

SURVEY ON LEGISLATION REGARDING WET COOLING SYSTEMS IN EUROPEAN COUNTRIES

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Wet cooling systems are often associated with large outbreaks of Legionnaires' disease. Several European countries have legislation for registering such systems. The authors aimed to obtain an overview of the situation in Europe. A questionnaire survey was sent to 35 of the countries that collaborate in the European Working Group for *Legionella* Infections. In two countries it was passed to a regional level (to three regions in both Belgium and the United Kingdom), so that 39 countries or regions were sent the survey; 37 responded. Nine countries stated having legislation for the registration of wet cooling systems. Separate legislation exists at a regional level for two regions in Belgium and all three regions in the UK, giving a total of twelve countries/regions with legislation. In nine of these countries/regions, the legislation has been introduced since 2001. All of these countries/regions require periodic microbiological monitoring between twice a year and weekly; in nine, the legislation requires periodic inspection of the systems. Regulations for the registration of wet cooling systems should be required by public health authorities. During an outbreak of legionellosis, a register of wet cooling systems can speed up the investigation process considerably. The authors believe that the European Centre for Disease Prevention and Control (ECDC) should take the initiative to propose European Community (EC) regulations for all Member States.

Introduction

Legionnaires' disease is an atypical pneumonic infection, acquired by inhaling aerosols containing *Legionella* spp. The *legionella* bacteria are commonly found in the natural and man-made aquatic environment, and enter the atmosphere through aerosol-generating outlets such as showers and cooling towers [1]. The first recognised outbreak of Legionnaires' disease occurred in 1976 at a hotel in Philadelphia [2] and was probably attributable to a cooling tower. Since then, wet cooling systems (including cooling towers, evaporative condensers and fluid coolers) have been established as some of the most common sources for outbreaks of legionellosis worldwide [1]. Wet cooling systems are heat rejection devices that utilise the evaporation of water to provide cooling. Common features are the recirculation of water which is sprayed or otherwise broken up into droplets in a counter current of air that is then ejected into the atmosphere. Some droplets may thus escape and form an aerosol outside of the cooling device. The recirculation of water can create good conditions for growth of *legionellae*.

Wet cooling systems can favour the growth of *legionella* by maintaining water temperatures of up to 35°C (temperatures in the range of 20°C to 45°C favour the growth of *Legionella* spp.) and by containing high levels of organic material and protozoa. About 2% of the water used in wet cooling systems escapes as aerosol and can drift more than 500 metres, in a few cases up to several kilometres, from its source [3,4]. When combined with poor maintenance and under-dosing of biocide, these systems can foster extensive growth of bacteria including *Legionella pneumophila*.

Every year the European Working Group for *Legionella* Infections (EWGLI) collects an aggregated dataset of all cases and outbreaks of Legionnaires' disease that have occurred in Europe during the previous year. Between 2002 and 2007, 44 outbreaks with cooling towers as the suspected source were reported in 11 countries, involving 1,175 cases (Table 1) [5-7].

For community-acquired outbreaks of Legionnaires' disease it is important to identify and treat the source as quickly as possible in order to prevent further infections. This can be a lengthy process if no register of wet cooling systems exists. Several European countries, especially those which have already experienced large cooling tower outbreaks, are known to have legislation for registering such devices. To obtain an overview of the situation in Europe, the authors conducted a questionnaire survey among the countries that participate in EWGLI.

Methods

A questionnaire was approved by the steering committee for the European Surveillance Scheme for Travel Associated Legionnaires' disease (EWGLINET) and sent to 35 EWGLI collaborating countries; it was passed to a regional level in Belgium (Brussels, Flanders and Wallonie) and the UK (England and Wales, Northern Ireland and Scotland). Therefore, 39 countries or regions were asked to participate.

The questionnaire included the following questions, and allowed space for further comments:

- Does your country have legislation for registering wet cooling systems?
- If yes, is the legislation national or regional?
- Which ministry issued the legislation?
- In what year was the legislation introduced?

- Is there an official requirement for periodical inspection of wet cooling systems?
- Who is responsible for the periodic inspection of wet cooling systems?
- Is there an official requirement for microbiological monitoring?
- Are there penalties imposed for unregistered wet cooling systems?
- Does a register of wet cooling systems exist?
- Who holds the register?
- How does the authority get the information?
- Who is responsible for maintaining the information?

