LEGIONELLA MANAGEMENT & PREVENTION PLAN

Project No:	

REVISION HISTORY	ISSUE DATE	DESCRIPTION	REVIEW / STATUS
00			

PREPARED BY:	**REVIEWED & APPROVED BY:**
QA QC ENGINEER	PROJECT ENGINEER

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1.0. SCOPE & OBJECTIVE

This document presents the Legionella Management & Prevention Plan (LMPP) for any type of public construction project.

Normally the requirements are given within the project specifications, and the contractor is responsible for developing and implementing a legionella management plan for all relevant water-based systems.

2.0. BACKGROUND TO LEGIONNAIRES 'DISEASE

2.1. The Legionnaires' disease is caused by the bacterium Legionella pneumophila and related bacteria.

2.2. The disease is a potentially fatal form of pneumonia that can affect anyone but principally affects those who are susceptible due to age, illness, immunosuppression smoking, etc.

2.3. The disease is normally contracted by inhaling Legionella bacteria, either in tiny droplets of water (aerosols) or in droplet nuclei (the particles left after the water has evaporated) contaminated with Legionella, deep into the lungs.

2.4. It may also be contracted by inhaling legionella bacteria following ingestion of contaminated water by susceptible individuals. Symptoms of the disease include dry cough and difficulty in breathing.

2.5. Some infected patients may develop diarrhea or vomiting and some may become confused or delirious.

2.6. The disease can be treated effectively with appropriate antibiotics. The incubation period is usually between 3 – 6 days before the symptoms are developed.

2.7. Legionella bacteria are common and can be found naturally in environmental water sources such as rivers, lakes, and reservoirs, usually in low numbers.

2.8. They are found in water at temperatures between 6 – 60°C and water in the range of 20 – 45°C seems to favor growth.

2.9. The bacteria do not appear to multiply below 20°C and will not survive above 60°C, however, they may remain dormant and multiply when the temperature is suitable.

2.10. The sources of nutrients for the Legionella bacteria to multiply may include algae, amoebae, and other bacteria.

2.11. In addition, the presence of sediment, sludge, scale, and other materials may harbor and provide favorable conditions for the bacteria to grow.

2.12. The Legionella bacteria are commonly encountered colonizing manufactured water systems such as cooling tower systems, hot and cold water systems, and other plants that use or store water.

2.13. Therefore, to control the risk of exposure to the bacteria, it is important to:

2.14. Disallow the proliferation of the bacteria in water system; and

2.15. Reduce exposure to water droplets and aerosol

3.0. APPLICATION OF LEGISLATION FOR LEGIONELLA CONTROL

3.1. The Health and Safety at Work Act 1974 (HSWA) extends to the risk of legionella bacteria, which may arise from work activities.

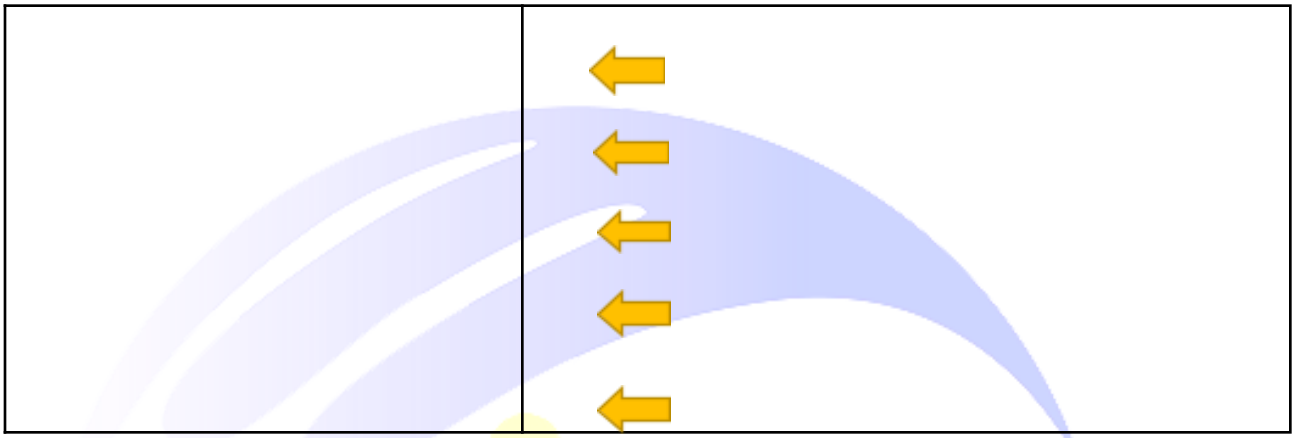
3.2. Three sets of Regulations and Approved Code of Practice apply to the control of legionella bacteria in water systems:

