Technical Regulation

This document is mandatory

Water – Drinking Water

The Board of the Jordan Standards and Metrology Organization (JSMO) approved - in its session No. 8/2015 held on 30/12/2015 - the adoption of standard specification no. 286/2015 as a mandatory (mandatorily enforceable) technical regulation, to come into effect as of 1/5/2016, pursuant to the powers granted to the said Board, in accordance with paragraph B of Article 10 of the Jordan Standards and Metrology Law, No. 22/2000 and its amendments.

Jordan Standards and Metrology Organization

The Hashemite Kingdom of Jordan

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Sixth Edition

Jordanian Metrological Standard

Water – Drinking Water

Standards and Metrology Organization

Hashemite Kingdom of Jordan

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Tables

This Jordanian metrological standard is a substitute for the same Jordanian metrological standard issued in 2008 and shall replace it.

Introduction

The Jordan Standards and Metrology Organization (JSMO) is the national organization for standardization in Jordan. It creates Jordanian metrological standards (or "Jordanian standard specifications") through technical committees, usually composed of members representing the main bodies relevant to the standard in question. These bodies may express opinions and make comments on this Jordanian metrological standard during the period set out for circulation of the voting proposal. This helps the Jordanian metrological standards be as in line as possible with national, regional and international standards; it will also enable removal of the technical barriers from trade and facilitate the flow of commodities among countries.

The Jordanian metrological standards are structured and drafted in accordance with the technical operational manual of the Standardization Directorate 1-2/2005, part 2: Rules for Structuring and Drafting Jordanian Metrological Standards*.

Consequently, the standing water and wastewater technical committee - 17 studied the Jordanian metrological standard 286/2008 relevant to **water – bottled water** and the draft Jordanian metrological standard 286/2014 relevant to **water – bottled water**, and recommended adopting the amended proposal as a Jordanian technical standard 286/2015, pursuant to Article 12 of the Standards and Metrology Law No. 22 of 2000 and its amendments.

Consequently, the standing water and wastewater technical committee 17 studied the Jordanian metrological standard 286/2008 relevant to **water – drinking water** and the draft Jordanian metrological standard 286/2014 relevant to **water – drinking water**, then recommended adopting the amendment as a Jordanian technical standard 286/2015, pursuant to Article 12 of the Standards and Metrology Law No. 22 of 2000 and its amendments.

* Currently under amendment.

J M S 286 / 2015

Water – Drinking Water

1 – The Scope

This Jordanian metrological standard pertains to the standard conditions for microbiological, chemical, physical and radioactive properties and procedures for drinking water quality control and assessment, whether it is from a public or private water supply source.

2 – Standardization references

The following reference documents are indispensable for the enforcement of this document. In the event of a dated referral, the referenced edition only shall apply. In the event of an undated referral, the last edition of the reference document indicated below shall apply (including any amendments). It is noteworthy that the Standards and Metrology Organization's library contains indexes of the currently valid standards.

- Water Quality Book published by the International Standards Organisation (ISO).
- Standard Methods for Analysing Water and Wastewater (Book) published by the American Public Health (APHA).
- Water Analysis Methods Book, Report No. 71 on Public Health and Medical Affairs, 1994, published by the Public Health and Medical Affairs Association, Britain.
- Guidelines for Drinking Water Quality published by the World Health Organization (WHO), issue 4, recommendations 2011.
- Document on effective "Microbiological Standards on Raw Water Quality for Drinking Water Sources and Minimum Requirements of Treatment for Utilization of those Sources", published by the Water Quality Higher Committee.

3 – Terms, definitions, symbols and abbreviations and acronyms

3 – 1 Terms and definitions

For the purposes of this Jordanian metrological standard, the below terms and definitions shall be used:

3 – 1 – 1

Drinking water

Water intended for drinking purposes, home use, food industries and ice.

3 – 1 – 2: Contamination

Any change to the physical, chemical, microbiological or radioactive properties of the water, limiting its potability (drinkability).

3 – 1 – 3: Purification

The process of controlling microbial activity through the use of purifiers, such as chlorine, chlorine dioxide, ultraviolet rays, ozone, or any purifiers approved by the operational and oversight bodies (Ministry of Water and Irrigation, Ministry of Health).

3 – 1 – 4: Water distribution network

All drinking water supply facilities (enterprises…), equipment and lines, starting from the source after treatment and ending with the consumer's water supply meter on the public network.

