Management of a legionella epidemic in a densely populated urban area

August, the 8th, 1999

Paris – [Seine]

France

Release of contaminated aerosols

Cooling towers

Legionella

Abandoned channels

Victims

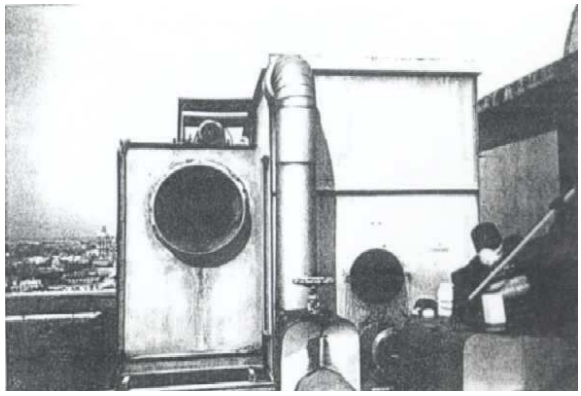
Epidemiological surveys

Draining/Cleaning/Disinfection

THE INSTALLATIONS IN QUESTION

The site

The installations in question are cooling towers connected to cooling systems and covered by the legislation governing classified installations.



History of the issue

Legionella is disease requiring compulsory notification. The DGS (Directions Générales Sectorielles) industry sector branches memorandum No. 97/311 dated April 24th, 1997 concerning monitoring and prevention of legionella specifies that where there are 2 or more cases of legionella, the health authority must conduct an epidemiological study with the aim of identifying a common source of infection (domestic hot water, cooling towers, etc.), in order that suitable preventive measures can be taken. An environmental study is then conducted on the basis of the information supplied by the patients. Water samples are taken from "suspect" installations, in order to determine their concentration of legionella and if a strain from patients is available, the environmental and clinical strains must be compared.

A first epidemic of legionella that occurred in Paris in 1998, during the Football World Cup (19 cases, in 4 of which the patients died), called into question a classified cooling installation. The consequence of this epidemic was a rising of the collective consciousness of the risk of legionella (a risk that was judged to be unacceptable by the chief of police) and it highlighted the necessity for the prevention of legionella to be taken into account in the regulations covering classified installations. This concerns, in particular, installations that have spray-type cooling towers and risks of emission into the environment of aerosols contaminated by legionella. Moreover, taking into account the health risk posed by installations now forms part of the priorities defined by the Ministère de l'Aménagement du Territoire et de l'Environnement (MATE) (the French Ministry of the Regional Planning and the Environment).

In order to take rapid action, the Service Technique Interdépartemental d'Inspection des Installations Classées (STIIIC), the interdepartmental technical department of the Classified Installations Inspectorate initially proposed completing the standard order and the authorisation orders with the following provisions : *"Disinfection of the water used in the cooling towers must be instigated, in order to prevent the development of bacteria that could affect human health. The efficiency of this disinfecting must be checked regularly, and the analyses must be sent to the inspector of classified installations".*

A work group from the DASS 75 (the local French department of health and social services) was set up in order to draw up complementary regulations. The most difficult problem was that of determining an action threshold (concentration of legionella). The thresholds were established empirically :

- below 10^3 CFU/l: maintenance and follow-up

- between 10^3 and 10^5 CFU/l: alert level → implementation of the measures required in order to bring down the concentration to below 10^3 CFU/l

- above 10^5 CFU/l: action level → shutdown of operation of the cooling system, informing of the classified installations inspectorate and the DDASS, emptying, cleaning and disinfecting before restart of activity.

The standard order, drawn up by the STIIIC, was signed by the chief of police on April 27th, 1999. Information concerning the order and a questionnaire designed to identify "at risk" towers were sent by the STIIIC to all operators declared under the heading 2920 that applies to cooling installations. This procedure was designed to make it possible to compile a list that can be used in crisis management and to allow a trend chart for each département to be established. There was only partial feed back on the questionnaires, and it had to be followed up by a telephone reminder.

