Guidelines
For
The control of Legionella in water systems
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Objectives of guidelines

Dubai Municipality, as part of its mandate, is striving to attain the highest level of health & 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 systems in all public establishments, such as hotels, furnished apartments, shopping malls, educational facilities, government buildings where cooling water system, hot and cold water and all types of water feature are used. This guidance is issued by Dubai Municipality to serve as a tool to enable concerned establishments to comply with relevant local regulations.

(Hospitals, medical care, special care facilities, must adhere to requirements relevant and more specific to their activities and building)

Scope of application

These guidelines are applicable to waters used in hotels, furnished apartments, commercial building, government building, theme park and labor accommodation.

Every violator to this guideline shall be held legally accountable according to local order No. (11) for the year 2003 concerning the public health and community safety.
Outcome/ Benefit

This Guideline focuses on methods to control contamination and minimize the risk of Legionellosis associated with building water systems. It provides advice and assistance to persons who design, install, own, operate or maintain all building water systems.

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

What is Legionella?

A genus of bacteria of the family Legionellaceae. It currently consists of at least 70 serogroups comprising over than 46 species. It has the ability to colonize water in distribution systems. 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 systems and be found in cooling tower systems, hot and cold water systems and other plant which use or store water.

What is 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 pneumophila 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.

**What is Conditions favoring the growth of Legionella?**

- temperature range from 20-45 °C
- high nutrient level
- accumulation of organic material, sediments, and other organisms

**Where can Legionella contamination occur?**

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

A water system includes all plant/equipment and components associated with that system, e.g. all associated pipe-work, pumps, feed tanks, valves, showers, heat exchangers, quench tanks, chillers etc. It is important that the system is considered as a whole and not, for example, the cooling tower in isolation. Dead legs and parts of the system used intermittently, e.g. test loops in engineering factories, injection moulding machines, also need to be included as part of the system since they can create particular problems with microbial growth going unnoticed. Once brought back on-line they can cause heavy contamination, which could disrupt the efficacy of the water treatment regime.

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

- **Cooling Towers and Evaporative Condensers**

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 wetted 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 systems 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.

- 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. The water normally collects in a sump and is recirculated. There is potential for microbial growth in such a system. Evaporative coolers should be kept dry when not in use.

**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:

a) Do not allow proliferation of the organisms in the water system; and

b) 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 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 commonly documented. This regulation focuses on two key aspects of prevention for cooling water towers: system treatment and maintenance.

The key aspects of this regulation are that the water system be kept clean and that a biocidal treatment program be used.

1- Maintenance

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

a) cause a reduction in heat transfer;
b) harbor Legionella and provide an environment for their growth;
c) induce highly localised microbial corrosion;
d) interfere with the effectiveness of corrosion inhibitors;
e) trap particulate matter, increasing the problem of fouling; and
f) disrupt water distribution within the tower.

Biocides are used to control microbiological activity. They should prevent the proliferation of micro-organisms but are not required to disinfect systems. Biocides can be oxidising or non-oxidising. Controlling biocide levels, i.e. the frequency and quantity of additions, will depend on the microbiological activity of the system.

Biocides, when correctly keeping the system clean reduces the nutrients available for Legionella growth. Regular visual inspections by the maintenance staff should be made. To avoid the build-up of dirt, organic matter or other debris, the cold water basin of the cooling unit should be cleaned regularly. Mechanical filtration can be used to help reduce this debris. Operations and maintenance records should include the following information:

- All water systems 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 persons responsible for system operation and shutdown
- Result of any testing of the systems and microbiological testing of water samples.
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:

a) corrosion;
b) scale formation;
c) fouling; and
d) Microbiological activity.

They are interrelated and failure to control any one 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 physico-chemical processes and inhibitors to control such processes should be added on a continuous basis.

All components of the treatment programme should be preferably be dosed by pump or eductor (sometimes referred to as an ejector) systems 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.

3- 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, carbon dioxide, sunlight, together with large surface areas all favor the growth of micro-organisms such protozoa, algae, fungi and bacteria, including Legionella.
Biocides, when correctly 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:

a) compatibility of all chemical components used; and

b) 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 systems, 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 programme. 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.

Legionella control method?

- **Temperature** It is recommended that hot water should be stored at 80 °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 400ug/l and 40 ug/l respectively, the technique can, if properly managed, be effective against planktonic Legionella in both hot and cold water systems.

- **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 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 systems. The maximum value of Chlorine dioxide in water should not exceed 0.5 mg/l as Chlorine dioxide. Chlorine dioxide level of 0.5 mg/l can, if properly managed, be effective against *planktonic Legionella* in both hot and cold water systems.

• **Ultraviolet light UV, and Ozone O3** The previous treatment systems are effective throughout the water system downstream to the point of application. UV & O3 can be used to treat water at or very close to the point of application.

**Water Quality of 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 is 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 which 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.

**All Water Features** with a water storage volume of over 1,000 litres and which produce spray or aerosol must maintain the minimum water quality outlined as bellow:-

• Legionella bacteria should be less than 1 cfu/litre.

