Health & Safety Department

(Enviromental Health Section)

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4	29th Sep 2024	Environmental Health Section	• Added new logo for both Dubai Municipality & Dubai Government. • Changing the name of Title No. (4) from (Abbreviations and Definitions) to (Terms and Definitions) • Title No. (9): Ionization paragraph: the concentrations of copper and silver ions were changed • Title No. (9): Ionization paragraph: chlorine dioxide level was changed • The last point was deleted from subtitle No. (13.2). • Add a subtitle (14.2) Working levels after testing the water in the cooling tower to title No.14 • Move the table from subtitle No. (14.1) to (14.2) • The previous subtitle No. (14.2) has been changed to (14.3), and (14.3) has been changed to (14.4). • In the first paragraph of the title 21, in the second point was added (of water use), third point (welfare was changed to comfort and health) • Adding channels of suggestions/ complaints/ and inquiries
5	17th Dec 2024	Environmental Health Section	• Title No. (11): The risk assessment should consider and evaluate paragraph: point No. (2) was added. • Title No. (23) was added

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1.Objectives of Guidelines

Dubai Municipality, as part of its mandate, is striving to attain the highest level of health and safety conditions within the public establishments to achieve its goals in protecting and promoting public health through disease control preventive measures. These guidelines are intended to minimize the risk of exposure to Legionella through safe operating, proper maintenance and scheduled monitoring of building water system in all public establishments, such as hotels, furnished apartments, residential buildings, shopping malls educational facilities government building where cooling water system, hot and cold water and all types of water feature are used. This guidance issued by Dubai Municipality to serve as a tool to enable concerned establishments to comply with relevant local regulations.

2.Scope

These guidelines are applicable to waters used in all built environment including, but not limited to hotels, Professional non-medical service provider premises, educational institutes, commercial, governmental and residential buildings, and labor accommodations.... Etc.

Every violator of these guidelines shall hold legal accountability according to local order No. (11) For the year 2003 concerning public health and community safety.

3.Outcome/ Benefits

These Guidelines focus on methods to control contamination and minimize the risk of Legionellosis associated with building water systems. It provides advice and assistance to people who design, install, own, operate or maintain all building water systems.

It is concerned with all water system that can incorporate water in which Legionella can grow and creates a water spray or aerosol such as cooling towers, evaporative condensers, potable water system, spas, fountains, waterfall system, evaporative air coolers, misters, air washers and humidifiers.

4.Definitions and terms

Definition	Meaning
Activated Carbon Filtration	A method of water filtering that uses a bed of activated carbon to remove chlorine, volatile Organic compounds, taste and dour from water by chemical absorption.
Biofilm	Microbial populations that adhere to and grow on the inside of pipes and other surfaces. Breakpoint chlorination The process of maintaining sufficient free chlorine in water to chemically convert chloramines and ammonia-nitrogen compounds to inert nitrogen gas.
CFU	Colony forming unit. A unit used to estimate the number of viable bacteria in a sample.
Chlorine	The main drinking water disinfectant is used worldwide. Generally dosed as either liquid sodium hypochlorite or chlorine gas. Requires pH to be maintained at ≤ 7.6.
Chlorine Dioxide	A reactive gas that is a more effective disinfectant than chlorine. Usually generated and dosed on site but also available as a established liquid.
Dead Legs	Sections of a water distribution system that do not allow the flow of water.
Free Residual Chlorine	The concentration of residual chlorine in water that is present as dissolved gas (Cl2), hypochlorous acid (HOCl) and/or hypochlorite ions (OCl–).
Hot Water	Heated water ≥60 °C.
Hot Water System	A heated water system that delivers heated water through the majority of the system at ≥60C. May include TMVs close to sanitary outlets.

Definition	Meaning
Hyperchlorination	Elevating the free residual chlorine concentration to obtain a specified level throughout the water system and holding it there for a sufficient time to control Legionella.
TBC	Total bacterial count. A measure of the total bacteria that can be cultured from a water sample in a general-purpose growth medium. It does not include other microbes (such as viruses or most fungi) or many other viable but nonculturable (VBNC) bacteria. Also known as total plate count (TPC), heterotrophic colony count (HCC) and heterotrophic plate count (HPC).
UV light	Ultraviolet light
Warm Water	Heated water distributed and/or delivered at approximately 45 °C for sanitary purposes to prevent scalding.

5.Legionella Bacteria

A genus of bacteria of the family Legionellae. It currently consists of at least 70 serogroups comprising over than 46 species. It has the ability to colonize water in a distribution system. It can cause disease in humans (e.g., Legionnaires' disease or Legionellosis) that is progressive and sometimes fatal (lifeless), or a milder form of pneumonic illness (Pontiac fever) that is self-limited (i.e., heals on its own) with respiratory symptoms similar to influenza.

Legionella bacteria are common and can be found naturally in environmental water sources such as rivers, lakes and reservoirs, usually in low numbers. Legionella bacteria can survive under a wide variety of environmental conditions and have been found in water at temperatures between 6°C and 60°C. Water temperatures in the range 20°C to 45°C seem to favor their growth.

As Legionella bacteria are commonly encountered in environmental sources, they may eventually colonize manufactured water system and be found in cooling tower system, hot and cold water system and other plant which use or store water.

6.Legionnaires Disease

Legionnaires' disease is a potentially fatal form of pneumonia which can affect anybody, but which principally affects those who are susceptible because of age, illness, immunosuppression, smoking etc. It is caused by the bacterium Legionella pneumophilae and related bacteria. Both the disease and the bacterium were discovered following an outbreak traced to a 1976 American Legion convention in Philadelphia. Pontiac fever, a flu-like illness, is also caused by Legionella organisms (Legionellae), but is not as serious as Legionnaires' disease.

Most people who get Pontiac fever recover within five days, without having to be hospitalized.

Legionnaires' disease develops within 2 to 10 days after exposure to Legionellae.

Initial symptoms may include loss of energy, headache, nausea, aching muscles, high fever (often exceeding 104°F), and chest pains. Later, many bodily systems as well as the mind may be affected. The disease eventually will cause death if the body's high fever and antibodies cannot defeat it. Victims who survive may suffer permanent physical or mental impairment.

The collective term used to cover the group of diseases caused by Legionella bacteria is legionellosis.