3 – 1 – 5: Surface water sources

Running (surface) water sources in rivers, seas, streams and valleys or lake, dam or pond water.

3 – 1 – 6: Protected ground water sources

Ground water sources with stable physical, chemical and microbial quality, which can be utilised for drinking purposes using purification processes alone.

3 – 1 – 7: Unprotected ground water sources

Ground water sources from wells, springs or supply mains the physical and/or chemical and/or microbial properties of which change due to external factors.

3 – 1 – 8: Protection areas

Areas of land subject to various activity prohibition or restriction to protect water sources from contamination.

3 – 1 – 9: Private water source

Water source owned by the private sector

3 – 1 – 10: Public water source

Water source owned by the public sector, from which citizens are supplied, whether a singular source (well, spring or supply mains), or a compound one (consisting of a mix of more than one single source (pumping station, desalination plant, gathering 'ground' reservoir).

3 – 1 – 11: Total Trihalomethanes

Total concentrations of trihalomethanes, including the following compounds:

Bromodichloromethane, dibromochloromethane, tribromomethane and trichloro methane.

3 – 1 – 12: Health survey

Field survey to discover sources of contamination in water supply sources, drinking water treatment plans, drinking water pumping stations, main drinking water reservoirs or drinking water networks, to be familiarised with any flaw that has occurred or that may occur, which would adversely impact drinking water quality.

3 – 1 – 13: Alpha radiators

Total radioactivity attributed to alpha radiators.

3 – 1 – 14: Beta radiators

Total radioactivity attributed to beta radiators.

3 – 1 – 15: Becquerel (Bq)

Radioactivity measuring unit (one becquerel is equal to disintegration or nuclear transformation (decay) per second).

3 – 1 – 16: Sievert (Sv)

The amount of exposure to radioactivity.

3 – 1 – 17: Supervisory body

The body mandated with supervision programmes in accordance with its law.

3 – 1 – 18: Operational body

The body mandated with producing, treating and supplying safe drinking water in accordance with its law.

3 – 2 Symbols and abbreviations and acronyms

For the purposes of this Jordanian metrological standard, the symbols, abbreviations and acronyms listed in Table 1 shall be spelled out/abbreviated as follows:

Table 1 – Symbols and abbreviations

Term in Arabic	Symbol	Abbreviated term
البيكاريل	Bq	Becquerel
برومو ثنائي كلورو الميثان	-	Bromodichloromethane
ثنائي برومو كلورو الميثان	-	Dibromochloromethane
ثنائي كلورو ثنائي فينيل ثلاثي كلورو الإيثان	DDT	Dichloro-Diphenyl-Trichloroethane
مادة المثيلين الأزرق الفعالة	MBAS	Methylene Blue Active Substance
وحدة عكارة نيفلومترية	NTU	Nephelometric Turbidity Unit
الرقم الهيدروجيني	pH	$-\log [H^{+}]$
السيفرت	Sv	Sievert
العسر الكلي	TH	Total Hardness
المواد الصلبة الذائبة الكلية	TDS	Total Dissolved Solids
الميثانات المهلجنة الكلية	TTHMs	Total Trihalomethanes
ثلاثي برومو الميثان	-	Tribromomethane
ثلاثي كلورو الميثان	-	Trichloro methane
وحدة لون حقيقية	TCU	True Colour Unit

4 – Standardized Conditions

The following standardized conditions must be fulfilled in drinking water:

4 – 1 Physical properties

The physical property values for drinking water should not exceed the maximum levels outlined in Table 2.

Table 2 – Drinking water physical properties

Property	Maximum Limit Permitted
Colour	15 true colour units (TCU)
Taste [a)]	Acceptable
Smell	Acceptable
Turbidity	5 Nephelometric Turbidity Units (NTU)
[a)] The test is conducted when necessary only.	

4 – 2 Substances and properties with a palatability impact on drinking water

The values of the substances and characteristics with a palatability impact on drinking water should not exceed the maximum limits outlined in Table 3.