3.3. The Control of Substances Hazardous to Health Regulations 1999 (COSHH)

3.4. The Notification of Cooling Towers and Evaporative Condensers Regulations

3.5. The HSE Approved Code of Practice ACOP L8 (rev) – "The control of legionella bacteria in water systems".

LEGIONELLA PATH TO INFECTION	CONTROLS
PRESENCE IN WATER SUPPLY ↓ AMPLIFICATION ↓ AEROSOL PRODUCTION ↓ INHALATION BY SUSCEPTIBLE HOST	PORTABLE WATER SUPPLY BIOCIDE WATER TREATMENT • Startup • Cleanup REDUCTION OF Nutrients by: • Drainage • Cleaning Regime AVOIDANCE OF OPTIMUM GROWTH TEMPERATURE • < 20°C Normal Operation • Full Drain When Not in Use AVOIDANCE OF DROPLET DUE TO LOW AIR VELOCITIES



3.6. ASHRAE 12-2000 Guideline: Minimizing the Risk of Legionellosis Associated with Building Water Systems

The site is generally divided into the building site and site office accommodation. During the construction stage, construction activities within the building site will include the following:

3.7. Preparation and installation of the concrete foundation of the building
3.8. Preparation and installation of main columns, core walls of the building
3.9. Preparation and installation of the main structure of the upper levels of the building including slabs, columns, block walls, and roofs
3.10. Installation of MEP services i.e. reticulation of piping and electrical systems, installation of electrical and mechanical equipment
3.11. Preparation and installation of landscaping works
3.12. Installation of basic interior work i.e. raised access flooring, drywall, etc.
3.13. Testing and commissioning of various MEP systems
3.14. Within the site office accommodation, the main activities will include:
3.15. Setting up and operation of site office accommodation
3.16. Installation, operation, and maintenance of support services for the site offices i.e. electrical, telecommunication, internet, water supply reticulation, sewerage, and waste management
3.17. Installation and maintenance of temporary facilities i.e. carpentry, bar bending workshops, waste separation area, chemical storage area, materials storage area, rest areas, canteen, toilets, etc.
3.18. Considering the site facilities and activities, the potential occurrence of Legionella bacteria on-site would be confined to the water-based system with low turnover.

3.19. During the initial construction stage, the areas of concern would be within the site offices compound i.e. hot/cold water system, and include the temporary facilities such as the water storage tanks.

3.20. The building site does not store water and is not expected to until the testing and commission stage, which is expected after the building construction.

3.21. To ascertain the risk of such occurrence during the construction stage, a Legionella Risk Assessment needs to be undertaken

4.0. PRELIMINARY LEGIONELLA RISK ASSESSMENT ON-SITE

4.1. A preliminary Legionella risk assessment will be conducted to identify any potential sources of the bacteria on-site and the potential risk of exposure. The assessment will be reviewed when required during the construction phase.

The preliminary risk assessment will be conducted based on the guidance provided in the Approved Code of Practice and Guidance (L8). 3rd Edition 2000, UK Health and Safety Executive:

4.2. Survey the construction site and identify all existing water-based systems i.e. water storage tanks, pipes, drinking water stations, and any hot and cold water systems, if any.

4.3. Assess the turnover of water usage of the existing water systems. As a general rule, the high turnover rate of water usage will usually minimize the chance of the bacteria multiplying. The entire cooling water loop should be cleaned and flushed monthly.

4.4. Note and estimate the range of temperature where the water is being stored. Water stored within the temperature range of 20 to 60°C will be noted.

4.5. Assess whether the identified water-based systems are distributing water in droplets or aerosol forms, and ensure that water is not distributed in such form.