7.Conditions favoring the growth of Legionella

1. Temperature ranges from 20-45 °C.
2. High nutrient level.
3. Accumulation of organic material, sediments, and other organisms.
4. Water stagnation.
5. pH fluctuations.
6. Inadequate levels of disinfectant.
7. Changes in water pressure.

8.Where can Legionella contamination occur

Experience has shown that cooling towers, evaporative condensers, hot and cold water systems, present a risk of exposure to Legionella bacteria. Other systems, such as fountains and water features, spa baths and pools, evaporative air coolers, misters, air washers, humidifiers, car/bus washes, wet scrubbers, also present a risk.

A water system includes all plant/equipment and components associated with that system, e.g. all associated pipework, pumps, feed tanks, valves, showers, heat exchangers, etc. It is important that the system is considered as a whole and not, for example, the cooling tower in isolation.

Following is the information about the main potential sources of Legionella contamination in cooling water system (cooling tower and evaporator condenser).

8-1 Cooling Towers and Evaporative Condensers

What is a cooling tower?

A cooling tower is a specialized heat exchanger in which air and water are brought into direct contact with each other in order to reduce the water's temperature. As this occurs, a small volume of water evaporates, reducing the temperature of the water being circulated through the tower.

In cooling towers, the warm water from the process (e.g. refrigerant gas Compression) is cooled in the cooling tower and recirculated to conserve water.

Air currents pass over large, wet surfaces (fill) to maximize evaporative cooling of the falling water.
The air is either blown through the fill (forced draft type) or drawn through it. (Induced draft type).
Evaporative condensers are similar in principle and in operation to cooling towers, except that the refrigerant itself is cooled.

The water system comprises a pump, which draws cooled water from the basin and recirculates it directly back to the top of the unit from where it is distributed over a bank of heat exchange pipes.
There is no heat exchanger fill as in a cooling tower and system water volume is much less than for most system incorporating a cooling tower.

Large quantities of organic material and other debris may accumulate in the water of cooling towers and evaporative condensers as a result of the air being scrubbed as it passes through the equipment.
With elevated temperatures and plenty of nutrients from organic material, the conditions are favorable for microbial growth. Many microorganisms may be dispersed in the water of the system.
They may attach to pipe work, heat exchangers and to other surfaces forming biofilms incorporating various microorganisms.

Biofilms provide an appropriate environment for the growth of Legionella bacteria within the system. These biofilms normally make up the bulk of the microbial population. Cooling system water is lost by carry-over of droplets as drift in the exhaust air stream. This drift contains visible droplets, as well as aerosol that can be inhaled.

Health problems may arise when the cooling tower from which the drift originates, is highly contaminated. Two key aspects of prevention for cooling water towers: system treatment and maintenance. The key aspects are that the water system be kept clean and that a biocide treatment program be used.

Why is it important to clean and disinfect the cooling system?

1. Legionellae are more likely to proliferate in water systems that are fouled with deposits and biofilm that can protect the organisms from water treatments and provide nutrients for them to multiply. So, maintaining system cleanliness is crucial.
2. Effective water treatment measures can reduce the rate at which a cooling system becomes fouled, however, an evaporative cooling system will inevitably accumulate airborne dust from the atmosphere and may be subject to contamination originating from the process for which the system provides cooling.

It is therefore necessary to take cooling systems out of service periodically for physical, and possibly chemical, cleaning to remove this fouling.

How clean does the pack need to be?

The cooling tower pack can potentially become fouled with a wider range of deposits than the cooling tower base tank and other system sumps and is a good indicator of the overall system cleanliness.

After a period of use, cooling tower pack is likely to become fouled and the extent and nature of the fouling will depend on a number of factors, including the chemical composition of the make-up water, the presence of process and environmental contaminants and the efficacy of the water treatment program in place.

1. <u>Maintenance</u>

Problems arise when microorganisms are allowed to grow or flourish to excess. This can result in the formation of biofilms on system surfaces, which can:

- Cause a reduction in heat transfer.
- Harbor Legionella and provide an environment for their growth.
- Induce highly localized microbial corrosion.
- Interfere with the effectiveness of corrosion inhibitors.
- Trap particulate matter, increasing the problem of fouling, and
- Disrupt water distribution within the tower.

Biocides are used to control microbiological activity.

- Biocides shall prevent the proliferation of microorganisms but are not required to disinfect the system.
- Most biocides may be oxidizing or non-oxidizing.
  Controlling biocide levels, i.e. the frequency and quantity of additions, will depend on the microbiological activity of the system.
- When correctly applied, system kept clean to reduce the nutrients available for Legionella growth.
  Regular visual inspections by the maintenance staff shall be made, to avoid the build-up of dirt, organic matter or other debris, the cold-water basin of the cooling unit shall be cleaned regularly. Mechanical filtration could be used to help reduce this debris.
- The control of microbial activity and biocide residual has been consistently achieved since the previous cleaning operation (i.e. continuous minimum free chlorine residuals of 0.5 - 1 mg/l or bromine residuals of 1-2 mg/l.)

2. Treatment

A complete water treatment programs based on the physical and operating parameters for the cooling system and a thorough analysis of the make-up water should be established. The components of the water treatment program should be environmentally acceptable and comply with any local discharge requirements.

It is important to ensure that water treatment programs have sufficient range of adjustment to cope with any potential variations in make-up water supply quality. This enables control to be maintained. Failure to take account of variations in quality may lead to the rapid development of uncontrolled microbiological conditions within the cooling system.

There are a number of factors, which will influence the effectiveness of any treatment programs:

- Corrosion.
- Scale formation.
- Fouling, and
- Microbiological activity.

They are interrelated and failure to control anyone may lead to all occurring simultaneously, resulting in an environment that encourages the growth of Legionella. In setting up an effective monitoring and control system, it should be remembered that corrosion, scale formation and fouling are continuous physic-chemical processes and inhibitors to control such processes should be added on a continuous basis.

All components of the treatment program should preferably be dosed by pump or educator (sometimes referred to as an ejector) system or by a suitable halogen dosing system such as a brominator.

This will minimize health and safety risks to operators and ensure that frequencies and rates of application are maintained as recommended.