Table 3 – Substances and properties with a palatability impact on drinking water

Property	Symbol	Maximum Limit Permitted
Hydrogen number	pH	From 6.5 to 8.5
Total dissolved solids [a)]	TDS	1000 mg per litre
Total hardness [b)]	TH	500 mg per litre
Methylene Blue Active Substance [c)]	MBAS	0.2 mg per litre
Ammonium [d)]	NH_4	0.2 mg per litre
Aluminium [e)]	Al	0.1 mg per litre
Iron	Fe	1.0 mg per litre
Zinc	Zn	4.0 mg per litre
Copper	Cu	2.0 mg per litre
Manganese	Mn	0.4 mg per litre
Sodium [f)]	Na	200 mg per litre
Chloride	Cl	500 mg per litre
Sulphate	SO_4	500 mg per litre

[a)] A maximum of 300 mg per litre is permitted if there is no water source available with a better quality, with Ministry of Health's approval.
[b)] A maximum of 600 mg per litre is permitted if there is no water source available with a better quality, with Ministry of Health's approval.
[c)] Measure indicating chemical cleaners' concentration.
[d)] Considered a contamination indicator and addressed on a case by case basis
[e)] A maximum of 0.2 mg per litre is permitted if there is no water source available with a better quality, with Ministry of Health's approval
[f)] A maximum of 300 mg per litre is permitted if there is no water source available with a better quality, with Ministry of Health's approval

4 – 3 Non-organic elements and compounds in drinking water

The values of the non-organic elements and compounds should not exceed the maximum limits outlined in Table 4.

Table 4 – Non-organic elements and compounds in drinking water

Non-organic chemical elements and compounds	**Symbol**	**Maximum Limit Permitted** ml per litre
Arsenic	As	0.01
Lead	Pb	0.01
Cyanide	CN	0.07
Cadmium	Cd	0.003
Total chromium	Cr	0.05
Barium	Ba	1.0
Selenium	Se	0.04
Boron	B	2.4
Mercury	Hg	0.006
Silver	Ag	0.1
Nickel	Ni	0.07
Antimony	Sb	0.02
Fluoride [a)]	F	1.5
Molybdenum [b)]	Mo	0.09
Nitrite	NO_2	3.0
Nitrate [c)]	NO_3	50

[a)] A maximum of 2.0 mg per litre is permitted if there is no water source available with a better quality, with Ministry of Health's approval
[b)] A maximum of 0.27 mg per litre is permitted if there is no water source available with a better quality, with Ministry of Health's approval
[c)] A maximum of 70 mg per litre is permitted if there is no water source available with a better quality, with Ministry of Health's approval

4 – 4 Organic chemical substances in drinking water

4 – 4 – 1 Organic biocides

The concentration values of the organic biocides in drinking water should not exceed those outlined in Table 5.

Table 5 – Organic Biocides [a)]

Chemical substances**	Symbol	Maximum Microgram per litre
Endrin [c)]	Endrin	0.6
Lindane [c)]	Lindane	2.0
Aldrin and Dieldrin [c)]	Aldrin and Dieldrin	0.03
Dichlorodiphenyltrichloroethane [c)]	DDT	1.0
Dichlorophenoxyacetic acid [d)]	2, 4-D	30
Trichlorophenoxyacetic acid [d)]	2, 4, 5-T	9.0

[a)] These biocides (pesticides?) (and any other biocides that may be found in the water distribution system) shall be assessed, then the probability of their presence and the frequency of the required tests will be determined.
[b)] When there is a flaw that requires testing for contamination by any other pesticide, the list of substances in the drinking water quality guidelines with their maximum limits and standards published by the WHO shall be followed.
[c)] Insecticides
[d)] Herbicides

4 – 4 – 2 Organic contaminants

The concentrations of organic pollutants should not exceed the values given in Table 6.

Table 6 – Organic contaminants in drinking water [a)]

Chemical substance [b)]	Symbol	Maximum limit Microgram per litre
Benzene	C_6H_6	10
Tetrachloroethane	C_2HCl_4	40
Trichloroethylene	C_2HCl_3	20
Ethylbenzene	$C_6H_5(CH_3CH_2)$	300
Total xylene	$C_6H_4(CH_3)_2$	500
Toluene	$C_6H_5CH_3$	700

[a)] These organic contaminants (and any other organic contaminants that may be found in the water distribution system) shall be assessed, then the probability of their presence and the frequency of the required tests will be determined.
[b)] In situations where testing for contamination by any other organic contaminant is required, the list of substances in the drinking water quality guidelines with their maximum limits and standards published by the WHO shall be followed.

4 – 5 Purification process outcomes

4 – 5 – 1 When using chlorine for purification, the water in the distribution network must contain a free chlorine residual level of no less than 0.2 mg per litre at the terminal end of the network and no more than 1.5 mg per litre after no less than 15 minutes from adding chlorine to the water. In all cases, 15 minutes must pass after the purification process before the purified water reaches the first consumer.