4.6. Tabulate a matrix system to assess the risk of exposure to the identified potential source of Legionella bacteria considering the factors of temperature, water turnover, and water distribution in droplets/aerosol forms.

4.7. Based on the risk assessment, proposed control measures to eliminate or minimize the risk.

4.8. Avoid dead-end piping, low spots, and other areas in the water distribution system where water may stagnate during shutdown.

5.0. CONTROL MEASURES FOR PRELIMINARY LEGIONELLA RISK ASSESSMENT ON-SITE

The following control measures are proposed, depending on the results of the preliminary assessment above:

5.1. Ensure water usage turnover is less than 3 days.
5.2. Ensure water is not distributed in droplets or aerosol.
5.3. For water usage turnover of more than 3 days, the storage tank will be cleaned and monitored for cleanliness.
5.4. Regular/weekly monitoring of water-based system on-site

6.0. CHILLED WATER SYSTEM

6.1. Cold /Domestic Water System
6.2. Hot Water System
6.3. Fire-fighting Water System
6.4. Irrigation Water System (this has not been confirmed at the time of this plan)
6.5. Chilled Water System
6.6. The chilled water system distributes the flow of chilled water to the air handling unit and fan coil units (which are essential equipment for the air conditioning of the project).
6.7. Two units of chilled water pump, AHU and FCU are located at the ground level.
6.8. The circuit is a closed loop.
6.9. The chilled water system is also equipped with an exclusive chemical dosing system which administers biocides and corrosion inhibitors during operation.
6.10. The biocide functions to prevent the growth of micro-organisms while corrosion inhibitors intend to avoid corrosion of the black steel pipes. The chilled water is maintained at a supply network temperature of around 5.5°C and a return network temperature of around 14.4°C.

7.0. COLD/DOMESTIC WATER SYSTEM

7.1. The cold water supply circuit distributes water to domestic utilities such as washrooms. Based on the current design, the cold water supply will distribute water to the washrooms in the basement, ground floor, first floor & second floor.
7.2. There are 2 water tanks for this purpose (at the ground floor pump room).
7.3. Water supply is provided by the “existing network” and fills up the RCC tank, water from the RCC tank is pumped to fill up the GRP tank and water will flow by booster pump for the washrooms in the upper levels.

7.4. The RCC tank booster pump is equipped with a recirculation pump with a constant flow rate of 4 liter/second. GRP Water tank is not equipped with a recirculation pump but is designed to have a half-day utilization per working day i.e. approx. 2 times fill up per day.

7.5. As such, water within all the tanks is not expected to stagnate.

8.0. HOT WATER SYSTEM

8.1. The hot water system distributes water to the male and female shower rooms located on level ground floor.

8.2. The system is an open-loop network with the possibility of human contact.

8.3. The source of supply is from the RCC water tank which receives water from the distribution company network.

8.4. The water enters the water heaters located at the same level, all hot water pipes are insulated to maintain a minimum temperature of 60°C.

9.0. FIRE-FIGHTING WATER SYSTEM

9.1. The fire-fighting circuit is to be used during a fire situation where water from the main domestic tank at ground level (fire reserve) is used for sprinklers, fire hose reel /fire hose cabinet of the project.

9.2. During fire conditions, this circuit becomes an open circuit and until such an unlikely event, the water forms a stagnation loop within the fire-fighting pipes.

10.0. WASTEWATER SYSTEM

10.1. The network caters for the disposal of grey and black water to the municipality drainage lines and there is no human contact.

10.2. All the drain water systems (from the HVAC SYSTEM) need to be connected to the rainwater system in the roof and all other areas are connected to the nearest wastewater system.

11.0. WATER TEST REPORTS

11.1. Water tests shall be arranged for all facilities which deal with water.

11.2. After getting a permanent water supply connection from the authority conduct a water test in an equal interval of time duration for all facilities which deal with water at third-party testing labs.

11.3. Make records of the test and if there is any variation in the test results take necessary action as mentioned in the prevention plan.