Microbiological Activity

The operating conditions of a cooling system provide an environment in which micro-organisms can proliferate. The water temperatures, pH conditions, concentration of nutrients, presence of dissolved oxygen, sunlight, together with large surface areas all favor the growth of micro-organisms such protozoa, algae, fungi and bacteria, including Legionella.

Selected, applied and controlled, as part of a comprehensive water treatment program, have been shown to be effective in preventing the proliferation of Legionella. Many factors will influence the selection of chemicals required for the treatment program. However, the success of the treatment program is dependent on:

- compatibility of all chemical components used, and
- Adherence at all times, to the recommended application, monitoring and control procedures.

Biocides are routinely applied at the tower sump or the suction side of the recirculating water pump but should be dosed so that the biocide will circulate throughout the cooling system. However, in air-conditioning system, where the tower can be bypassed, the biocide needs to be added to the suction side of the recirculating pump.

It is also recommended that the services of a qualified water treatment specialist be used to define and oversee the treatment program.

If a sample of water taken from the cooling tower has a heterotrophic colony count exceeding the acceptable limit, the water of the system must be manually treated with additional quantities of biocide (or an alternative biocide). Further, the water treatment program, tower operation and maintenance program of the system must be reviewed. Any faults must be corrected, and changes be made to prevent a re-occurrence of those faults.

If Legionella is further detected, the responsible person must ensure the water of the cooling tower system is disinfected, cleaned and re-disinfected.

Testing is not a substitute replacement for sound maintenance practices and water treatment.

8-2 Hot, warm and cold water system

Plumbing systems that supply water to faucets, showers, and other devices used by people in buildings are referred to as domestic or potable water systems.

It is within building water system that the bacteria generally find an environment where they can multiply to a more hazardous level.

- After water from a public water distribution system enters a building's domestic water system, it typically encounters warmer temperatures and is subject to low flow or stagnant conditions and a residence time that can lead to the loss of disinfectant residuals.
- biofilm develops on the surfaces of pipe walls, valves, and fittings, Legionella, along with other microorganisms, have a favorable environment for protection and colonization within biofilm
- factors that affect Legionella in a domestic water system include disinfectant residual, overall temperature range within the system, the size of the system, water stagnation (whether due to design, operation, or use), complexity of the system, surface area relative to water volume,
- Building owners must take reasonable steps to manage their domestic water system for Legionella control.

8-3 Fountains and water features

The water in water features is prone to contamination from the surrounding environment or from contact with people or animals. Regular maintenance and testing of the water are required to ensure that any contamination does not become a general health hazard.

The maintenance and testing measures required must also be carried out for water features, the water features that produce spray or aerosol should be maintained clean and that a regular regime of testing be in place. Keeping the system clean reduces the nutrients available for bacteria growth. Regular visual inspections should be made. To avoid the build-up of dirt, organic matter or other debris, the water basin of the water feature should be cleaned. Mechanical filtration can be used to help reduce this debris.

The need for testing is only as a check whether these actions have been performed adequately.

Should noncompliant test results be obtained, the inspection, cleaning and maintenance regimes must be revised.

8-4 Evaporative Coolers

In evaporative coolers, water is trickled over a medium through which the air is drawn. The evaporation of water-cools the air as it passes through.

Water normally collects in a slump and is re-circulated, and there is potential for microbial growth in such system. Evaporative coolers should be kept dry when not in use.

9.Legionella Control Methods

- **Temperature**

  It is recommended that hot water should be stored at 60 °C and distributed so that, after one minute of running, a temperature of at least 50 °C is attainable at outlets. Cold water storage and distribution should be at 20 °C or below.

- **Ionization**

  is the term given to the electrolytic generation of copper and silver ions for use as water treatment. The results of recent research have shown that where copper and silver ion concentrations can be maintained at 400 MG/L and 40 MG/L respectively, this technique, if properly managed, can be effective against legionella in both hot and cold water regimens.

- **Chlorination**

is the process of applying any of the chlorine containing compounds such as sodium hypochlorite (bleach solution) to the water to achieve necessary destruction of all bacteria; Chlorine is widely used as an important disinfectant and bleach. The World Health Organization Guidelines for Drinking-water Quality (2017) indicate/ establish the health –based limit values is 5.0 mg/l for total chlorine, however at high levels chlorine is likely to cause corrosion with prolonged use, The level used for treatment of domestic drinking water are usually maintained at between 0.2 and 0.5 ppm (mg/l) at the point of delivery when used continuously in domestic system.

- **Chlorine Dioxide**

is an oxidizing biocide capable of reacting with a wide range of organic substances. There are commercial systems available that release chlorine dioxide from a stabilized precursor solution into water system. The main concern with chlorine dioxide is with the residual concentrations of chlorine dioxide and the by-products chlorite and chlorate.

The World Health Organization Guidelines for Drinking-water Quality (2017) indicate/ establish the health –based limit values are 0.7 ppm for both chlorite and chlorate. The WHO states that guidelines values for chlorite and chlorate are designated as provisional because use of aged hypochlorite or of chlorine dioxide as disinfectants may result in the chlorite and chlorate guidelines values being exceeded, and difficulties in meeting the guidelines values must never be a reason for compromising adequate disinfection.

The guidelines health –based limit values for Chlorine dioxide did not establish by WHO (2017), however, it is normal practice to supply water with a chlorine dioxide residual of a few tenths of a milligram per liter to provide some protection against microbial regrowth during distribution. The maximum value of Chlorine dioxide in drinking water should not exceed 0.5 mg/l as Chlorine dioxide and this is often not enough to achieve control in colonized system. Chlorine dioxide levels of 0.5 mg/l, if properly managed, be effective against planktonic Legionella in both hot and cold water systems.

- **Ultraviolet light UV, and Ozone O3**

The previous treatment system is effective throughout the water system downstream to the point of application. UV and O3 can be used to treat water at or very close to the point of application.

10.How can I control Legionella

To reduce the possibility of creating conditions in which the risk from exposure to Legionella bacteria is increased, it is important to control the risk by introducing measures which:

- Do not allow proliferation of the organisms in the water system.
- Reduce, so far as is reasonably practicable, exposure to water droplets and aerosol.

Legionella bacteria also require a supply of nutrients to multiply. This can include, for example, commonly encountered organisms within the water system itself such as algae, amoebae and other bacteria.