4 – 5 – 2 The concentration of the purification process outcomes of Trihalomethanes and chlorites should not exceed the values in Table 7.

Table 7 – Outcomes of the purification process in drinking water

Substance	**Maximum limit permitted** Mg per litre
Total Trihalomethanes (TTHMs [a)])	0.15
Chlorites [b)]	0.7
[a)] These Total Trihalomethanes (TTHMs) are assessed together quarterly (every three months). If the maximum is exceeded, the operational body or water supplier must take the appropriate corrective action to guarantee there is no excess reoccurrence. [b)] Testing of sources using chlorine dioxide in treatment.	

4 – 6 Radioactive materials in drinking water

The benchmark for radioactive materials in drinking water should not exceed the limits outlined in Table 8.

Table 8 – Radioactive materials in drinking water

Radioactive material	**Benchmark for radioactive properties [a)]**
Alpha radiators except radon - 222	0.5 becquerel per litre
Beta radiators except tritium, carbon 14, and potassium 40	1 becquerel per litre
[a)] When these limits are exceeded, further investigation is required in 3 months to determine all radioactive isotopes whose total activity is causing such access. The concertation of each isotope radioactivity must be measured then the active dose resulting from each isotope must be calculated, followed by calculating the total active dose which should not exceed 0.5 mSv in a given year.	

4 – 7 Microbiological properties

4 – 7 – 1 Bacteria

The tested sample (which is 100 milli litres) must be free of the following:

a) Colon *bacillus (E. Coli)* when using the filtration method or any internationally approved method, or the total number of colon bacillus is less than 1.1 when using the most probable number method.
b) Heat resistant colon *bacillus* or *Escherichia coli* when using the filtration method or any other internationally approved method, or the total number of colon *bacillus* is less than 1.1 when using the most probable number method.

4 – 7 – 2 Pathogenic microbes

Drinking water must be free of all phases of parasites and all phases of pathogenic worms and pathogenic bacteria.

4 – 7 – 3 Live round worms (nematodes)

The number of live round worms (nematodes) should not exceed a single living organism per litre.

5 – Quality control

Potable (drinking) water and its compliance with this Jordanian metrological standard must be confirmed/verified by the supervisory and operational bodies. The laboratory tests indicated in this Jordanian metrological standard must be conducted. Records on the testing results must be kept and be presented to the supervisory authorities upon their request, so that the frequency of collecting and testing samples by the supervisory and operational bodies are as detailed below, at a minimum:

5 – 1 Microbiological quality

5 – 1 – 1 Bacterial quality (bacteria indicating contamination)

5 – 1 – 1 – 1 Drinking water testing frequency

Water is tested by the supervisory and operational bodies to check for colon bacillus and colon bacillus that is heat resistant and / or *E-coli* in drinking water sources, water distribution systems comprising such sources, treatment stations, pumping stations, general reservoirs, and water networks (systems), according to the frequency outlined in Table 9.

Table 9 –Sample collection frequency for colon bacillus microbial testing [a)]

Drinking water source [b)]	Operational body testing frequency [c)]	Supervisory body testing frequency [c)]
Protected / unprotected ground water sources (first category) [d)]	Sample / month	Sample / month
Surface water sources (third category) [d)]	3 samples throughout the week	Two samples throughout the week on days alternating with testing by the operational body
Unprotected ground water sources (second and third categories) [d)]	3 samples throughout the week	Two samples throughout the week on days alternating with testing by the operational body
Water network, distribution system (pumping stations, general reservoirs):		
1) Supplying less than 5,000 citizens	Sample / month	Sample / month
2) Supplying between 5,000 and 100,000 citizens	Sample / month / 5000 citizens	Sample / month / 5000 citizens
3) Supplying between 100,000 and 500,000 citizens	Sample / month / 10,000 citizens + 10 samples monthly	Sample / month / 10,000 citizens + 10 samples monthly
4) Supplying over 500,000 citizens	Sample / month / 50,000 citizens + 50 samples monthly	Sample / month / 50,000 citizens + 50 samples monthly

[a)] This frequency is the minimum number of samples.
[b)] If the source is a number of wells, such as pumping stations, the mixed water is tested before and after chlorination according to the categorization in the effective document "Microbiological standards of raw water quality for drinking water sources and the minimum treatment requirements to utilize these sources".
[c)] Free chlorine residual level must be measured during the sample collection process.
[d)] The categorization above is based on the effective document "Microbiological standards of raw water quality for drinking water sources and minimum treatment requirements to utilize these sources".