"THE ACCIDENT", ITS BEHAVIOUR AND CONSEQUENCES

« The accident »

The first symptoms of legionella were identified on August 8th, 1999. The appearance of group cases was detected on September 1st, 1999 (the DASS 75 informed the STIIIC by telephone on the same day). In total, 8 cases of legionella were recorded, one of which included a foreign tourist who had stayed in a hotel. The patients had all been in or around the 15th district in Paris, one of them will die. Pressure from the media was immediately brought to bear.

The results of the epidemiological study that was conducted as of 1st September, apart from domestic hot water, prompted the search to be directed towards an environmental source of contamination (common geographical area and simultaneous appearance of the first symptoms). Once again, the cooling towers came under suspicion.

The environmental enquiry was conducted by STIIC in parallel with the epidemiological enquiry. It was decided that an enquiry perimeter would be set up within a radius of 500m on both sides of the areas in which the patients had been. The place that they all had in common was the 15th district, and the enquiry was therefore confined to this district alone. Within the perimeter that was established, 20 establishments were listed (9 authorisations/11 declarations).

The information that was collected on the basis of the list compiled from the results of the questionnaire allowed the identification of 6 "at risk" sites. The person who died was working on a flat roof close to the cooling towers of one of these sites (the towers were operating, which a posteriori justified the mandatory wearing of a mask, as per the order concerning legionella). Naturally, this was the first site to be visited.

The first series of analyses began on September 8th, 1999 (7 days after the group cases were identified, and 1 month after the appearance of the first symptoms). Samples were then taken on September 10th and 13th, 1999. Of the 6 sites, 20 cooling towers were listed as being on flat roofs. Nine samples (each of which corresponded to an independent circuit, according to the information provided by the on-site operators) were carried out, with a view to testing for the presence of legionella.

It was noted that 4 out of 6 sites had at least one tower contaminated by Legionella. One of the contaminated sites had a strain that matched that of the patients. There were 8 towers on that site. In two of these towers, the concentration of legionella was between 10^3 CFU/l and 10^5 CFU/l.

In light of information later supplied by the operator, the two offending towers were supplied with make-up water from 2 common water tanks of 100 m³ that were located in the basement with the cooling systems and the water treatment plant. These tanks were also used to maintain the supply of water to the fire alarm circuit and all the buildings. In this case, a high-rise building that was constructed at the beginning of the 70s, and the water supply system is the original one. Both towers are located on the same premises, but they belong to different owners, which accounts for their different maintenance and use.

The consequences

Eight cases of legionella, including 1 death, were reported over the period involved.

European scale of industrial accidents

By applying the rating rules of the 18 parameters of the scale made official in February 1994 by the Committee of Competent Authorities of the Member States which oversees the application of the 'SEVESO' directive, the accident can be characterised by the following 4 indices.

The parameters that comprise these indices and the corresponding rating method are available at the following address: http://www.aria.ecologie.gouv.fr.

By default, parameter H5 of the "Human and social consequences" is rated as level 2: as the number of sick persons at the site having a bacterial strain in common with those of certain patients is unknown (H5 between 1-5 injured from the general public).

ORIGIN, CAUSES AND CIRCUMSTANCES OF THE "ACCIDENT"

The site that matched the patient strains has existed for 30 years. For this reason, the circuits of the cooling towers are no longer well-known. In addition, access to the towers for maintenance purposes is difficult, which has led to a build up of considerable scale. Moreover, the site is complex (there are several owners and 8 towers that correspond to 4 different circuits).

Biocide treatments were carried out on May 21st and July 20th. In July, the operator had called in a society that specialises in the provision for legionella risks. At the end of July, however, a malfunctioning of the deconcentration system occurred, which probably led to the concentration of bacteria.

All of these facts taken together would explain the proliferation of legionella.

It should be noted that only 6 of the 20 sites at risk were visited, and the analyses were performed after the actual epidemic took place.

