

Legionella Solutions

Companies develop treatment for hot water installations and air conditioning systems

Legionnaires' disease is considered so catastrophic that, in France, it must be reported to the medical authorities immediately. This practice has been in place since 1987. During the last decade, public health monitoring systems for this disease have been strengthened. Today, this hazard that arises from buildings has become an emerging public health problem in industrialized countries. The resulting respiratory infections are behind the recurrent epidemics emanating from hot water systems in buildings and air-conditioning cooling towers.

New Health Hazards from Buildings

Sensitive populations, mainly the elderly or people with immune deficiencies, are at risk from this respiratory disease, particularly in public buildings such as healthcare establishments (hospitals and clinics), hotels, campsites, swimming pools and gymnasiums. "Infection arises from inhalation by these receptive people of a large dose of micro-droplets carrying pathogenic bacteria," explain experts from France's Public Health Council, the authors of a recent report on the management of *Legionella* hazards.

The cause of this new bacteriological hazard is bacilli that have a particular

affinity for hot water in the range from 77°F to 104°F. These bacilli tend to multiply within biofilms in pipework. Contamination of the lungs occurs only with the inhalation of an aerosol that can come from showers, lengthy baths, and outlets for air cooling towers. Two processes exist for eradicating *Legionella* from contaminated water systems: thermal shock and chemical disinfection (chlorination).

Cyclical, Continuous Pasteurization of Hot Water

As the optimal temperature conditions for the growth of *Legionella* are between 86°F and 113°F, raising the temperature of the water to 158°F for one minute in the water system will destroy the *Legionella*. The French company PM Industrie, located in southwestern France's Gironde region, is developing an exclusive process patented in August 2000 by the firm Jean-Jacques Boiffier—the Pastor Master.

"Our process acts on three levels. It provides cyclic and continuous pasteurization of domestic hot water, it maintains the temperature of the distribution network and it ensures constant circulation including inside the fixtures," explains Jean-Jacques Boiffier, the inventor.



Alternative treatment to highly corrosive chlorine makes use of the complementary and alternative activity of two organic nonoxidizing biocides that attack both the *Legionella* organisms and their nutritive environment—biofilm.

One thermal substation constructed in 316 L stainless steel ensures bacteriological sterilization by the controlled passage of domestic hot water through a semi-instantaneous exchanger. PM Industrie offers two ranges of compact monobloc substations: the PM 130 SI with a power of 185 kW and a peak flow rate of 300 cubic feet per hour, and the PM 250 SI with a power of 300 kW and a peak flow rate of 459 cubic feet per hour. The Back Flow Master three-channel adapter makes it possible to quickly modify (installed as a by-pass on the header) the fittings of standard two-channel showers to three-channel fittings with an integral loop. "This ensures bacterial disinfection of the hot water tank from where the water is constantly circulated," Boiffier says. To date, 10 French hospitals have adopted this innovative process.

Disinfection Using a Chlorine Dioxide Generator

The second method of treating water systems uses shock chlorination (57 to 76 mg/gallon of chlorine added during a 24-hour time period). However, this type of decontamination strongly corrodes pipework, damages joints and gives the water a strong smell of chlorine. It also requires draining the installations. To solve this problem, Thétis Environnement has developed an emerging technology

in collaboration with the EDF Research Center and with the support of ANVAR.¹ "We designed a generator of chlorine dioxide using electrolysis, which avoids the storage of dangerous reagents, corrosion of the installations and increased maintenance," says Charles Dubost, founder of Thétis Environnement.

Available since the start of 2001, the monobloc system (4.9 ft. high, 6.6 ft. wide and 3.3 ft. deep) includes sodium chlorite tanks, a holding tank for chlorine dioxide, an electrically powered electrolyzer and one or more dosing pumps to inject precisely the required quantity of chlorine dioxide into the water system. This SECUROX generator produces 5 to 100 grams per hour of chlorine dioxide. Thanks to its self-monitoring system that maintains continuity of treatment and, in particular, continuous monitoring of effectiveness, it always is operational. With this system, the production of 35 cubic feet of water costs about three cents. The SECUROX has been adopted by several French hospitals for combating *Legionella*, and is being used by drinking water producers and agro-food companies.

Combination of Biocides to Treat Cooling Towers

The principle of air-cooling towers is to extract the heat of condensation from

Glossary of Terms

- **Biofilm**—Deposit combining bacteria, polymers and mineral salts that line domestic hot water pipes.
- **CFU**—colony forming units per liter (characteristic of the measurement technique using culture growth). It supposes that each colony observed corresponds to one *Legionella* present in the sample.
- **Disinfection**—Operation making it possible to reduce the microbiological content of water by a factor of 105.
- **Legionella**—Gram-negative, aerobic bacilli, occurring naturally in rivers, lakes and sometimes soil, but also in surface water environments such as domestic hot water fittings (showers, taps), air-conditioning equipment and cooling devices, pools and fountains. Their size is between 0.5 and 0.7 μm in width and from 1 to a few μm in length.
- **Legionnaires' Disease**—Acute respiratory infection whose treatment requires the administration of special antibiotics (macrolides, fluoroquinolones). Incubation time is two to 10 days. Mortality, which is of the order of 15 percent, can reach 40 percent in hospital patients and more for those with lowered immunity.

air-conditioning units. The water in the condensation system flows from the top to the bottom of the tower. This water, condensed into fine droplets to increase surface area, is sprayed head-on into a jet of air. It is precisely this process that causes the entrapment of droplets in an aerosol, which forms a plume that can be colonized by *Legionella*.

The water treatment company Protec now offers an alternative treatment to highly corrosive chlorine. "We make use of the complementary and alternative activity of two organic nonoxidizing biocides that attack both the *Legionella* organisms and their nutritive environment—biofilm," says Marc Georgelin, Protec's managing director. The isothiazolone-based Bio Top 35 has the chemical effect of cellular lysis on *Legionella*, while Bio Top 20 based on tetra hydroxyl phosphonium salt inhibits the enzymes necessary for the growth of bacteria. Using them alternately prevents the bacteria from developing tolerance. Two dosing pumps automatically inject these products without the need to shut down the air-conditioning system. Results announced by Protec show a reduction of at least 103 Colony Forming Units per liter. **WQP**

CSTBat Service— Disinfection of Systems

Since September 1999, the Water and Healthcare Equipment Service of France's Building Science and Technology Center (CSTB) has been awarding certification relating to the products employed, the competence of the operating companies and the service. "This new certification testifies to the competence of a service provider to perform full disinfection procedures," explains Patrick Paris, head of CSTB's Water and Housing Division.

The CSTBat Service certification for disinfection of water systems (systems for domestic hot water, heating, air-conditioning and air-cooling towers) relates both to the company's quality assurance system and to the procedure for carrying out the disinfection process. It covers all processes, including those applied in healthcare establishments.

This new certification satisfies the requirements of both parties: the applicant who wants to be assured of the competence of the service provider, and the service provider who wants to be recognized for its professionalism and expertise.



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References

- 1 National Authority for the Promotion of Research.

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The SECUROX chlorine dioxide generator has been adopted by several French hospitals for combating *Legionella*.