5 – 1 – 1 – 2 Measures to be taken when contamination is discovered in the first sample

5 – 1 – 1 – 2 – 1 Colon bacillus contamination

Confirmation samples are collected from the same site in which the contamination appeared, at a rate of two samples at least with one-hour interval, to be taken by the body that conducted the testing (supervisory or operational). Pumping must be stopped from and to the site if the contamination appears in two out of three samples. The appropriate corrective action must be taken, and pumping cannot resume until the validity of all samples collected by the supervisory and operational bodies is confirmed, at a rate of two samples with one-hour interval for both of said two bodies.

5 – 1 – 1 – 2 – 2 Heat resistant colon bacillus or *E-coli* contamination

a) The site from which the sample was collected is considered contaminated if the contamination is proven in either of the two samples tested according to points “c” or “d” below.

b) A survey is conducted to check for sources of contamination and disconnect water supply meters of citizens in the affected area.

c) If the contamination source is discovered, the pumping should be stopped from the source or to the affected network. The contamination must be removed, and pumping cannot resume until the validity of two consecutive samples is proven with two-hour interval by the supervisory and operational bodies.

d) If the source of contamination is not discovered, the pumping should be stopped from the source or to the affected network, with work done to remove the contamination. The scope of the search for the source of contamination must be expanded and increased samples must be collected from the neighbouring area until the source of contamination is discovered. Pumping may not resume until after the validity of two consecutive samples is proven on two consecutive days from the same point in which the contamination appeared the first time by the supervisory and operational bodies.

5 – 1 – 1 – 3 Annual assessment of the water networks

The efficiency of the water networks/systems is assessed annually (i.e. 12-month periods) so that the ratio of the non-compliant samples does not exceed 5%. If it exceeds 5%, the necessary corrective action must be taken to address the problem.

5 – 1 – 2 Biological quality and pathogenic microbes

5 – 1 – 2 – 1 Drinking water testing frequency

Water is tested when needed and when contamination is suspected, in order to discover:

a) Pathogenic protozoa or pathogenic intestinal worms

b) Pathogenic intestinal bacteria

- Drinking water from surface water sources is tested by microscope at a rate one sample per week by the operational entity to discover free nematodes, as this is an operational test.

5 – 1 – 2 – 2 Measures to be taken when contamination is discovered

- If contamination is proven by any of the pathogenic causes indicated under items “a” and “b” of sub-section 5 – 1 – 2 – 1 pumping shall be stopped immediately. Two consecutive samples must be taken one day apart and pumping cannot resume until all samples are free of contamination.

- If the number of free live nematodes exceeds the permitted limit in any sample, four other samples shall be tested on two consecutive days at a rate of no less than two samples per day, with six-hour interval between the two samples. Pumping shall continue if the number of compliant samples exceeds half of the tested samples, and pumping shall be stopped if the number of non-compliant samples exceeds half of the number of tested samples. The necessary corrective action shall be taken and pumping shall not resume unless the number of compliant samples was over half of the number of tested samples within three days, at a rate of two samples per day and with six-hour interval.

5 – 2 Physical, chemical and radioactive quality

5 – 2 – 1 Drinking water testing frequency

5 – 2 – 1 – 1 To test the properties in tables 2 and 3 along with the nitrates and nitrites from table 4, water (which includes water resulting from mixing two or more water sources "final product", or from a single source pumped directly into the network) shall be tested by the operational and supervisory bodies according to the frequency outlined in Table 10. The following must, however, be taken into consideration:

a) Water from new sources and existing sources that are re-operated after a suspension of more than six months: three samples are tested chemically and physically for the properties outlined in Tables 2 and 3 with 24-our interval between the samples. The arithmetic mean shall be used when calculating concentrations for any property to determine the quality compliance with this Jordanian metrological standard before licensing the source. The analysis shall be repeated every six months for the first year only, and the water sources categorization shall subject to the "Microbiological Standards on Raw Water Quality for Drinking Water Sources and Minimum Requirements of Treatment for Utilization of those Sources".
b) Water from surface water sources, ground sources susceptible to surface contamination, and water from protected ground water sources shall be tested for all of the properties outlined in Tables 2 and 3, as indicated in Table 10.
c) The operational body must test the turbidity parameter (Table 2) in the treated water, on a daily basis, and document such information in a record provided to the supervisory bodies. The supervisory body shall test this parameter at least once a week.

