

## **EUROVENT 9/6 - 2002**

### **EUROVENT GUIDELINES ON HOW TO KEEP YOUR EVAPORATIVE COOLING SYSTEM SAFE**

The major European manufacturers of evaporative cooling equipment participate in the Eurovent/Cecomaf WG 9 "Cooling Towers". The Working Group focuses on the environmental importance of efficient and safe heat rejection systems. Evaporative cooling technology is highly effective in this regard but there has been some concern about the safety of such systems.

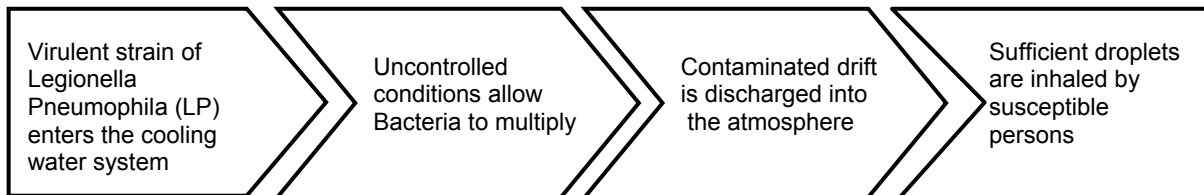
Accordingly the Group has prepared these guidelines on how to keep evaporative cooling systems safe. A more extensive code of good practice is available as Eurovent Document 9/5.

#### **LEGIONNAIRES' DISEASE AND ITS PREVENTION**

Although rare, cases of Legionnaires' Disease have been associated with evaporative cooling systems that have not been properly maintained and monitored. No cases have been linked to clean systems that incorporate the necessary elements to control unwanted biological growth and that have been monitored properly. The purpose of these guidelines is to describe the chain of events that can lead to Legionnaires' Disease and the preventive actions required to minimise the risk of bacteriological contamination and thus avoid this risk.

## THE CHAIN OF EVENTS

An outbreak of Legionnaires' Disease associated with a cooling tower or an evaporative condenser requires a "Chain of Events" with ALL EVENTS in the chain LINKED together and occurring in sequence.



If this chain can be broken at any stage the risk to health from Legionnaires' Disease is avoided.

However not ALL of the chain links have the same significance and not ALL of them can be directly avoided. It is for example not possible to prevent Legionella Pneumophila (LP) bacteria entering into the cooling water since it is often present in small quantities in the main water supply. It is also not possible to eliminate drift completely or to prevent people coming into contact with drift. The proactive approach is a scheme to prevent uncontrolled growth of bacteria, including Legionella Pneumophila (LP) in which case the water remains bacteriologically harmless and drift, even if inhaled by susceptible persons, will not be hazardous.

## **PREVENTIVE CARE PHILOSOPHY**

To maintain system efficiency and safety, appropriate water treatment and mechanical maintenance actions, as per the service provider or manufacturer's recommendations, should be implemented and recorded. These form the basis of the preventive care philosophy. The design of an appropriate water treatment, maintenance and service programme depends on product type and water quality and is outside the scope of these guidelines.

Thus the philosophy of preventive care is based on good system design, regular maintenance and especially on controlling the conditions in the system so that the Legionella bacteria cannot multiply to harmful levels. This can be achieved by the following measures:

- the Total Aerobic Bacteria (TAB) colony concentration must be controlled;
- scaling and corrosion within the system must be prevented (scale provides a haven for the bacteria and corrosion products can provide nutrients);
- existing biofilms must be minimised and the formation of new biofilms discouraged.
- the cooling system should not contain organic materials that support bacteriological growth;

In summary a preventive care programme should be established, that consists of five elements:

- General System Requirements. (Table 1)
- Water Quality Control Parameters. (Table 2)
- Maintenance & Servicing. (Table 3)
- Monitoring Activities. (Table 4)
- TAB Concentration Corrective Action Levels. (Table 5)

The Tables below give more detail of the elements of a suitable preventive care programme:

**Table 1: General System Requirements**

Type of requirement	Time of activity
Cooling system risk analysis to assess the risk of Legionnaires' Disease.	Before system start-up (*)
Operating plan including water treatment and maintenance to avoid the risk.	Before system start-up
Installation of suitable biocide treatment with automatic or continuous dosing.	Before system start-up & maintained continuously thereafter
Installation of a water treatment system to control scale and corrosion as necessary depending on the supply water quality.	Before system start-up & maintained continuously thereafter
Logbook to record service & maintenance activities.	Before system start-up and updated regularly (weekly or monthly)

Note: (\*) Risk analysis is recommended; however it is becoming compulsory in certain European countries. Check national or regional regulations.

**Table 2: Water Quality Control Parameters**

Type of Parameter	Required Value
TAB in recirculating water	Not exceeding $10^5$ cfu/ml (*) (***)
LP (when measured)	Not exceeding $10^4$ cfu/l (**) (***)
pH of recirculating water	between 7 and 9
Hardness of recirculating water	< 50°F < 28°D < 500 mg/l as CaCO <sub>3</sub>
Other parameters, as chlorides, sulphates and conductivity	As per system specification or water treatment specialist recommendations.

Note: (\*) cfu/ml : Colony Forming Units per millilitre  
 (\*\*) cfu/l : Colony Forming Units per litre  
 (\*\*\*) refer to table 5 for corrective action

**Table 3: Maintenance and Servicing**

Activity	Time of Execution
Maintenance of cooling tower or evaporative condenser.	As per manufacturer's recommendation.
Maintenance of water treatment system.	By water treatment specialist or as per supplier's instructions.
System cleaning & disinfection	Prior to start-up, annually, after a shutdown longer than one month. If TAB is above $10^5$ cfu/ml. If LP concentration is above $10^4$ cfu/l. If excessive growth of organic material is noticed.

**Table 4: Monitoring Activities**

Monitoring Activity	Time of Execution
Monitor TAB (*) concentration.	Weekly
Monitor recirculating water quality against Control Parameters.	Monthly
Visual inspection for algae biofilm formation.	Every 6 months
Check LP concentration (**)	If TAB remains high (see Table 5) after corrective action. If LP contamination is suspected.

**Note:** (\*) TAB : (Total Aerobic Bacteria) expressed in cfu/ml  
Refer to Table 5 for recommended actions.

(\*\*) LP concentration expressed in cfu/l.

**Table 5: TAB Concentration Corrective Action Levels**

TAB concentration in cfu/ml	Recommended Action
Below $10^4$	No action required
Between $10^4$ and $10^5$	Repeat test and if high TAB concentration is confirmed increase biocide treatment. If high TAB persists carry out LP test. If LP concentration at $10^4$ cfu/l or above is confirmed, clean and disinfect the system. Repeat test every two weeks until LP concentration remains below $10^3$ cfu/l.
Above $10^5$	Immediate cleaning and disinfection is required.

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