11.4. Water Sterilization and Disinfection Procedure and Tests

Pre-Requisites:

11.5. Ensure that the installation work has been completed. The system was successfully pressure tested and witnessed.
11.6. Ensure that all the heaters are switched off and any filters/softeners are bypassed.
11.7. The availability of electricity at the site for lighting.
11.8. Confirm the availability of Labour/Manpower at the site for 24-hour operation.
11.9. Confirm the availability of chemicals, fire extinguisher, and duct for smoke exhaust at the site.
11.10. Confirm availability of safety equipment on site and ensure that workers are trained in safety requirements.
11.11. Ensure the availability of a continuous supply of fresh water.
11.12. All future tap-offs should have isolation valves for flushing the chlorinated water.
11.13. Confirm sufficient capacities of booster pumps are ready for operation.
11.14. Confirm that Provision/arrangement is to be made to collect the drain water and dispose of the same.

12.0. TESTING CRITERIA

12.1. After Addition of Chlorine Chemical Parameter Supply Water After Static Flushing Chlorine < 0.2ppm & > 50ppm
12.2. After Flushing of the Chlorine Chemical Parameter Supply Water After Static Flushing Chlorine > 0.2ppm < 0.5ppm

Note:

The above values are for indicative purposes based on the Supply of water quality.

13.0. POTABLE DOMESTIC WATER CHLORINATION PROCEDURE

13.1. Chlorination chemicals will be added in the storage tank to 50-ppm residual levels Subsequently, after 1/2 hours of residence time in the tank, the chlorinated solution shall be distributed to the roof tank and then to all the parts of the water pipeline network.
13.2. Any shortfall in the residual level of chlorine shall be made up to achieve full 50-ppm residuals by topping up the required chemical in the system.
13.3. The above shall ensure that the entire system is chlorinated as per the requirement

13.4. After 24 hours of stagnancy, the chlorinated water from the basement tank will be transferred to a temporary storage tank & the de-chlorination chemical will be dosed into the temporary storage tank.

13.5. After testing of chlorine level (<0.5ppm) in the temporary storage tank, the water from the temporary storage tank shall be drained into the sewer or any approved area.

13.6. Fresh water will be added to the water storage tanks and flushed through all parts of the pipe network and will be tested for a chlorine level of < 0.5 ppm.

14.0. DETAILED CHLORINATION METHOD

The chlorine shall be manually dosed, into the respective tanks as recommended.

Under the supervision of the chemical treatment supplier, the detailed procedure adhered to for Chlorination is as follows:

14.1. Flushing with water to remove loose debris from the tank.

14.2. Chlorination of storage tank and water pipeline network.

14.3. Flushing of Chlorinated Water

14.4. Testing of water in storage tank and pipe work after flushing

15.0. CERTIFICATION

15.1. Flushing with water to remove loose debris

15.2. The ground/basement & roof water storage tank of all the buildings has to be cleaned manually to remove the debris in the tank.

15.3. After the cleaning, water has to be filled in the tank.

15.4. The tank and feeding line have to be flushed till the water is clear and free of suspended solids.

15.5. In this step, the system is flushed through all the taps, with plain water to remove particulate and suspended matters from the line.

15.6. This step is required as particulate matter of any form can help in the proliferation of bacteria in the system.

16.0. CHLORINATION OF STORAGE TANK AND WATER PIPELINE

16.1. After flushing with plain water, chlorine is introduced into the basement tank and roof water tank and once chlorine levels (50 ppm) are established, the chlorinated water is allowed to remain for 24 hours in the tank.

16.2. The authority line to the basement tank is closed.

16.3. After adding the chemicals (within 2 hours after adding the chemicals) the chlorinated water is distributed from the tank to the roof tank.

16.4. The chlorine level will be checked for > 50ppm, if the level is low chlorine will be added to increase the level to 50ppm.

16.5. Once the chlorine level is > 50 ppm in the roof tank, chlorinated water will be distributed to the domestic water network. Also, chlorinated water will be distributed to lower levels.

16.6. Residual chlorine is checked at random points in the pipework by using the Chlorocol tablets.

17.0. FLUSHING OF CHLORINATED WATER

Flushing of Chlorinated Water

17.1. After 24 hours of stagnancy, the basement tank chlorinated water and the roof tanks, and the remaining water will be drained through the drain and collected in the basement sump and will be de-chlorinated.