The presence of sediment, sludge, scale and other material within the system, together with biofilms, is also thought to play an important role in harboring and providing favorable conditions in which the Legionella bacteria may grow.

A biofilm is a thin layer of micro-organisms which may form as a slime on the surfaces in contact with water. Such biofilms, sludge and scale can protect Legionella bacteria from temperatures and concentrations of biocide that would otherwise kill or inhibit these organisms if they were freely suspended in the water.

A number of measures can be taken to prevent disease. These activities can be influenced by good engineering and maintenance practices.

A variety of aerosol-producing devices have been associated with outbreaks of Legionnaires' disease including cooling towers, evaporative condensers, showers, whirlpool spas, humidifiers, decorative fountains, and misters. Transmission via cooling towers and evaporative condensers have been the most documented.

11.Risk assessment

Identifying and assessing the risk from legionellosis from work activities and water sources on premises and determining any necessary precautionary measures. The premises must Carrying out a legionella risk assessment and ensuring it remains up to date and is a key duty when managing the risk of exposure to legionella bacteria.

The risk assessment should consider and evaluate:

- Clear allocation of management responsibilities
- Conduct a periodic risk assessment of water systems at least once a year, based on the condition of the system and any changes or additions that may occur.
- Competence and training of key personnel.
- A description of the water system, including an up-to-date schematic diagram.
- An evaluation of the risk including factors promoting the growth of legionella
- Safe operating procedures for the water system, including controls in place to control risks.
- Monitoring, inspection and maintenance procedures.
- Results of monitoring, inspection and any checks carried out.
- Arrangements to review the risk assessment regularly and particularly when there is a reason to suspect.
- Layout of the water system, illustrating plant and equipment, including servicing and control valves, outlets, strainers and filters or parts that are out of use.
- Layout of the Sampling points locations according to the risk assessment survey of all water system in the building that pose a risk to human health.

The risk assessment should identify the risk of the following water system

- Hot, warm and cold water system
- Cooling Towers and Evaporative Condensers
- Fountains, water fall system and water feature (indoor and outdoor)
- Spa pool, Whirlpool spas, Jacuzzi
- Others system including humidifiers, evaporative air coolers, air misters, air washers, irrigation water system and gray water system

Factors which increase the risk of legionellosis to be considered as bellow

- Areas which contain water at temperatures likely to support the growth of Legionella (i.e. above 20°C but below 50°C)
- Locations where water aerosols can be created and released into the atmosphere.
- Infrequent use Pipe work and stagnant water or slow-moving water and dead legs.
- Water system where the water is not treated (check the Presence of biocides).

12.General Guidance

The owners, principal manager, or person in charge of the premises should comply with their legal duties as following: -

12-1 Regular Maintenance Procedures

- Named person responsible for Legionella control and this person must be trained in control of Legionella.
- Keep the water system clean to reduce the nutrients available for bacteria growth. Regular visual inspections should be made at least every week to avoid the build-up of dirt, organic matter or other debris.
- All water system which creates a water spray or aerosol, and Spa pools must be treated and maintained to minimize the risk of Legionella bacteria contamination.
- The premise shall have Flushing policy and run all taps and showers in guest rooms and other areas for several minutes to draw through water at least once a week if rooms are unoccupied, and always prior to occupation.
- Any cooling water system including its make-up water tanks must be fitted with an automatic biocide dosing device for effective management of corrosion, scaling, fouling and microbial growth. And should work properly all the year.
- Cooling tower should be located so that the drift directed away from the air-intake system, operable window and entrances of the building. The cooling tower must be fitted with drift eliminators.
- All cooling water systems, including all associated tanks, pumps, pipes, water filters and fittings, must be emptied, cleaned and disinfected at least once every six (6) months and if legionella is detected in the system.

- All water storage tanks, water heaters (calorifiers), water filters must be emptied, cleaned and disinfected at least twice a year and if legionella is detected in the system.
- All dead legs should be removed or disconnected (stagnant lines and stubs) from the water system.
- Always Keep hot water (warm water) hot: It should be maintained at temperatures (50 – 60 °C) and cold water cold at all times: It should be maintained at temperatures below 20 °C.
- Water system (hot, warm and cold water) must be flashed at least every six month and if legionella is detected in the system, with water of not less than 70 °C for 5 minutes (or an equivalent temperature /time combination) or treated with chlorine to provide minimum free chlorine residual of 1-2 mg/l at all outlets.
- Shower heads and taps should be kept clean regularly and disinfected at least quarterly and if legionella is detected in the system.

12-2 Monitoring

Water quality must be tested as mentioned in Table (1 and 2) and the test results must be available for inspection by the Dubai Municipality staff.

Sampling and testing must be carried out for the presence of bacteria, both

- General (aerobic) bacterial species
- Legionella bacteria.

12-3 Records and manuals

- Formal Risk assessment and scheme of control to ensure the safe operation, maintenance and monitoring program on place and to ensure the ongoing safety of water system.
- Layout of the Sampling points locations according to the risk assessment survey of all water system in the building that pose a risk to human health.
- All water system schematic, manuals for operation and maintenance procedures.
- System water volume, with date and method of determination
- Inspections, maintenance, infection control dates and results of each inspection.
- Details of treatment procedures, type and use of biocide, Material Safety Data Sheets for chemicals used (MSDS).
- Names of personnel responsible for system operation and shutdown
- Result of any testing of the system and microbiological testing of water samples.

All above records must be available for inspection by Dubai Municipality staff, and must be submited every two weeks to ehcinspection@dm.gov.ae

13.Monitoring Microbial Levels in Water System

13-1 Water system type, components and minimum number of water samples

Water quality must be tested to assess efficacy of the water treatment system and general system cleanliness.

- Sampling and testing must be carried out for the presence of bacteria, both general (aerobic) bacterial species and Legionella bacteria.
- The sampling points should be identified according to the risk assessment survey of all water systems in the building/premises that pose a risk to human health. (sampling points layout mentioned in risk assessment earlier to be considered)
- Sampling points should include at least all system type, components, minimum number of samples and sampling frequency set out in table (1) below:

Table (1): - Water system type, Components and minimum number of water samples in quarterly basis.

