مؤسسة مدينة دبي للطيران
DUBAI AVIATION CITY CORPORATION

DUBAI AVIATION CITY CORPORATION OHSE CODE OF PRACTICES

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DACC CODE OF PRACTICE - CONTROL OF LEGIONELLA IN WATER SYSTEMS

1.0 INTRODUCTION

i. This Code of Practice (CoP) is mandatory to all operational facilities within the Dubai South jurisdiction. This CoP is designed to incorporate requirements set by UAE and other relevant Regulatory authorities. If requirements of this document conflict with requirements set by another regulatory authority, operational facilities are required to follow the more stringent requirement.

ii. This Code of Practice (CoP) is mandatory applicable to waters used in hotels, furnished apartments, commercial building, government building, theme park and labor accommodation. Hospitals, medical care, special care facilities must adhere to requirements relevant and more specific to their activities and building.

iii. This Code of Practice (CoP) 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.

iv. This Code of Practice (CoP) 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.

v. 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.

vi. Operational facilities mean the business units such as Factories, Logistics and Warehouse Facilities, Recreational Facilities, Multi Store Apartments, Retail Facilities, Offices, Educational Institutions, Medical Facilities, etc. and all other facilities which are registered under Dubai South Licensing and Registration Department and operating in Dubai South Jurisdiction.

vii. A duty holder is defined as;

a) The person(s) who owns or is in control, through contact or tenancy, of non-domestic premises;

b) With regard to multiple tenanted premises, the duty holder shall be the person who owns or is in control of the building, including access and egress

c) All other persons shall cooperate with the duty holder to allow them to comply with their duty's requirements under this CoP.

2.0 TRAINING AND AWARENESS

(i) The Duty Holder shall ensure that OHSSE training complies with the requirements of Dubai South OHSERF - Regulations 6 – Competence Management, Training and Awareness;

(ii) The Duty Holder shall ensure that all employees involved in work that may expose an employee or other person to legionella are given suitable and sufficient information, instruction and training. This includes information, instruction and training on the significant findings of the risk assessment and the appropriate precautions and actions they need to take to safeguard themselves and others. This should be reviewed and updated whenever significant changes are made to the type of work carried out or methods used.

(iii) The Duty Holders must ensure that the named person responsible for Legionella control are trained in control of Legionella.

3.0 REQUIREMENTS

3.1 ROLES AND RESPONSIBILITIES

The Duty Holders comply with their legal duties as following: -

(i) 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 create 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 times: 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 months 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).

(ii) Monitoring:

a) Water quality must be tested as mentioned in Table (1) and the test results must be available for inspection by the Dubai South OHSSE staff.
b) Sampling and testing must be carried out for the presence of bacteria, both General (aerobic) bacterial species & Legionella bacteria.

(iii) 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 liter of water, he or she must submit the report to Dubai South OHSSE 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 liter of water, he or she must submit the report to Dubai South OHSSE within 24 hours of receiving the report.

c) The Duty Holder 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 South 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 South 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 South OHSSE within 3 months. 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 South to perform the required testing.

3.2 Maintenance

(i) Biocides are used to control microbiological activity. They should prevent the proliferation of micro-organisms but are not required to disinfect systems.

(ii) Biocides can 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.

(iii) 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:

a) All water systemsschematic, 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.

3.3 Treatment

(i) 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.

(ii) 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.

(iii)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.

(iv)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 Physicochemical processes and inhibitors to control such processes should be added on a continuous basis.

(v) All components of the treatment program should 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.

3.4 Microbiological Activity

(i) 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 microorganisms such protozoa, algae, fungi and bacteria, including Legionella.

(ii) 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.

(iii) 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.

(iv) 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.

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

3.5 Legionella control method

i) **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.

ii) **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 40ug/L respectively, the technique can, if properly managed, be effective against planktonic Legionella in both hot and cold-water systems.

iii) **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.

iv) **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.

v) **Ultraviolet light UV, and Ozone 03**. The previous treatment systems are effective throughout the water system downstream to the point of application. UV & 03 can be used to treat water at or very close to the point of application.

3.6 Water Quality of Water Features

(i) 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.

(ii) 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.

(iii) 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.

(iv) All Water Features with a water storage volume of over 1,000 liters and which produce spray or aerosol must maintain the minimum water quality outlined as below: -

a) Legionella bacteria should be less than 1 cfu/liter.
b) Total Bacteria Count (TBC) in excess of 500cfu/ml may indicate that maintenance practices are not satisfactory.
c) Testing for Legionella bacteria and Aerobic count must be carried in accordance with Table (1).