17.2. The basement tank will be flushed with fresh water by opening the incoming supply line valve.

17.3. Flushing will be continued until the chlorine level is below 1 ppm.

17.4. The drained water will be collected in the sump in the basement.

17.5. Once the chlorine level is below 1ppm from the basement tank drain line, the drain valve will be closed.

17.6. The basement tank will be filled with fresh water.

17.7. Once the basement tank is full, the booster pump will be operated to transfer water from the basement tank to the roof tank. (Before transferring the water chlorinated water in the roof tank will be drained).

17.8. Open the taps provided on the top level (Roof Floor) and start flushing through all the taps from the topmost level.

17.9. Continue flushing till the chlorine level is below 0.5 ppm.

17.10. Once the chlorine is below 0.5 ppm stop flushing from the taps, close the taps, and go to the next low level.

17.11. Continue the flushing through taps on the next low level till the chlorine level is below 0.5 ppm.

17.12. Similarly continue the flushing of taps on each level till the lowest level is reached with chlorine below 0.5 ppm.

17.13. All the chlorinated water from the building should be collected in a tank and the same to be disposed of in the sewerage line or diluted till the chlorine level reaches the required limits.

17.14. This confirms the chlorination is completed.

18.0. TESTING OF WATER IN STORAGE TANK AND PIPE WORK AFTER FLUSHING

18.1. Testing of water in storage tank and pipe work after flushing

18.2. After all the chlorinated water is drained out, flushing with fresh water is continued till the chlorine level is below 0.5 ppm.

18.3. Then water samples are tested by a comparator kit (for low-range chlorine levels) for the final chlorine level after flushing.

18.4. All the chlorinated water from the building should be collected in a tank and the same to be disposed of in the sewerage line or diluted till the chlorine level reaches the required limits.

Certification

Final certification shall be provided upon satisfactory completion of the above. A sample will be collected and submitted to an external laboratory for microbiological analysis.

19.0. LEGIONELLA PREVENTION IN THE OPERATION STAGE OF THE BUILDING

Legionella Prevention in the Operation Stage of the Building

Under general health and safety law, the employer has to consider the risks from legionella that may affect staff, students, or members of the public and take suitable precautions. FM team must:

- Identify and assess sources of risk;
- Prepare a scheme (or course of action) for preventing or controlling the risk;
- Implement and manage the scheme – appointing a person to be managerially responsible, sometimes referred to as the 'responsible person';
- Keep records and check that what has been done is effective.

20.0. LEGIONELLA RISK ASSESSMENT PROCEDURE

20.1. The risk assessment is the responsibility of facility management who are in control of the premises. The assessment can be carried out directly by a person within the FM team or from outside sources, e.g. consultants, specialists, etc.

20.2. The FM team needs to find out if any of the installed water systems (including the equipment associated with the system such as pumps, heat exchangers, showers, etc.) are likely to create a risk.

The following shall be considered for risk assessments.

20.3. Are conditions present that will encourage bacteria to multiply? For example, is the water temperature between 20-45°C?

20.4. Is it possible that water droplets will be produced and, if so, could they be dispersed over a wide area? For example, consider showers.

20.5. Is it likely that anyone particularly susceptible will come into contact with the contaminated water droplets?

21.0. ON-SITE WATER TREATMENT

21.1. A site water treatment system, consisting of a copper-silver ionization unit and media filter is employed to keep the cold water supply system clean and to control the growth of bacteria, even if the temperature rises above 20 0C.

21.2. The water storage and distribution system shall be thoroughly cleaned before disinfection.

21.3. Chemical disinfection shall be carried out by chlorinating the water in the storage tank; the water should have 50 50ppm residual chlorine for disinfection purposes. Each of the taps and outlets shall be systematically opened to allow water to flow until there is a chlorine smell and the chlorine levels are maintained at 50 ppm. Thereafter water shall be allowed to stand in the system for about 24 hours. The chlorine concentration shall be monitored throughout the entire system and up to the farthest discharge point to

ensure there is enough residual chlorine level, at least 30mg/liter. The system shall be thoroughly flushed following chlorination.

21.4. It is strongly recommended to use food grade chlorination chemical, one which has pH as near to that of water as possible, fast dissolving, rapid release type, preferably of effervescent type which will inherently aid in mixing.