	Water system type	Components	Number of water samples (minimum)/quarterly (every three month at least)
1	**hot, warm and cold water system**	Main water tank (which connected directly with water source)	1 sample
		Other water tank or cistern	1 Sample should be collected from each water storage tank with a water storage volume of over 1000 liters
		centralized water heater (calorifiers)	1 Sample should be collected from each centralized water heater (calorifiers)
		hot water tap	2 sample at least from different floors, rooms, locations
		cold water tap	2 sample at least from different floors, rooms, locations
		Shower	2 sample at least from different floors, rooms, locations
		water softener, filters	1 swab Sample from each softener, filters
2	**Cooling tower**	Make-up water tank	1 sample from each Make-up water tank
		Collection basin (an area below the tower where cooled water is collected)	1 sample from each Collection basin
3	**Fountains, water fall and water feature (indoor and outdoor)**	Collection basin	1 sample from each Collection basin
	Whirlpool spas, Jacuzzi	Pool	1 sample from each Whirlpool spas, Jacuzzi Pool
4	**Irrigation system**	Storage water tank or cistern	1 sample from each Irrigation system Storage water tank or cistern
		Irrigation Water jet if available	1 sample from any Irrigation Water jet if available
5	**Others (Swimming and hydrotherapy pools, humidifier, etc.)**	Pool Balance/storage tank	1 sample from each system

- Samples/swabs should be taken from selected Showers head and water filter in case of investigation or when adverse results follow up, (4 to 6 sets of samples at least should be taken from the backside of showers head and water filters after it has been removed).

13-2 Monitoring recommended for good operating practice

- The minimum recommended sampling frequency as shown in Table (2) below:

Table (2): - Monitoring recommended for good operating practice

Legionella	Quarterly	Quarterly
Aerobic count	Quarterly	Monthly

The Testing for legionella bacteria must be detected by culture of viable organisms according to the international standard ISO 11731 (Enumeration of Legionella) (Latest version).

- The sampling method should be in accordance with BS 7592 (Sampling for Legionella bacteria in water system) (Latest version)
- The analysis of microbiological samples must be undertaken by a laboratory that is accredited by The Emirates International Accreditation Centre (EIAC) to perform the required testing.
- The test results must be available for inspection by the Dubai Municipality staff.

14.Water Quality Guidelines

A detectable population of Legionella bacteria in the water indicates that there will be a larger population in sediments and biofilm within the system.

Undetectable Legionella bacteria in the water sample may not necessarily indicate that the system is free of these organisms, as they maybe still be attached to surfaces.

The primary tool for the control of Legionella bacteria is good hygiene practice.

It has been found to be very difficult to manage the microbial characteristics of water system based only on Legionella bacteria-specific data.

Monitoring the overall bacterial level is far more effective.

Recommended limits for bacterial contamination in (cfu/l) unit, according to the water system in Table (3).

Table (3): Limit reference of microbial contamination

No	Water system	Microorganism	Limit Reference
1	**Cooling water system (cooling tower and evaporative condenser)**	Legionella	Not exceed 1000 cfu/l
		Aerobic bacterial count	Not exceed 10000 cfu/ml
2	**Hot, warm and cold water system.**	Legionella	Not exceed 1000 cfu/l
		Total bacterial count	500 cfu/ml
3	**Fountain, waterfall system, evaporative air coolers, misters, air washers, humidifiers, spa pool, whirlpool spas, Jacuzzi, spa baths**	Legionella	Less than 1000 cfu/l
		Total bacterial count	500 cfu/ml

14-1 Cooling water system (cooling tower and evaporator condenser).

- Legionella bacteria count should not exceed 1000 cfu/liter.
- Total Bacteria Count (TBC) should be below 10000 cfu/ml of water sample. However, this may not be practical in all circumstances.
- Concentrations above 10000 cfu/ml indicate that conditions in the system are favoring bacterial multiplication.
- Table (4) below details recommended action to be undertaken for a range of TBC's.

14-2 Working levels after testing the water in the cooling tower

Action levels following testing water in cooling tower

Table (4): - Action levels following testing of cooling tower water

Microbiological activity		Action required
Aerobic Count cfu/ml	**Legionella bacteria cfu/liter**	
< 5000 cfu/ml	Not detected	• Acceptable
>5000 cfu/ml < 10000 cfu/ml	100 cfu/l or less	• Continue with routine maintenance and inspection
>10000 cfu/ml < 100000 cfu/ml	Between 100 cfu/l and 1000 cfu/l	• Review dosing and biocide level, pH, etc. within target limit, review risk assessment and control measures • Resampling • If a similar count is found again, cleaning and disinfection for cooling tower should be done and resample cooling tower water • Implement remedial actions and monitoring till resampling water indicate the legionella count <100 cfu/l and Aerobic Count < 10000 cfu/ml
> 100000 cfu/ml	More than 1000 cfu/l	• Turn the tower off • An immediate cleaning and disinfection for cooling tower should be done and resample Cooling Tower water • Review risk assessment and control measures, review dosing and biocide level, pH, etc. within target limit • Add alternative biocide • Implement remedial actions • Turn the tower on if resampling water indicate the legionella count legionella count <100 cfu/l and Aerobic Count < 10000 cfu/ml

14-3 Hot, warm and cold water system

- Legionella bacteria count should not exceed 1000 cfu/litre.
- Total Bacteria Count (TBC) in excess of 500 cfu/ml may indicate that maintenance practices are not satisfactory.

Table (5) Action levels following legionella sampling in hot, warm and cold water system

Legionella bacteria (cfu/l)	Action levels following testing of hot, warm and cold water
Not detected	• **Acceptable**
>100 cfu/l and up to 1000 cfu/l	• Review risk assessment and control measures • Resampling • If a similar count is found again, cleaning and disinfection should be done and water re-sampling. • Implement remedial actions and monitoring till water re-sampling indicate the legionella count <100 cfu/l
>1000 cfu/l	• Immediate cleaning and disinfection of the whole system (hot, warm and cold water system) should be done and water re-sampling. • Review risk assessment and control measures, temperature, review dosing and biocide level,etc. within target limit • Continue implementing remedial actions, disinfection for whole system, monitoring and resampling water till water results indicate the legionella count is less than 100 cfu/l

14-4 Fountain, waterfall system, evaporative air coolers, misters, air washers, humidifiers, spa pool, whirlpool spas, Jacuzzi, spa baths

- Legionella bacteria should be less than 1 cfu/liter. (not detected)
- Total Bacteria Count (TBC) in excess of 500 cfu/ml may indicate that maintenance practices are not satisfactory.
- Swimming pool safety Dubai Municipality technical guidelines should be followed for other microbiological and chemical parameters to control pool and spa water quality

It is advisable for the owner of premises on which a high-risk manufactured water system is installed to establish an effective communication process for the rapid provision of microbiological results from the laboratory.