3.7 Monitoring microbial levels in water systems

(i) 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.

a) Sample should be collected from each cooling water system (Cooling Towers and Evaporative Condensers).
b) Sample should be collected from each Water system with a water storage volume of over 1,000 liters and which produce spray or aerosol such as spas, fountain, waterfall systems, evaporative air coolers, misters, air washers and humidifiers.
c) Whereas 4 to 6 sets of samples at least should be collected from different location of hot and cold-water systems.
d) 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.
e) the minimum recommended sampling frequency as shown below: -

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

Parameter	Timing	
	ALL water system (except cooling water system)	Cooling water (Cooling Towers and Evaporative Condensers)
Aerobic count	Quarterly	Monthly
Legionella	Quarterly	Quarterly

f) 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.

g) The analysis of microbiological samples must be undertaken by a laboratory that is accredited by Dubai South to perform the required testing. And the test results must be available for inspection by the DACC OHSE staff.

3.8 Water Quality Guideline.

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

(ii) 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.

(iii) **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 Legionella bacteria count should not exceed 1000 cfu/liter.

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

Action levels following testing of Cooling Tower Water		
Microbiological activity		Action required
Aerobic Count cfu/ml at 30°C (minimum 48 hours incubation)	Legionella bacteria colony-forming unit per liter	
< 10 000 cfu/ml	100 or less	Continue with routine maintenance and inspection
>10 000 cfu/ml, < I 00 000	Between 100 and 1,000	• Retest • Review dosing • Monitor trend
> 100 000	More than 1,000	• Add alternative biocide • Retest • Review dosing • Monitor trend

(iv)**In Hot and cold water systems**

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

(v) **In fountain, waterfall systems, evaporative air coolers, misters, air washers and humidifiers**

a) Legionella bacteria should be less than 1 cfu/liter. (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 OM technical guidelines 69 should be followed for other microbiological and chemical parameters to control pool and spa water quality

(vi) 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/liter in a hot and cold water system, and >1000 cfu/liter in a cooling tower).

(vii) 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.

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

The Duty holder 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 are 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.

(ix)Inspecting and cleaning a (hot and cold) water system

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

(x) Emergency plan: The Duty Holder 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: -

a) Named persons (team) and their responsibilities for Legionella control and this person must be trained in control of Legionella.
b) command & control points
c) assembly areas (outdoor & indoor assembly area).

d) Communication procedures (mobile phone contact number & email address of responsible persons)

(xi)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: -
   - Tracing of all pipe work runs;
   - Detailed scrutiny of all operational records.
e) The person in charge of the premises should immediately submit a report to Dubai South within 24 hours if any confirmed cases of Legionellosis occurring in the premises.

(xii) Emergency decontamination: **Emergency decontamination is required if:**

a) A manufactured water system is suspected of being associated with an outbreak of Legionellosis; or
b) a system is known to or suspected of containing Legionella populations of:

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

(xiii) Along with any disinfection methods of treatment used; the following 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. Reinstate water treatment programs.

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

a) 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
b) Treated with chlorine to provide minimum free chlorine residual of 1-2 mg/l at all outlets.

4.0 RECORD KEEPING

(i) The Duty Holder shall maintain distribution records as per the requirements of: Dubai South OHSSERF - Regulations 8 Document Control and Record Management;

(ii) A Risk Assessment must be carried out to record the significant findings and ensure appropriate records are kept. This should include any groups of employees identified as being particularly at risk and the steps taken to prevent or control risks. If the employer has less than five employees there is no statutory duty to write anything down, but it may be useful to keep a written record of what has been done.

(iii) The following records must be available for inspection by the Dubai South OHSSE staff.

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.

5.0 REFERENCES

NO.	DOCUMENT NAME	DOCUMENT NO.
1	Risk Management	DS-OHSERF – Regulation 2
2	Leadership, Roles, Responsibility and Self-Regulation	DS-OHSERF – Regulation 5
3	Competence Management, Training and Awareness	DS-OHSERF – Regulation 6
4	Communication, Consultation and Participation	DS-OHSERF – Regulation 7
5	Emergency Management	DS-OHSERF – Regulation 10
6	Incident Management, Monitoring, Investigation and Reporting	DS-OHSERF – Regulation 12
7	Local order No.11 for the year 2003 concerning the public health and community safety.	Local order No.11- 2003