21.5. The hot water system shall be thermally disinfected by raising the hot water temperature to 600C and circulating hot water in the system for about one hour. Each tap/outlet shall be opened sequentially to allow the hot water to run for at least five minutes.

21.6. Biocide treatment: Chlorine shall be used as an oxidizing biocide to manage and control the growth of planktonic and sensible legionella in water distribution systems. The dosage shall not exceed 0.50 mg/liter continuously.

21.7. The concentration of chlorine shall be monitored daily to ensure that a minimum level of 0.30-0.50 mg/liter is achieved.

22.0. GENERAL LEGIONELLA MONITORING

The risk of exposure to legionella shall be controlled by ensuring the precautions taken are monitored regularly. This shall comprise the following:

22.1. Visual inspection of the water storage tank to check the condition of the inside of the water storage tank and the stored water. The lid of the storage tank shall be in good condition and shall fit closely. The thermal insulation of the tank and pipe work shall be in good condition.

22.2. Hot water storage shall be drained and cleaned if necessary.

22.3. Checking the quality of stored water for clarity, taste, and odor

22.4. Test water samples at various outlets for minimum biocide concentration levels, every month.

22.5. Collect samples from various outlets and forward them to reputed laboratories for legionella analysis on an annual basis.

23.0. PREVENTING OR CONTROLLING THE RISK

23.1. If a risk is identified during the operations which cannot be prevented proper controls are necessary to be introduced.

23.2. Risks from Legionella in water systems can be controlled by careful planning, successful management policy, competent staff, and attention to proper control strategies.

23.3. Risks have been already eliminated during the design and verified during construction. After the building is handed over to the facility management team it is their responsibility to ensure that risks are managed and controlled to avoid the growth or spread of Legionella.

The FM team will need to prepare a written scheme based upon the below-mentioned guidelines/requirements, which sets out how it intends to control the risk from Legionella:

23.4. The system – an up-to-date plan or schematic diagrams are sufficient;
23.5. Who is responsible for carrying out the assessment and managing its implementation?
23.6. The safe and correct operation of the project system;
23.7. What control methods and other precautions will be used; and
23.8. What checks will be carried out on the control scheme and how often.
23.9. Ensure that the release of water spray is properly controlled;
23.10. Avoid water temperatures and conditions that favor the growth of Legionella and other micro-organisms;
23.11. Ensure water cannot stagnate anywhere in the system by keeping pipe lengths as short as possible or by removing redundant pipework;
23.12. Avoid materials that encourage the growth of Legionella;
23.13. Keep the system and the water in it clean; and
23.14. Treat water to either kill Legionella (and other microorganisms) or limit their ability to grow.

24.0. RESPONSIBILITIES AT OPERATION STAGE

Service	Task	Frequency
Hot Water System	a. Arrange for samples to be taken for hot water storage, to note conditions of drain water. b. Check the temperature of the water at the outlet of the water heater. c. Check the water temperature for up to one minute to see if it has reached 500 C in the selected taps.	a. Monthly b. Daily c. Monthly
Cold Water System	a. Check the temperature is below 20°C after running the water for up to two minutes in the selected water taps. b. Visually inspected cold water storage tanks and carried out remedial works where necessary checking representative tasks for temperature as above on a rotational basis.	a. Monthly b. Annually

Shower heads	Dismantle, Clean, disinfect, and de-scale shower heads and hoses.	Monthly
Little used outlets	Flush through and purge to drain, or drain immediately before use, without release of aerosols.	Weekly

Overall Responsibility Matrix for Legionella Management

Water System	Description of potential risks	Design action take	Residual risk after installation	Responsibility of residual risk
Air conditioning system	Risk from water Cooled system	Air-cooled systems have been considered for this project. Water cooled system is not applicable.	Install air conditioning as per approved design drawings/ specification	Contractor
Cold water system	Water supply from main and cold water storage	All water tanks shall be insulated and designed according to Applicable standards	Prepare and use a legionella management plan to monitor and manage risk	Contractor
Cold water system	Excessive storage and risk of stagnation	All water tanks shall be designed according to Applicable standards	Periodic maintenance/ checking required throughout the life of the Building.	Client's maintenance team
Cold water system	Risk from open water tanks	Tanks designed as fully enclosed with sealed access covered and screened vents and overflows	Ensure tank is kept closed and maintain fly Screens. Periodic checking is required	Client's maintenance team
Hot water System	Risk from hot water	Hot water at 60 ^{0}C shall be generated by an electric heater or solar heater All water heaters should have a drain valve located in an accessible position at the lowest point of the vessel so that accumulated sludge can be drained easily and the vessel emptied in a reasonable time. The pipe branches to the individual hot taps should be of sufficient size to enable the water in each of the	Install hot water system as per Approved design drawing.	Contractor