• Total Bacteria Count (TBC) in excess of 500 cfu/ml may indicate that maintenance practices are not satisfactory.

• Testing for Legionella bacteria and Aerobic count must be carried in accordance with Table (1)
Monitoring microbial levels in water systems

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.

- Sample should collected from each cooling water system (Cooling Towers and Evaporative Condensers).
- Sample should collected from each Water system with a water storage volume of over 1,000 litres and which produce spray or aerosol such as spas, fountain, waterfall systems, evaporative air coolers, misters, air washers and humidifiers.
- Where as 4 to 6 sets of samples at least should be collected from different location of hot and cold water systems.
- Swabs should be taken from selected showers head and water filters. The sample should be taken from the back side of shower head and water filters after it has been removed.
- the minimum recommended sampling frequency as shown below:-

Table (1):- Monitoring recommended for good operating practice

<table>
<thead>
<tr>
<th>parameter</th>
<th>Timing</th>
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<tr>
<td>ALL water system (except cooling water system)</td>
<td>Cooling water (Cooling Towers and Evaporative Condensers)</td>
</tr>
<tr>
<td>Aerobic count</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Legionella</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>

- Microbiological Analysis of water Samples:- Samples may be analyzed by the laboratory by either culture of viable organisms or polymerase chain reaction (PCR), or both.
- The analysis of microbiological samples must be undertaken by a laboratory that is accredited by Dubai Municipality to perform the required testing, and the test results must be available for inspection by the Dubai Municipality (DM) staff.
**Water Quality Guideline.**

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 may 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 a cooling water system based only on Legionella bacteria-specific data. Monitoring the overall bacterial level is far more effective.

- **Cooling water system** (cooling tower & evaporator condenser).

  a) **Total Bacteria Count (TBC) should be below 10 000 cfu/ml of water sample.** However, this may not be practical in all circumstances. Concentrations above 10 000 cfu/ml indicate that conditions in the system are favoring bacterial multiplication. The Table (2) below details recommended action to be undertaken for a range of TBC’s. and

  b) **Legionella bacteria count should not exceed 1000 cfu/litre.**

**Table (2):- Action levels following testing of Cooling Tower Water**

<table>
<thead>
<tr>
<th>Microbiological activity</th>
<th>Action required</th>
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<tr>
<td><strong>Aerobic Count cfu/ml At 30°C (minimum 48 hours incubation)</strong></td>
<td><strong>Legionella bacteria colony-forming unit per litre</strong></td>
</tr>
<tr>
<td>&lt; 10 000 cfu/ml</td>
<td>100 or less</td>
</tr>
<tr>
<td></td>
<td>continue with routine maintenance and inspection</td>
</tr>
<tr>
<td>&gt; 10 000 cfu/ml, &lt; 100 000</td>
<td>Between 100 and 1,000</td>
</tr>
<tr>
<td></td>
<td>!reteness</td>
</tr>
<tr>
<td></td>
<td>!review dosing</td>
</tr>
<tr>
<td></td>
<td>! monitor trend</td>
</tr>
<tr>
<td>&gt; 100 000</td>
<td>More than 1,000</td>
</tr>
<tr>
<td></td>
<td>! add alternative biocide</td>
</tr>
<tr>
<td></td>
<td>! retest</td>
</tr>
<tr>
<td></td>
<td>! review dosing</td>
</tr>
<tr>
<td></td>
<td>! monitor trend</td>
</tr>
</tbody>
</table>
In Hot and cold water systems

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

In fountain, waterfall systems, evaporative air coolers, misters, air washers and humidifiers

a) Legionella bacteria should be less than 1 cfu/litre. (This Legionella acceptance level is applicable for spa also)
b) Total Bacteria Count (TBC) in excess of 500 cfu/ml may indicate that maintenance practices are not satisfactory.
c) Swimming pool safety DM technical guidelines 69 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 hot and cold water system, and >1000 cfu/litre 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.

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 –

a) The cooling water systems are provided with suitable automatically controlled, water treatment systems for effective management of corrosion, scaling, fouling and microbial growth; and
b) The water treatment systems are inspected at least once every month by a competent person to ensure the systems are operating in the ways for which they were designed.

c) The systems is inspected and tested for total bacteria count (TBC) at least once every week by a competent person to identify if the system contains acceptable levels of microbial contaminants; and

d) If the system contains unacceptable levels of microbial contaminants - is treated to bring the TBC to acceptable levels; and

e) If the system is shut down for more than four (4) days – is cleaned before it is restarted; and

f) Is cleaned no more than 6 months after the last cleaning.

Inspecting and cleaning a (hot and cold) water system

a) water systems (hot & cold water) must be flushed at least every six month 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.

b) Reduce dead legs (stagnant lines and stubs) in the system,

c) Clean and inspect hot water tanks regularly – annually as a minimum,

d) Continually run hot water circulation pumps – avoid recycling to mixing valves only,

e) 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),

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 are not under control,

g) Flush the entire water system on a regular basis (at least quarterly),

h) Consider routine treatments – including the use of approved biocides.