5 – 2 – 1 – 2 To test the properties in Table 4, with the exception of nitrates and nitrites, water shall be tested by the operational and supervisory bodies for new sources and those suspended for over six months one time, and then according to the frequency indicated in Table 10.

5 – 2 – 1 – 3 To test the properties in Tables 5 and 6, biocides and organic pollutants for new sources and sources suspended for over six months shall be tested one time, and then according to the frequency indicated in Table 10.

5 – 2 – 1 – 4 The properties in Table 7 shall be tested as follows:

a) Free chlorine residual level:

- Tested daily for all water sources treated by the operation entity
- Tested at water sources and in networks by the operational and supervisory bodies according to the microbe testing program in Table 9.

b) Chlorite

- Tested daily for water treated by chlorine dioxide as indicated in Table 10.

c) Total trihalomethanes (TTHMs)

- TTHMs shall be tested for all types of water sources as indicated in Table 10.

5 – 2 – 1 – 5 To test the properties in Table 8, the alpha and beta radiators shall be tested for the new sources and the sources suspended for over six months one time, and then according to the frequency in Table 10.

Table 10 – Testing frequency for physical, chemical and radioactive properties [a)]

Drinking water source	Physical properties and substances with a palatable impact (Tables 2 and 3) and nitrates and nitrites (Table 4)	Non-organic substances with the exception of nitrates and nitrites (Table 4)	Organic biocides and contaminants (Tables 5 & 6)	Purification process outcomes			Alpha and beta radiators (Table 8)
				Excess chlorine in the water source and chlorite (Table 7)		Total Trihalomethanes TTHMs (Table 7)	
				Operational body	Supervisory body		
New sources or sources re-operated after a suspension of over six months	Every six months for the first year only and then according to categorization	Once for the first year only and then according to categorization	Once and then according to categorization	Daily	According to the sample collection schedule	Once and then according to categorization	Once and then according to categorization
Unprotected surface or ground sources (second category, third category) [b)]	Once every six months	Once a year	Once a year	Daily and also daily for chlorite for water treated with chlorine dioxide	According to the sample collection schedule	Once a week – for sources and networks fed from unprotected ground water - Once a year for those that are fed from unprotected ground water	Once every two years
Protected ground water sources (first category) [b)]	Once a year	Once a year. If there is stability for two consecutive years, then once every 3 years		Daily	According to the sample collection schedule	Once a year. If there is stability for two consecutive years, then once every 3 years	Once a year. If there is stability for two consecutive years, then once every 3 years

* These samples represent the minimum required for tests.
** According to the categorization in the "Microbiological Standards on Raw Water Quality for Drinking Water Sources and Minimum Requirements of Treatment for Utilization of those Sources"

5 – 2 – 2 Measures to be taken when this Jordanian metrological standard is exceeded ("violated" "breached")

5 – 2 – 1 – 1 Physical properties and substances and properties with a palatable impact on drinking water in Tables 2 and 3, in addition to nitrites and nitrates in Table 4

If the tested sample shows readings beyond the maximum limit set out in this Jordanian metrological standard for any of the properties indicated above, pumping shall continue, and two confirmation samples shall be taken on two consecutive days with regard to colour, taste, odour, turbidity and hydrogen number, and on two consecutive weeks with a seven-day interval between one sample and the next with regard to the remaining properties. If the arithmetic mean of the three samples is within the maximum limit, pumping shall continue. If the arithmetic mean of the three samples exceeds the maximum limit, pumping shall be suspended and is only resumed after the concentration becomes within the permitted limits after testing three samples within one week, with two-day intervals between samplings.

5 – 2 – 2 – 2 Non-organic chemical elements and compounds in Table 4 except nitrates and nitrites

If the tested sample exceeds the maximum limit in this Jordanian metrological standard for any of the properties indicated above, pumping shall continue, and two confirmation samples shall be taken in four days with two days separating each sample. If the arithmetic mean of the three samples is within the maximum limit, pumping shall continue. If the arithmetic mean of the three samples exceeds the maximum limit, pumping shall be suspended. The causes must be explored (investigated), and pumping is only resumed after the concentration becomes within the permitted limits after testing two samples within four days, with two days separating each sample.