It is important that an effective process is implemented to ensure an effective response to results exceeding mandatory reporting and decontamination levels (e.g. detection of Legionella >1000 cfu/litre in a warm water system, and >1000 cfu/liter in a cooling tower).

Culturing for Legionella bacteria may be appropriate if carried out for a specific purpose such as establishing an effective water treatment regime, to trace the source of an infection, or to establish that decontamination procedures have been properly carried out,

The engineering practices, and regular maintenance and cleaning programs are the key to reducing the risk of Legionella transmission.

Monitoring of water quality is never accepted to replace the continuation of inspection, maintenance and cleaning program but must be used in conjunction with them to determine their effectiveness.

15.Inspecting and cleaning a cooling water system (Cooling Towers and Evaporative Condensers)

An owner of cooling water system should ensure that the unit or tower:

- The cooling water system are provided with suitable automatically controlled, water treatment system for effective management of corrosion, scaling, fouling and microbial growth; and
- Water treatment systems are inspected at least once every month by a competent person to ensure the system is operating in the ways for which they were designed.
- The system is inspected and tested for total bacteria count (TBC) at least every month by a competent person to identify if the system contains acceptable levels of microbial contaminants, and
- If the system contains unacceptable levels of microbial contaminants - is treated to bring the TBC to acceptable levels, and
- If the system is shut down for more than four (4) days – is cleaned before it is restarted and is cleaned no more than 6 months after the last cleaning.

16.Inspecting and cleaning a water system (hot, warm and cold

- Water system (hot, warm and cold water) must be flashed and cleaned at least every six months with water of not less than 70 °C for 5 minutes (or an equivalent temperature /time combination), and,
- Disinfected at least every six months with chlorine sufficient to produce a minimum free chlorine residual of 1-2 mg/l for 1 hour (each outlet is allowed to flow for at least 5 minutes).
- Reduce dead legs (stagnant lines and stubs) in the system.
- Clean and inspect hot water tanks regularly – at least twice year
- Continually run hot water circulation pumps – avoid recycling to mixing valves only,
- Store hot water at a minimum temperature of 60 °C (140 °F) and deliver to the taps at a minimum temperature of 50 °C (122 °F),
- Store and distribute the cold domestic water below 20 °C (68 °F) – if not possible, then consider monitoring for Legionella and using a disinfection system if Legionella is not under control.
- Flush the entire water system on a regular basis.
- Consider routine treatments – including the use of approved biocides.

17.Legionellosis Outbreak Measures /Emergency Plan

The owners, principal manager, or person in charge of the premises should establish an emergency plan to protect public health and prevent further infection of major outbreaks of infectious disease including legionellosis.

An outbreak is defined as two or more confirmed cases of legionellosis occurring in the same locality within a six-month period.

This plan should contain the following: -

1. Named persons (team) and their responsibilities for Legionella control and this person must be trained in control of Legionella.
2. command and control points
3. assembly areas. (outdoor and indoor assembly area)
4. Communication procedures. (mobile phone contact number and email address of responsible persons)
5. Emergency decontamination procedures which contain the following: -
   - shut down any processes which can generate and disseminating airborne water droplets and keep them shut down until sampling procedures and any remedial cleaning or other work has been done
   - To take water samples from the system before any emergency disinfection being undertaken.
   - provide staff health records to discern whether there are any further undiagnosed cases of illness
   - Co-operate fully in an investigation of any plant that may be suspected of being involved in the cause of the outbreak. This may involve, for example:
     - ↳ Tracing of all pipe work runs.
     - ↳ Detailed scrutiny of all operational records.

The person in charge of the premises should immediately submit a report to Dubai Municipality \ health and safety department within 24 hours if any confirmed cases of Legionellosis occurring in the premises.

18.Emergency Decontamination

Emergency decontamination is required if:

- a manufactured water system is suspected of being associated with an outbreak of Legionellosis; or
- a system is known to or suspected of containing Legionella populations of:
  - More than 1000 cfu/liter for a warm water system.
  - More than 1000 cfu/liter for a cooling tower.

Along with any disinfection methods of treatment used, the following is an abbreviation of the emergency cooling water disinfection methods:

18-1 Disinfection of cooling towers and evaporative condensers

- Shut the system off.
- Isolate cooling tower fans to prevent operation.
- Circulate a dispersant throughout the system.
- Dose with sodium hypochlorite and circulate to maintain a free chlorine residual of 5–10 mg/L at pH 7.0–7.6, maintain these concentrations and monitor at 15 minute intervals for at least 60 minutes.
- Isolate the system and drain water to a sewer or trade waste in accordance with the requirements of the appropriate relevant regulatory authority, ensuring that any isolated pipe work such as bypass pipes and secondary pumps are also drained.
- Open all system drains temporarily to flush drain lines with disinfected water.
- Clean all wet surfaces in accordance with the manufacturer's instructions or by using water spray and mechanical cleaning as necessary. Exercise care to avoid damaging components.
- Refill the cooling tower.
- Dose the circulating cooling water with sodium hypochlorite to maintain a free chlorine residual of at least 1–5 mg/L at pH 7.0–7.6 and monitor these concentrations at 15 minute intervals for at least 30 minutes.
- Drain the system, refill, and recommission. Reinstate water treatment programs.

Along with any disinfection methods of treatment used, the following are recommendations to reduce of the incidence Legionella contamination within domestic plumbing:

18-2 Disinfection of (hot, warm and cold) water system

- Water system (hot, warm and cold) must be flushed with water of not less than 70 °C for 5 minutes (minimum of 60°C) measured at the outlets.
- Hot and cold water system shall be Disinfected with chlorine sufficient to produce a minimum free chlorine residual of 1-2 mg/l for 1 hour (each outlet is allowed to flow for at least 5 minutes).