		hot taps to reach 50^{0}C within one minute of turning on the tap.		

25.0. LEGIONELLA TRAINING SCHEDULE

25.1. Training shall be conducted regarding the legionella prevention plan for all the users of the above-said systems.

25.2. All users of the above-mentioned systems should be aware of the legionella prevention plan.

25.3. MEP subcontractor shall hand over the details of the legionella prevention plan to the Facilities management team to conduct training after the handing over of the project.

26.0. LEGIONELLA RISK ASSESSMENT SUMMARY

26.1. Considering the permanent water circuits in the project, only the Fire-fighting Water Circuit (within the fire-fighting pipes) presents a potential risk of Legionella growth and this circuit is only activated during fire situations, where water within the pipes will be rapidly replaced with circulated water from the fire reserve tank, hence the risk is deemed very low.

26.2. On the other hand water systems identified in the project lie within the temperature range that is favorable for legionella growth. Therefore, during construction, water systems will be tested and inspected upon installation of a permanent water supply.

26.3. Legionella audit checklist will be filled by the QAQC engineer or commissioning Agent.

26.4. However, during operation, the water systems must be monitored to ensure all equipment is in good operating condition, otherwise, this may increase the risk.

26.5. The risk assessment will be revised, should there be any changes in the design/installation during the construction period.

The Legionella risk assessment is summarized in the Table below.

Chilled Water	10°C	Closed	None	Constant internal circulation	A	Y	Y	Y
Cold Water Supply	30°C	Open	Ground Water Tanks	6 liter/s	B	N	N	N
Hot Water Supply	45°C	Open	Water heaters	None	C	Y	Y	N
Fire-fighting	30°C	Open	Fire Reserve Tank	5 liter/s	D	N	N	Y
Wastewater	**25°C**	Open	Gutter from ADSSC	None	E	Y	Y	N

27.0. LEGIONELLA MONITORING AND INSPECTION

During the operational period, to avoid any possibility of a Legionella outbreak, the project facilities management team should undertake monitoring and inspection of the water systems.

The monitoring and inspection should follow the guidelines within the Legionnaire's Disease-The Control of Legionella Bacteria in Water Systems', Approved Code of Practice and Guidance (L8). 3rd Edition 2000, UK Health and Safety Executive.

The following should be considered during the operational period by the facilities management team:

27.1. Annual Legionella Risk Assessment
27.2. Monitoring and Routine Inspection:
27.3. Pipes, valve fittings, etc. for all water systems are in good condition
27.4. Temperature of the chilled water circuits as specified
27.5. All circulation pumps and stand-by pumps are in good working order
27.6. Filtration and dosing equipment is in good working order
27.7. Dosing chemicals and filter media are stored in good order
27.8. Scheduled replacement/supplement of the following:
27.9. Filter media
27.10. Dosing chemicals

28.0. CORRECTIVE ACTIONS FOR LEGIONELLA

In case of the presence of Legionella bacteria in any system, immediate action shall be taken to clean the area and isolate it until necessary chemical treatment of the system is done. Find the root cause and take necessary corrective action to stop the occurrence of the same situation which may include:

28.1. Avoid the water temperature between 20-45 Celsius
28.2. Avoid water stagnation in any area, and remove any dead legs
28.3. Keep the water system clean and well-maintained
28.4. Control the release of water spray
28.5. Use suitable water treatment chemical

29.0. RECORD KEEPING

A copy of this Legionella Prevention Plan should be provided to the Project facilities management.

30.0. ATTACHMENTS:

30.1. Legionella Audit Checklist
30.2. As Build Drawings
30.3. Construction Checklist
30.4. Commissioning Checklist