)

4.1.1.1 Water For Drinking

The water is tested for Fecal Coliform Rods and for Heat-Resistant Coliform Rods or E. Coli according to the following frequency at least:

- a) Protected underground water: 1 sample tested each month
- b) Surface and underground water sources susceptible to contamination tested at the rate of 1 sample/day (5 samples/week)
- c) Water distribution network according to the number of citizens served as follows:

Less than 5000 Citizens	1 sample/month
5000 - 50000 Citizens	1 sample/month/5000 citizens
More than 50000 Citizens	1 sample/month/10000 citizens + 10 samples

4.1.1.2 Measures to be Taken when Contamination is Discovered in the First Sample

4.1.1.2.1 Contamination with Fecal Coliforms

At least two verification samples are collected from the same site with 1-hour interval between taking the samples. Pumping is stopped from and to the site if contamination appears in two out of three samples, and the necessary corrective measures are to be taken, and pumping is not resumed till after two samples, taken 1 hour apart, prove suitable.

4.1.1.2.2 Contamination with Heat-Resistant Coliforms or E. Coli

- a) Carry a health survey to investigate the source of contamination
- b) In the case the source of contamination is discovered, pumping from the source or network affected by the contamination is stopped, and efforts should be made to remove the contamination, and pumping should not be resumed till after water is proved to be suitable for two successive days at the rate of 1 sample/day
- c) In case that the source of contamination is not determined, the scope and coverage of investigation should be expanded, and to test more samples from the neighboring area, and test two successive samples, taken 1 hour

apart, from the same spot where the contamination appeared in the first time.

- d) The site, from which the sample was collected, is considered to be contaminated/polluted if any of the two samples mentioned in © above tested positive for contamination. In this case, pumping is stopped from and to the site and is not resumed till after the causes of contamination are eliminated and two successive samples test to be suitable for drinking.

4.1.1.3 Annual Assessment of the Water Networks

The efficiency of large networks, supplying 50 000 citizens or more, is assessed annually (I.e. a period of 12 months). Ratio of samples not conforming to the Bacteriological Quality Standards should not exceed 5 %, if it exceeds 5% corrective measures have to be taken to deal with the situation.

4.1.2 Biological Quality and Pathogenic Microbes

4.1.2.1 As need arises, water is tested for:

- a) Pathogenic primates or intestinal worms
- b) Pathogenic intestinal bacteria

If contamination with any of the afore-mentioned pathogenic causes is confirmed, pumping is immediately stopped and two successive samples are to be taken, and pumping will not be resumed unless all samples prove to be free from contamination

4.1.2.2 Drinking water from surface sources is microscopically tested, to checked for free living organisms (Nematodes), at the rate of 1 sample/week.

If the number of living organisms (Nematodes) exceeded the permissible limit in any sample, six additional samples will be tested in three successive days at the rate of 2 samples/day, samples will be taken six hours apart. Pumping will continue if the number of samples conforming with quality is more than half the number of samples tested, and it is stopped if the number of samples that do not meet the requirements is more than half the total number of tested samples, and corrective action is taken. Pumping is resumed only after the number of samples conforming with quality is more than half the number of samples tested over three days at the rate of 2 samples/day, samples will be taken six hours apart.

4.2 Physical, Chemical and Radioactive Quality

4.2.1 Cyclic Nature of Analysis (Frequency)

4.2.1.1 The First Group of Properties Listed in Tables 1 & 2, as well as the Nitrates and Nitrites from Table 3

- a) New Sources and Sources That are Re-operated after a 6-Month Stoppage: Three samples are physically and chemically tested for the above-mentioned properties at intervals of 72 hours between successive samples, and the weighted average is considered when calculating the concentration of a property to illustrate the extent of conformity of the quality with the Standard before approving the source. Tests are repeated once every three months only for the first year.
- b) Surface and Underground Water Sources Susceptible to Surface Contamination:
The above-mentioned properties are tested at least once every three months

- c) Protected Underground Sources:
The above-mentioned properties are tested at least once every year

4.2.1.2 The Second Group of Properties Listed in Table 3 and Excluding Nitrates and Nitrites

- a) New Sources and Sources That are Re-operated after a 1-year or more Stoppage:

A sample is physically and chemically tested for the above-mentioned properties to illustrate the extent of conformity of the quality with the Standard before approving the source. Tests are repeated once every six months only for the first year.

- b) Surface and Underground Water Sources Susceptible to Surface Contamination:

The above-mentioned properties are tested at least once every year

- c) Protected Underground Sources:

The above-mentioned properties are tested at least once every year, and if tests showed the stability of quality for these properties and its conformity with the requirements of the Standard for two successive years, then the above-mentioned properties shall be tested once every three years. On the other hand, if tests showed an unstable quality of the source concerning these properties, testing will go on annually.

