

## Incident

# Legionnaires' disease — an unusual outbreak

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## Summary

This article describes a case in which three people, all employed on the same factory, but in widely different areas, all caught Legionnaires' disease within about six months of each other. No positive cause for their illnesses could be established.

Investigations carried out on the systems for water and shower treatment at the laboratories found some non-compliance with HSE advice, in particular cooling towers had not been cleaned annually and the biocide dosing of one tower had not been operating. Even so, no detectable levels of legionella had been found in any system.

Significant lessons that were learned from the incident include:

- All water supply systems that might generate legionella should be kept well maintained and cleaned, dosed regularly to an approved schedule with appropriate biocides or chemicals, or treated by other approved means, and regularly sampled and analysed.
- Such a regime should be carried out by the occupier of the site or on contract by a competent contractor.
- The source of a Legionnaires' disease outbreak is not always easy to find. The moral of that point is simple — always seek to eliminate all *potential* sources before they become *actual* ones.

**Keywords:** Legionnaires' disease; Legionella; Laboratory

## Introduction

Ever since the first recorded outbreak of Legionnaires' disease, in Philadelphia, Pennsylvania — the outbreak that, in fact, gave the disease its name — strict attention has been paid throughout industry, commerce, academia and elsewhere to the prevention of similar incidents. This is done by operating a rigorous system of biocidal and chemical dosing with agents that will kill or inhibit the organism that causes the disease, or by use of certain non-intrusive techniques including ultra violet radiation, and of testing for its presence.

Despite this, outbreaks and isolated cases do continue to occur in the United Kingdom and elsewhere. A very serious case in the UK was at Barrow-in-Furness in 2002 when six men and one woman died as a result of the illness. A further 172 contracted the disease, the source of which was found

to be a contaminated cooling tower in the town's art centre<sup>1</sup>. In Norway, in 2005, 56 people became ill and ten of them died from the disease contracted as a result of bacteria growing in an air scrubber of a nearby factory<sup>2</sup>. This incident is described in much more detail, along with several other outbreaks of Legionnaires' Disease, elsewhere in this edition of the Bulletin<sup>3</sup>.

This article describes a case in which three people, all employed on the same factory, but in widely different areas, all caught Legionnaires' disease within about six months of each other. No positive cause for their illnesses could be established, but the investigations pointed to some shortcomings in procedures, and emphasised the importance of strict observation and usage of preventative actions such as those described above.

## Description of the facility

The facility was a large manufacturing works in the UK employing about 3500 people in a wide range of chemical and engineering plants, backed up by comprehensive engineering maintenance and design, process development, analytical and safety advisory departments. There was also a full range of administrative support teams on the site, covering personnel, training, security, commercial and public relations. Also on the site, in its own separate enclave, was a research and development laboratory operating under its own management, but sharing certain common services including safety advice. At the time, about 600 people were employed in this area. Figure 1 shows a schematic plan of the site indicating only the areas and items of relevance to these cases.

## The occurrence of the cases

The first case (Case 1 on Figure 1) was a process supervisor on a chemical plant situated in the north-west of the site and this was registered in November 1989. He became extremely ill for a time but recovered and eventually returned to work to his normal duties on shifts. Immediate action was taken to sample and test all hot and cold water systems and showers throughout the site (not just in the plant concerned). All samples tested negative for the sero group that causes Legionnaires' disease. The site's procedures for inspection, cleaning and dosing of water systems all, *as a minimum*, complied with the Health and Safety advice in operation at the time<sup>4</sup>. The 'dosing' procedure comprised the addition of sodium hypochlorite solution or proprietary biocide (as appropriate) in scheduled specified amounts. These results