19.General Provisions

- If the owner of premises on which a cooling water system is installed receives a report of the results of microbiological testing of water taken from the system indicating the presence of 1000 or more colony forming units of Legionella per liter of water, he or she must submit the report to Dubai Municipality\ health and safety department within 24 hours of receiving the report.
- If the owner of premises on which a warm water system is installed receives a report of the results of microbiological testing of water taken from the system indicating the presence of 1000 or more colony forming units of Legionella per liter of water, he or she must submit the report to Dubai Municipality\ health and safety department within 24 hours of receiving the report.
- The owners, principal manager, or person in charge of the premises should take immediate decontamination procedure actions for water system, If the results of microbiological testing of water taken exceeded the acceptable limit shown above.
- If Dubai Municipality is satisfied that a high risk manufactured water system installed on premises situated in its area is not being maintained as required by these regulations, Dubai Municipality may give the owner of the premises written notice requiring the owner to shut down the system immediately or take specified action immediately within a specified period of time.
- The analysis of microbiological samples must be undertaken by a laboratory that is accredited by The Emirates International Accreditation Centre (EIAC) to perform the required testing (for more information about regulatory updating of these guidelines, please call Dubai Municipality call center 800900 or visit (www.dm.gov.ae) and accredited laboratories list (www.eiac.gov.ae).

20.Checklists for minimizing risk of legionella in water system

Check from checklists to minimizing risk of legionella in water system

20-1 General Checklist

- The premise shall implement a legionella control program.
- The premise shall Have one trained person responsible for Legionella control/ The training and the name of the trained person must be documented.
- Establishments shall apply a routine maintenance and cleaning program for the water system.
- Water quality shall comply with UAE and Dubai Municipality standards and specifications.
- Water pollutants in concentrations shall be with acceptable limits.
- A well designed, water distribution system shall be provided, with good repair.
- Water system cleaning and maintenance company shall be approved by Dubai Municipality.
- All water filters shall be kept Clean and disinfected regularly, at least monthly, Water filters shall be changed periodically.
- The water treatment system shall be validated to ensure it is effective in each system and a monitoring plan shall be put in place to ensure ongoing verification.
- Number of water samples, frequency of sampling and sampling points shall comply with the minimum requirements mentioned in Dubai municipality guidelines.
- Daily records of all water treatment readings, such as temperature, pH, chlorine and biocides concentrations shall be kept and ensure they are checked regularly by the manager as being satisfactory.
- Water tank cleaning and disinfection certificate shall be valid.
- Record for water test results according to Dubai Municipality guidelines for Legionella Control shall be provided.
- Self-compliance monitoring program Audits, risk assessment and records shall be provided.
- Sampling and monitoring Documents (water) shall be provided.
- Valid Water System Maintenance Contract from approved company shall be provided (cleaning and disinfection).
- The required reports shall be submitted online to Dubai Municipality through Building Health and Safety Compliance Test Reports e-services available on the Dubai Municipality website.

20-2 Domestic water (hot, warm, cold water system) checklist

- Premises shall have a Flushing policy and run all taps and showers in guest rooms and other areas for several minutes to draw through water at least once a week if rooms are unoccupied, and always prior to occupation.
- Premise shall maintain hot water hot and circulating at all times: 50°C - 60°C throughout the entire hot water system/hot water storage shall maintained at minimum temperature 60°C.
- Premise shall always maintain cold-water cold. It should be maintained at temperatures below 20°C throughout the system for all outlets.
- Premise shall Keep shower heads and taps clean and free from scale.
- Hot and cold water system shall be Disinfected with chlorine sufficient to produce a minimum free chlorine residual of 1-2 mg/l for 1 hours (each outlet is allowed to flow for at least 5 minutes) (at least twice a year and if legionella is detected in the system)/ pipeline Disinfection service shall be valid.
- All water storage tanks shall be cleaned and disinfected with 50mg/l chlorine at least twice per year.
- All water storage tanks shall be kept clean and inspected at least monthly. Ensure that all coverings are intact and firmly in place.
- The improvement of the hydraulics in the pertinent water tanks shall be maintained.
- All dead legs shall be removed or disconnected to avoid water stagnation (stagnant line and stubs) from the water system.
- Water heaters (calorifiers) shall be kept Clean, drained and disinfected at least twice per year.
- For the water heaters (no greater than 15 liters), the water temperatures should be kept close to 60 °C.
- The calorifier flow temperatures (thermostat settings should modulate as close to 60 °C as practicable without going below 60 °C), the calorifier return temperatures (not below 50 °C).
- The premise shall be using a supplemental source of chorine (a chlorine automatic dosing system) at the water tank which connected directly with the main water supply in order to achieve a sufficient chlorine concentration at the terminal points (0.2-0.5mg/l). This level is used for continuously treatment of building domestic drinking water distribution system including all water tanks, hot and cold water system.
- Daily records of all water treatment readings, such as temperature, pH, chlorine and biocides concentrations shall be kept and ensure they are checked regularly by the manager as being satisfactory.

20-3 Spa Pool, Whirlpool Spas, Jacuzzi, Spa Baths Checklist

- Continuously treated with 1–2mg/l chlorine or 2–3mg/l bromine.
- Biocides concentrations levels and pH shall be monitored/recorded at least three times per day.
- At least half of the water is replaced each day.
- Sand filters are backwashed daily.
- The whole system is cleaned and disinfected once per week.
- The biocide dosing system shall be functioned.
- Daily records of all water treatment readings, such as temperature, pH, chlorine and biocides concentrations shall be kept and ensure they are checked regularly by the manager as satisfactory.

20-4 Cooling Towers Checklist

- All cooling water systems, including its make-up water tanks shall be provided with suitable automatically controlled water treatment systems for effective management of corrosion, scaling, fouling and microbial growth.
- Premises shall maintain biocide concentration level effective to control microbial growth in all cooling tower, biocide dosing system shall be functioned, the continuously treatment (biocide residual level) shall include all Cooling towers and associated pack, pipes, all water tanks (makeup water tank), pumps, water filters and fittings used in evaporative air conditioning system and verified by regular testing for legionella.
- Cooling towers and associated pack, pipes, tanks, pumps, water filters and fittings used in evaporative air conditioning system shall be disinfected regularly - (at least twice a year and if legionella is detected in the system) and kept clean and free from any dirt and debris.
- Daily records of all water treatment readings, such as pH, chlorine or bromine and biocides concentrations shall be kept and ensure they are checked regularly by the manager as being satisfactory.