5 – 2 – 2 – 3 Organic biocides and contaminants in Tables 5 and 6

If the tested sample reflects readings that exceed the organic biocides and contaminants in Tables 5 and 6 in the tested sample, two confirmation samples shall be tested in two consecutive weeks with seven-day intervals between the two samples. The arithmetic mean of the three samples is calculated. If the arithmetic mean is within the maximum limit, pumping shall continue. If the arithmetic mean exceeds the maximum limit permitted by this Jordanian metrological standard, pumping shall be suspended. The causes must be explored (investigated) and addressed. Pumping may only be resumed after the concentration of the arithmetic mean for three consecutive samples collected within one week "at a rate of one sample every two days" is within the maximum limit permitted by this Jordanian metrological standard.

5 – 2 – 2 – 4 Purification process outcomes (free chlorine, chlorite and TTHMs)

A) Sources

The monthly average for the TTHMs concentration in the source shall be computed. If it exceeds the maximum limit, the entity responsible for that source must take the measures necessary to address such excess. If the excess persists for a second month, pumping shall be suspended until the average returns to the permitted limits for seven days in a row. …

As for the water sources susceptible to contamination or for the protected sources, if the value in this Jordanian metrological standard is exceeded, three confirmation samples shall be collected within one month and the arithmetic mean is calculated. If the excess persists for a second month, pumping shall be suspended until the average returns to the permitted limits.

B) Networks

The monthly average for the free chlorine residual level, TTHMs and chlorite sampled from any network shall be computed for all the samples tested within the given month. If it exceeds the maximum limit, the responsible entity must take the measures necessary to address such excess. Testing is repeated from any point in the network which has indicated an excess of the maximum limit for two successive weeks at a rate of one sample per week. If the excess persists within two consecutive weeks at a rate of one sample per week, the causes are explored (investigated) and addressed. If the case persists for three months with regard to the TTHMs, pumping shall be suspended until concentrations return to the acceptable limits.

5 – 2 – 2 – 5 Radioactive materials (alpha and beta radiators) in Table 8

When the limits in Table 8 are exceeded, more exploration is required in 3 months to determine all radioactive isotopes whose total activity is causing such excess. The radioactivity concentration from each isotope must be measured, then the active dose resulting from each isotope must be calculated, followed by computing the total active dose which should not exceed 0.5 mSv in a single year.

If the active dose does not exceed 0.5 mSv in a single year, monitoring shall continue with samples being collected and analysed to ensure this limit is not exceeded.

If the active dose exceeds (0.5 mSv in a single year), samples must be continually collected, and the necessary analyses conducted during an additional three-month period to check this excess. If the excess is confirmed, the health authorities and water suppliers must be informed to work on reducing the concentration of radioactive isotopes by appropriate means to below (0.5 mSv in a single year). The water sources may continue to be used for a period agreed upon by the competent authorities, so that it does not exceed 18 months while the water supplying bodies correct the situation.

If the doses are exceeded (1 mSv during the year) drinking water (intended for human consumption) must be stopped immediately and the necessary immediate interventions must be undertaken to correct the situation. A study must also be conducted on the matter and the appropriate decision made based on the results of the study.

6 – Sample collection and testing

The sample collection and testing methods in any of the following references shall be adopted/used:

6 – 1 American Public Health Association Standard for the Examination of Water and Wastewater and its amendments.

6 – 2 Standard methods outlined in the International Standard Organisation's (ISO's) Water Quality Standards Catalogue.

6 – 3 Water Analytical Methods Book, report number 71 on public health and medical matters, 1994, published by the Public Health and Medical Matters Association, Britain.

References

- Canadian Guiding Principles for Some Chemical, Physical and Microbiological Standards, amended since the publication of the sixth edition of the Canadian Guiding Principles for Drinking Water Quality in 2010.

- UN Environment Standards (Drinking Water Contaminants 2009).

- Drinking Water Quality Guidelines published by the WHO in 2011, recommendations, fourth issue, Geneva.

- Water Safety Plan Manual: Step by Step on Risk Management for Drinking Water Suppliers, WHO, Geneva, 2009.

- Council Directive 596/2009/EC on the quality of water intended for human consumption. Adopted by the Council, on 7/8/2009.

- Geldreich E. (1996) Microbial Growth of Water Supplies in Distribution Systems, (Edited by Geldreich E.), Lewis publisher, Boca Raton, Florida.