4.2.1.3 The Third Group of Properties Listed in Table 6 “Byproducts of the Sanitation Process”

- a) Free Chloride Surplus:

Tested daily from the sources and networks

- b) Chlorite:

Tested daily from water treated with Chloride Dioxide

- c) Total TriHalomethanes (TTHM):

Total TriHalomethanes will be tested, at least once a week, in the networks fed from surface sources treated with chloride compounds

Total TriHalomethanes will be tested, at least twice a year, in networks fed from underground sources susceptible to contamination

4.2.1.4 The Fourth Group of Properties “Pesticides and Organic Contaminants” Listed in Tables 4 & 5

Pesticides and Organic Contaminants will be tested once a year in surface and underground water susceptible for contamination

4.2.1.5 The Fifth Group of Properties “Radioactive Substances” Listed in Table 7

Alpha and Beta radionuclides will be tested once every two years for the water sources

4.2.2 Action Mechanism When the Standard is Exceeded

4.2.2.1 Physical and Chemical Properties Listed in Tables 1 & 2, as well as the Nitrates and Nitrites

If any permissible level for any of the above-mentioned properties is observed, two daily verification samples will be tested successively concerning the color, taste, odor, turbidity and the Hydroxide number, and in two successive weeks for the remaining properties. If the weighted average for the three samples is within the permissible limits pumping will continue. If the weighted average is higher than the permissible limits pumping will continue while investigating the causes and dealing with them. However, if the weighted average for the last three samples is higher than the permissible limits pumping will be stopped and will not be resumed till the concentration is within the maximum permissible concentration level after testing three samples within one week at two day intervals between samples.

4.2.2.2 Elements and Compounds Listed in Table 3 and Excluding Nitrates and Nitrites

In case the permissible level as given in the Standard is exceeded for any of the above – mentioned properties, two verification samples will be tested one week apart (and in two successive weeks) and the weighted average for the three samples will be calculated, if it is within the permissible concentration level then pumping will continue. If the weighted average is higher than the permissible limits pumping will be stopped while investigating the causes, and pumping will not be resumed till the concentration is within the permissible concentration level after testing three samples within one week at two-day intervals between samples.

4.2.2.3 Byproducts of the Sanitation Process (Free Chloride, Chlorites and Total Trihalomethanes)

a) Sources:

The monthly average for the concentration of Total Trihalomethanes in the source is calculated, if it exceeds the permissible level then the party responsible for that source has to take the necessary measures to deal with the situation. In case the situation continues for another month, pumping will be stopped till the average is back to the permissible level for seven successive days.

b) Networks:

The monthly average for the concentration of Free Chloride, Chlorites and Total Trihalomethanes for all the samples tested during the month from any network, if the average exceeds the permissible level then the responsible party has to take the necessary measures to deal with the situation and testing is repeated from any point in the network where an exceeding of the permissible level was detected in two successive weeks at the rate of one sample/week, if the concentration continues to exceed the permissible level during two successive weeks at a rate of one sample/week the causes have to be investigated and addressed (eliminated)

4.2.2.4 Pesticides and Organic Contaminants Listed in Tables 4 & 5

If the permissible levels for the Pesticides and Organic Contaminants listed in Tables 4 & 5 is exceeded in any sample, two verification samples in two successive weeks will be tested and the weighted average for the three samples is calculated, if it is within the permissible level pumping continues, while if the weighted average is higher than the permissible limits pumping will be stopped while investigating the causes, and pumping will not be resumed till the weighted average for the concentration of three successive samples collected within one week is within the level permissible by the Standard.

4.2.2.5 Radioactive Substances (Alpha & Beta Radionuclides) Listed in Table (7)

If the reference level for the above-mentioned radioactive materials is exceeded in any sample, the types of radionuclides present in water and hazards to public health will be investigated and necessary measures taken afterwards.

5. Collection and Testing of Samples

Samples collection and testing methods given in any of the following references can be used:

- "The Standard Water & Wastewater Analysis Methods" published by "The American Public Health Society" and modifications introduced to it.
- The standard methods listed in the book "Water Quality" published by the World Health Organization
- "Water analysis Methods", Report No. 72 on Public Health and Medical affairs Society, London/Britain

6. References

- APHA (1998) Standard Method for the Examination of Water and Wastewater. APHA, AWWA, WEF, Washington D.C.
- Canadian standards
- EC Standards
- EPA Standards
- Geldreich E. (1996) Microbial Growth of water Supplies in Distribution Systems, (Edited by Geldreich E.) Lewis Publisher, Boca Raton, Florida.
- WHO (1996) Guidelines for Drinking-Water Quality –(Second Edition 2-Volume 2) World Health Organization, Geneva