ACTIONS TAKEN

Action taken by the Paris Chief of Police as regards the owners of the cooling towers:

Note: In Paris, the regulations concerning ICPE (installations classified for protection of the environment) legislation are issued by the Chief of Police, and those concerning the Public Health code are issued by the Paris Prefect.

On the basis of a legal analysis performed for the DASS in 1998, following the first legionella epidemic, an order was issued on September 15th, 1999 by the Paris Prefect, based on article L 17 of the Public Health Code. It required the owners of "at risk" towers located within the perimeter to proceed with emptying, cleaning and disinfecting of the water circuits without delay. Specific provisions were laid down for the installations that could not be shutdown (with documentary evidence). The owners had a time limit of 15 days within which they had to report to the DASS75 on the action taken. The DASS 75 was instructed to supervise the applying of the order. In parallel, a press release was published by the DGS on September 20th, 1999.

The operator of the 2 towers that were suspected of being the cause of the environmental contamination received the order of the Paris Prefect on September 24th, 1999. The towers were subjected to cleaning and disinfecting procedures as of October 1st, 1999. A preventive treatment was initiated (using a quaternary ammonium-type biocide), as well as monitoring of water consumption and physical-chemical parameters.

No sanction was imposed on the operator, as he had called in a water treatment firm at the beginning of July in order to safeguard against the risk of legionella, and had shown complete co-operation during the enquiry.

A total of 23 sites were affected by the order. An evaluation of the application of the order was made on 24th November, 1999 by the DASS 75: 7 owners had not replied, 3 sites turned out to be located the area concerned (errors in the addresses), 4 notifications were returned (marked "Not known at this address"), 2 owners replied that the towers were not "at risk" (dry system) and 7 sites were subject to disinfecting procedures. It should be noted that the order of the Paris Prefect was not founded on the regulations covering classified installations.

Post-crisis management:

The STIIIC decided to launch a systematic campaign for all the classified installations inside the perimeter of the epidemic, taking local interests into account (densely populated urban area). The aim of the campaign was to check the technical specifications for the classified installations that are subject to declaration (AT 2920 modified and submitted), and to carry out visits, with the aim of drawing up complementary orders for classified installations subject to authorisation. In all cases, the aim was to raise the operator's awareness of the "legionella" risk.

The campaign took place from 5th to 22nd October, 1999 : 16 sites in the 15th district were subjected to at least one visit (the list was completed during the campaign). The 4 sites in the 15th district that had been identified as being contaminated during the epidemic were subjected to reinforced monitoring (knowledge of the networks, the water treatment procedures in the cooling circuits, analytical follow-up available, etc.).

The site on which the towers suspected of being the cause of the environmental contamination were located was subjected to several follow-up visits. Analyses of legionella were carried out monthly. A complementary prefectorial order was issued on October 19th, 2000. An audit of the installation was requested, taking into account the complexity of the site. Following the audit, the operator made numerous modifications (in particular, removal of abandoned channels that were the cause of the re-contamination of the installation). The preventive treatment, which was carried out in an empirical fashion, *in situ*, was validated using the analyses of the legionella. The considerable scale of the networks delayed the implementation of an efficient treatment for several months.

LESSONS LEARNED

Management of the crisis and post-crisis period brought to light the following points :

On a technical level:

- ✓ The almost non-existent training and knowledge of the operators
- ✓ Passive that requires management in the existing towers : circuit design, existing air intakes or passage zones, scale build-up of circuits, random water treatment procedures, access to difficult towers
- ✓ An audit is necessary in some cases
- ✓ The need for a detailed visit of "at risk" installations
- ✓ Analysis of legionella: in cases where the concentration is greater than 10^5 CFU/l, it is essential that the operator be required to furnish an explanation and a new analysis must be carried out 3 weeks after the decontamination, in order to verify that there has been no recontamination of the circuit. In the case of unsatisfactory results, an audit must be requested and a new decontamination must be carried out.
- ✓ A maintenance book must be established: this ensures traceability as regards the actions carried out by the operator and any failure in the installations.