20-5 Fountains and water feature Checklist

- All fountains and water feature including its make-up water tanks shall be provided with suitable automatically controlled water treatment system for effective management of corrosion, scaling, fouling and microbial growth and verified by regular testing for legionella.
- Continuously treated with 1–2mg/l chlorine or 2–3mg/l bromine.
- Biocides concentrations levels and pH shall be monitored/recorded at least three times per day.

- ↳ The whole system is cleaned and disinfected once per week.
- ↳ Biocide dosing system shall function.
- ↳ Daily records of all water treatment readings, such as temperature, pH, chlorine and biocides concentrations shall be kept and ensure they are checked regularly by the manager as satisfactory.

21. Cleaning and Disinfection Methods

Chlorine-based disinfection

- the effectiveness of chlorine as a disinfectant is pH dependent and pH values above 7.6 should be avoided
- Signage and outlet warning labels should be fitted to all areas of water use.
- A pre-disinfection should take place if the conditions within the cold-water storage tank are so poor that they could adversely affect the comfort and health of the operators undertaking the cleaning.

Cleaning:

- Drain the tank to the designated drain, neutralize any residual chlorine if a pre-disinfection has been completed.
- Under normal operation, the float-operated valve is a restriction within the supply pipework and so should be operated fully open, flushing any particulate matter from the supply main.
- Physically clean the tank and associated fittings using a method that does not damage the tank coatings. (It may not be possible to clean galvanized tanks where there is evidence of corrosion).
- Remove residual sludge and water by using a wet and dry vacuum cleaner, disposing to the designated location, and rinse the tank with fresh water.

Disinfection:

- Refill the tank with fresh make-up water, isolate it from the mains supply and add the required quantity of disinfectant using the turbulence of filling to distribute it.
- Test the contents of the tank to confirm the required level of disinfectant has been achieved using a quantitative test kit.

- Draw the disinfecting solution through to the water heaters and subsequently to all outlets fed from the system.
- Test key far sentinel outlets to ensure the required concentration is reached.
- Test all other outlets with a fast and simple test showing the presence or absence of disinfectant.
- Top up the tank with fresh water and sufficient disinfectant to bring the concentration back up to target levels.
- Leave the system for the designated contact period.
- Retest key outlets at the end of the contact period to confirm that satisfactory disinfectant levels are achieved.
- Check concentrations at intervals during the contact period and restore the disinfectant levels if they decline. If the concentration should fall below the minimum, restart the process.
- Add a neutralizing agent to the tank and ensure there is no disinfectant before flushing through to the water heaters.
- Draw neutralized water through to all outlets, measuring to ensure the absence of disinfectant.
- Remove signage and outlet warning labels.
- If the water is for non-potable use, the tank inlet can be reopened as long as the subsequent refilling dilutes any neutralizing product to insignificant levels. If the tank supplies wholesome water to outlets, it should be fully drained, refilled with fresh water and flushed with water free from neutralizing agent.

22. Daily record templates

Schedule (1) Daily Records for Reading of Disinfectants and Temperature of hot and cold water system

Record sheet for daily reading of disifectants and temperature											
Hotel/ Establishment Name:-						License Number:-					
The Disifectants in use(Cl2/CLO2/other...) (scientific name):-											
	Date and time	Hot and cold water system outlets (shower/tap) (at least 4 different locations,floors/day)				Water tanks					
No.		Room No	ppm	Cold water tempreture	Hot water tempreture	Main water tank	ppm	Roof water tank	ppm	Other water tank	ppm
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
The form must be completed daily					Name and Signature of person incharge						
The form must be submited every two weeks to ehcinspection@dm.gov.ae											

Schedule (2) daily records for Reading of Disinfectants and parameters for cooling water system (cooling Towers, Evaporative condensers)

Record sheet for daily reading of disifectants in cooling water system										
Hotel/ Establishment Name:-						License Number:-				
The Disifectants in use(chlorine/bromine/...) (scientific name):-										
No.	Date and time	Cooling tower 1	ppm	Orp	Cooling Tower 2	Ppm	ORP	Make-up water tank	ppm	ORP
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
The form must be completed daily The form must be submited every two weeks to ehcinspection@dm.gov.ae					Name and Signature of person incharge					

Schedule (3) for Daily records for reading of disinfectants for fountains, water features

Record sheet for Daily reading of Disifectants in fountains, water features										
Hotel/ Establishment Name:-						License Number:-				
The Disifectants in use(chlorine/bromine/...) (scientific name):-										
No.	Date and time	Fountains, water features 1	ppm	Orp	Fountains, Water features 2	ppm	ORP	Make-up water tank	ppm	ORP
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
The form must be completed daily The form must be submited every two weeks to ehcinspection@dm.gov.ae					Name and Signature of person incharge					

Schedule (4) for Daily records for Reading of Disinfectants for Spas, Jacuzzi

Record sheet for Daily reading of Disifectants in Spas, Jacuzzi										
Hotel/ Establishment Name:-						License Number:-				
The Disifectants in use(chlorine/bromine/...) (scientific name):-										
NO	Date and time	Spas, Jacuzzi 1	ppm	ORP	Spas, Jacuzzi 2	ppm	ORP	Make-up water tank	ppm	ORP
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
The form must be completed daily The form must be submited every two weeks to ehcinspection@dm.gov.ae					Name and Signature of person incharge					

23. References

- Local Order No. (11) of 2003 Concerning Public Health and Community Safety in the Emirate of Dubai
- LEGIONELLA and the prevention of legionellosis/ World Health Organization 2007
- HSG 274 Part 2 - The control of legionella bacteria in hot and cold-water systems/ Health and Safety Executive/ UK/ 2014
- The World Health Organization Guidelines for Drinking-water Quality/ 2017

For (suggestions, comments, and complaints)	For further information
▪ Unified interactive platform that connects Dubai Government and its customers: The 04 Platform https://04.gov.ae/ ▪ ✆ Dubai Municipality - Call Center (24/7): 800900	▪ Email: ehcinspection@dm.gov.ae ▪ ✆ Dubai Municipality - Call Center (24/7): 800900