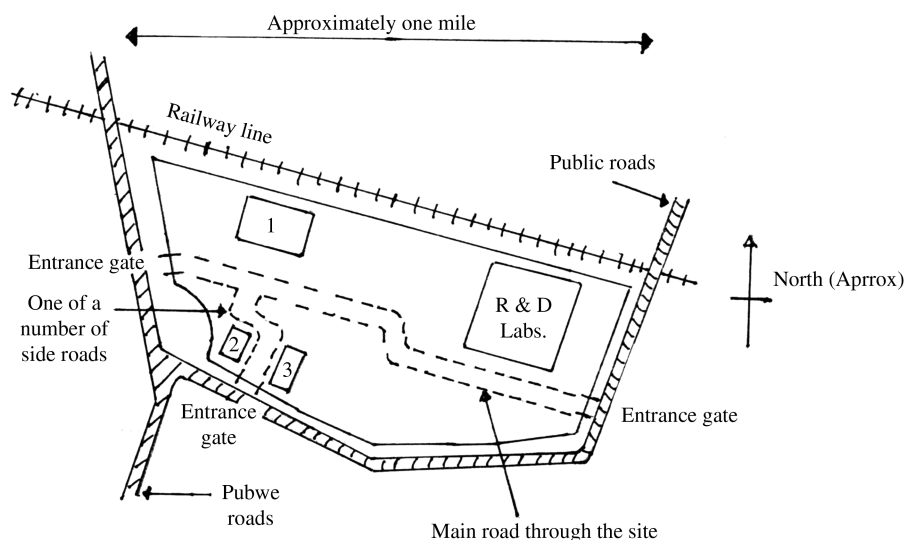


Figure 1: Site Layout and Location of Cases. 1. A Chemical Plant – November 1989, 2. An Assembly Line – July 1990, 3. An Office Block – July 1990

confirmed that the site was not the source of this case and this was accepted by the Health and Safety Executive.

Then, in July 1990, two more cases occurred. The first (Case 2 on Figure 1) was an assembly line worker employed in the south-west part of the site. The second (Case 3) was an office worker located in a building just across the road from Case 2. Both of these employees had what was termed 'non-contact' jobs which meant that they did not have any contact with the primary products of the processes and, therefore, did not need to shower at the end of each working day or shift. This immediately eliminated shower contamination as the source of their infection — in contrast to Case 1, who was engaged in chemical process supervision, so had to take a shower at the end of each shift. Again, both men were very ill and Case 2 suffered permanent renal impairment and could not resume work. Case 3 did, in time, return to his normal duties. Once again, rigorous testing and examination of all systems and procedures was carried out, and neither the site nor the HSE could find any faults.

However, the incidence of three cases of Legionnaires' on the same site in such a short period of time, could clearly have been more than mere coincidence so at this point the focus of attention moved to the research and development laboratories at the east end of the site. Up to then, this had not been regarded as a credible source of the infections because all the victims worked so far away from there. The site measures roughly one mile 'east-to-west' and about half-a-mile at its widest 'north-south' extent. The HSE carried out an inspection of the systems for water and shower treatment at the laboratories and, together with the laboratory management, found some shortcomings. These, principally, were non-compliances with the requirements of EH 48. Some cooling towers were not cleaned annually and the biocide dosing of one tower had not been operating for one-to-three weeks in late June and early July. Because of this, even though no detectable levels of legionella had been found in any system for at least three years, HSE said that they would be advising prosecution of the laboratories on grounds of non-compliance.

The Laboratories were, in fact, prosecuted and fined a total of £4000 plus costs of £1131 at the local Magistrates Court. This was for putting workers and the public at risk

although the HSE Principal Inspector said that there was no allegation that non-compliance had actually caused the Legionnaires' cases<sup>5</sup>.

It is important to emphasise now that neither at the time nor since, was there any conclusive evidence to link the three cases with either the manufacturing or laboratories parts of the site. Nevertheless, following the discovery of the procedural faults, the investigation attempted to find any factor which might link the three victims with the laboratories or with each other. The following facts and theories were considered:

- None of the three had ever worked at the laboratories and, as far as could be established, had never had occasion to be inside them — at least, not for many years.
- The gate at the east of the site, leading to a road past the laboratories, was used for access to work at the start and end of shifts or days. One victim used this gate 'sometimes' but not on foot.
- The site social club and a public house were situated just outside this east gate. Both of these served meals at lunchtime during days. None of the three made use of these facilities.
- Much of the east end of the site was rural, as was the area outside the site boundary. Workers commonly used these areas for lunchtime 'constitutionals' particularly in fine weather. One victim did this.
- The three victims did not know each other, so any contact at work would have been vague and very occasional at most.
- Case 1 had to shower at the end of each day or shift; Cases 2 and 3 did not.
- They did not know each other at all outside work.

Thus, there appeared to be no link between the day-to-day movements of the three victims and none between any of them and the laboratories. In addition, one victim (Case 2) first exhibited symptoms of the disease at a time consistent with his having contracted it when he was on annual leave from work, possibly in Scotland. It is, therefore, entirely possible that the source of the outbreak was off the site and was carried by the wind onto the site. However, there were

no known sources of Legionella in the area at the time and no other proven cases of Legionnaires' Disease.