Emergency plan

the owners, principal manager, or person in charge of the premises should established an emergency plans 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 & control points
3. assembly areas (outdoor & indoor assembly area)
4. Communication procedures (mobile phone contact number & email address of responsible persons)
5. Emergency decontamination procedures which contain the following :-
   a) shut down any processes which are capable of generating and disseminating airborne water droplets and keep them shut down until sampling procedures and any remedial cleaning or other work has been done
   b) To take water samples from the system before any emergency disinfection being undertaken.
   c) provide staff health records to discern whether there are any further undiagnosed cases of illness
   d) 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:-
      (i) Tracing of all pipe work runs;
      (ii) Detailed scrutiny of all operational records;

The person in charge of the premises should immediately submit a report to Dubai Municipality \ public health & safety department \ contact centre 800900 within 24 hours if any confirmed cases of Legionellosis occurring in the premises

**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/litre for hot and cold water system;
  - more than 1000 cfu/litre for a cooling tower;

Along with any disinfection methods of treatment used The following is an abbreviation of the **emergency cooling water disinfection method**:-

a) Shut down the system.

b) Isolate cooling tower fans to prevent operation.

c) Circulate a dispersant throughout the system.

d) 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.
e) 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.

f) Open all system drains temporarily to flush drain lines with disinfected water.

g) Clean all wetted surfaces in accordance with the manufacturer's instructions or by using water spray and mechanical cleaning as necessary. Exercise care to avoid damaging components.

h) Refill the cooling tower.

i) 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.

j) Drain the system, refill, and recommission. Reinstall water treatment programs.

Along with any disinfection methods of treatment used, the following are recommendations to reduce the incidence Legionella contamination within domestic plumbing (hot and cold) water systems:

- water systems (hot & cold water) must be flushed with water of not less than 70 °C for 5 minutes (minimum of 60°C) measured at the outlets, or
- treated with chlorine to provide minimum free chlorine residual of 1-2 mg/l at all outlets.

**Guidance**

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

1. **Regular maintenance procedures:**
   
a) Named person responsible for Legionella control and this person must be trained in control of Legionella.

b) Keep the water systems clean to reduce the nutrients available for bacteria growth. Regular visual inspections should be made at least every month To avoid the build-up of dirt, organic matter or other debris.

c) All water systems which creates a water spray or aerosol, and Spa pools must be treated and maintained to minimize the risk of Legionella bacteria contamination.
d) Any cooling water system must be fitted with an automatic biocide dosing device and should work properly all the year. Cooling water system must be cleaned at least once every six (6) months.

e) Cooling tower should be located so that the drift directed away from the air-intake system, operable window and entrances of the building. Cooling tower must be fitted with drift eliminators.

f) All cooling water systems, including all associated tanks, pumps, pipes, water heaters (calorifiers), water filters and fittings, must be emptied, cleaned and disinfected at least once every six (6) months.

g) All cold water storage tanks, water heaters (calorifiers), water filters must be emptied, cleaned and disinfected at least once a year.

h) All dead legs should be removed or disconnected (stagnant lines and stubs) from the water systems.

i) Keep hot water hot at all time: 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.

j) All water taps, showers, water outlet should be flushed weakly.

k) Water systems (hot, warm & cold water) must be flushed at least every six month 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.

l) Shower heads and taps should be disinfected and kept clean regularly (at least monthly).

2. Monitoring

Water quality must be tested as mentioned in Table (1) and the test results must be available for inspection by the Dubai Municipality (DM) staff. Sampling and testing must be carried out for the presence of bacteria, both

a) general (aerobic) bacterial species
b) Legionella bacteria.

3. records and manuals:

a) All water systems schematic, manuals for operation and maintenance procedures.

b) System water volume, with date and method of determination

c) Inspections, maintenance, infection control dates and results of each inspection.

d) Details of treatment procedures, type and use of biocide, Material Safety Data Sheets for Chemicals used (MSDS).
e) Names of persons responsible for system operation and shutdown
f) Result of any testing of the systems and microbiological testing of water samples.

ALL above records must be available for inspection by the Dubai Municipality (DM) staff.

4. GENERAL PROVISIONS

a) 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 litre of water, he or she must submit the report to Dubai Municipality\public health & safety department within 24 hours of receiving the report.

b) If the owner of premises on which a hot, warm & cold 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 litre of water, he or she must submit the report to Dubai Municipality\public health & safety department within 24 hours of receiving the report.

c) the owners, principal manager, or person in charge of the premises should take immediate decontamination procedure actions for water systems, if the results of microbiological testing of water taken exceeded the acceptable limit shown above.

d) 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.

e) The owner of premises on which cooling water system must registered with Dubai Municipality\public health & safety department, within 3 month. The register must include the type of water system, the full name and address of the premises.

f) The analysis of microbiological samples must be undertaken by a laboratory that is accredited by Dubai Municipality to perform the required testing (for more information about regulatory updating of this guideline pls. call DM contact centre 800900 or visit (www.dm.gov.ae) and accredited laboratories list (www.dac.gov.ae).