### Mechanism for contracting Legionnaires' disease

Legionellosis infection normally occurs after inhalation of an aerosol containing legionella bacteria. Such an aerosol can originate from any infected water source and such sources are extremely common. For example, many puddles that stand after a period of rainfall contain the bacteria. Fortunately, however, it is much more difficult to transform most of these sources into a breathable aerosol. If mechanical action breaks the surface of the water, small droplets can be formed and if they contain the bacteria and become suspended in the air they become a source of infection. Thus, shower systems, and recirculating water systems which often generate a water mist, are common potential sites for the formation of such aerosols. It was for this reason that there was concern about the defects in the laboratories' systems though, as was established above, the three victims did not come into close contact with the laboratories and no laboratory personnel contracted the disease.

It has since been established that airborne legionella can travel up to about 6 miles. An investigation into an outbreak in France in 2003–2004, in which 18 people died and a further 68 were infected, showed that some of the victims lived that distance from the source. Even in 1990, the possibility of transmission from the laboratories to where the three victims worked was considered. The distance would have been about half-a-mile. However, the prevailing wind direction in the area is south-westerly veering periodically to westerly. This would have driven any source from the laboratories (if, indeed there was any) *away from where they worked, not towards*. Easterly winds *do* occur in the area, though less frequently, and such a wind would, of course, have had the opposite effect. However, that is mere speculation.

### Conclusions

- Three employees, all working on the same site contracted Legionnaires' disease within a short time of each other.
- Although nothing was ever established to link these cases, either to each other or to any source where they worked, it was reasonable that some people regarded the occurrences as 'more than just a coincidence'.
- Three cases, in the same place, at roughly the same time, is not unique but it is unusual.
- No defects were found in the water dosing and maintenance systems of the manufacturing organisation on the site.
- Some defects were found in the dosing and maintenance systems of the laboratories on site.
- The systems of the manufacturing and laboratories were all free from legionella.

### Lessons learned

Despite finding no causal link for these cases, some significant lessons can be learned or re-emphasised from the saga. These include:

- It is vitally important that all water supply systems that might generate legionella are kept well maintained and

cleaned, dosed regularly to an approved schedule with appropriate biocides or chemicals, or treated by other approved means, and regularly sampled and analysed.

- Such a regime can be carried out by the occupier of the site or on contract by any one of a range of competent, easily identifiable contractors.
- Health and Safety Executive will be very liable to prosecute any cases of non-compliance even if they can not be positively linked to cases of Legionnaires' disease. This is a potentially crippling, even fatal, disease and, as far back as when the cases described herein occurred, the then Director General of HSE said that the cost of diseases linked to legionella was as much as £10–15 million/year.
- The source of a Legionnaires' disease outbreak is not always easy to find. The moral of that point is simple — always seek to eliminate all *potential* sources before they become *actual* ones.
- There is ample, easily available, regulatory and advisory information available on how to prevent the incidence and spread of legionella in water systems. Some key documents are noted in the references<sup>6,7 and 8</sup>.
- These documents list and explain employers' duties in law. Key among these are:
  - assessment of the risk;
  - preventing or controlling the risk;
  - use of methods of water treatment (dosing and others);
  - sampling and record keeping;
  - notification of certain items to the local authority (cooling towers and evaporative condensers);
  - what to do if cases of Legionnaires' disease do occur.

### Authors' Note

In a recent newspaper article<sup>9</sup>, the disease, its symptoms and how it is treated were described. The article also gave the NHS Direct phone number (0845 4647) that members of the public can use if they think that they, or anyone they are in contact with, may have contracted the disease.

### References

1. HSE Report of the Public Meetings into the Legionella Outbreak in Barrow-in-Furness, August 2002; [www.hse.gov.uk/legionnaires/index.htm](http://www.hse.gov.uk/legionnaires/index.htm)
2. Wedege, E., *Clinical and Vaccine Immunology*, 2009, 16(4)528
3. Legionnaires Disease, Causation, Prevention and Control, P A Carson and C J Mumford, LPB216, December 2010, pg. 20
4. Blackpool Evening Gazette, March 21 and 22, 1991
5. Health and Safety Guidance Note EH 48, Legionnaires' Disease, January 1987
6. The Control of Substances Hazardous to Health (COSHH) Regulations, 2002
7. The Control of Legionella Bacteria in Water Systems. Approved Code of Practice and Guidance L8 (Third Edition) HSE Books 2000, ISBN 978 0 7176 1772 2
8. Legionnaires' Disease, A Guide for Employers IACL 27 (Rev 2), 02/09 ISBN 978 0 7176 1773 9
9. Guardian, G2, September 28, 2010.