The initial results were presented at the 22nd EWGLI conference in Stockholm [8], and comment and interpretation was sought from the collaborating countries.

Results

Representatives from 37 collaborating countries or regions (94.9%) returned the questionnaire. Of these, 12 (32.4%) reported having legislation requiring the registration of wet cooling systems at a national level (Andorra, France, Malta, The Netherlands, Norway and Spain) or a regional level (Belgium: Wallonie and Flanders; UK: England and Wales, Northern Ireland and Scotland; and the Russian Federation) (Table 2). The countries or regions that returned the questionnaire and do not have such legislation are: Austria, Belgium (Brussels), Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Poland, Portugal, Romania, Slovak Republic, Slovenia, Sweden, Switzerland, Turkey.

In five countries or regions this legislation is issued by the Ministry of Public Health, in three by the Ministry or Department of the Environment, in two by the Ministry or Department of Trade and Industry, and in one by the Department of Industrial Construction.

In the Netherlands, the registration is voluntary and is covered by environmental legislation; it is anticipated that legislation requiring the registration of new wet cooling systems will be introduced in 2009. In England and Wales, Scotland and Northern Ireland, legislation has existed since 1992 or 1994; in all other countries or regions the legislation has been introduced since 2001.

All countries or regions which have legislation require periodic microbiological monitoring between twice a year and weekly; 'microbiological monitoring' was not further specified in the questionnaire and the responses are likely to refer to dipstick tests rather than to full environmental sampling. In nine countries the legislation requires periodic inspection of the systems. In all twelve of the countries or regions which have legislation, a register of wet cooling systems exists. This register is held by national authorities (n=2), regional authorities (n=3) or local authorities (n=7), and in nine of these countries/regions, penalties are imposed for unregistered systems. In eight of the nine countries/regions where penalties can be imposed, the owner of the system is responsible for ensuring that the information on the register is correct.

Of the 25 (67.6%) countries or regions with no legislation for registering wet cooling systems (Table 3), five require microbiological monitoring and four stated that technical standards require periodic inspections; two will impose penalties for not following these

TABLE 3
Countries or regions without legislation on the registration of wet cooling systems, EWGLI survey, 2007

Number of countries or regions	Periodical inspections	Microbiological monitoring	Does register exist	Who holds register (authority)
25	21 no 4 yes	20 no 5 yes	23 no 2 yes	1 national 1 regional

TABLE 1

Outbreaks of Legionnaires' disease with wet cooling systems as the suspected source, as reported to the EWGLI annual dataset by collaborating countries, 2002-2007 (n=44 outbreaks)

Country (region) of outbreak	2002		2003		2004		2005		2006		2007	
	WCS outbreaks	Number of cases	WCS outbreaks	Number of cases	WCS outbreaks	Number of cases	WCS outbreaks	Number of cases	WCS outbreaks	Number of cases	WCS outbreaks	Number of cases
Austria											1	9
France	2	22;31	3	31;24;84			1	34	3	29;10;12	1	9
Italy			1	15								
Netherlands									3	31;9;10		
Norway	1	28					1	58				
Portugal									2	3;21		
Spain	2	108;9	4	11**;6;13;6	2	32;29	4	12;15;50;4	1	146	1	18
Sweden					1	32						
UK (England and Wales)	2	6;146	1	27	1	4	2	3;2				
UK (Northern Ireland)	1	3					1	3				
UK (Scotland)					1	7	1	3*				

WCS outbreaks = wet cooling system outbreaks

* Two Scottish cases and one English case

** Associated with an evaporative condenser

NB: These figures were provisional reports at the time of submission to EWGLI; subsequent reports may cite different case numbers. Some countries (Norway, Spain and Sweden) have provided updated data to reflect final case numbers for these outbreaks.

TABLE 2

Countries or regions in Europe with legislation on the registration of wet cooling systems, EWGLI survey, 2007

Country (region)	Legislation: national or regional	Which ministry issued legislation	Year of introduction	Content of legislation	Periodic inspections	Who is responsible?	Microbiological monitoring	Penalties for unregistered towers	Does register exist?	Who holds register (authority)	How does authority get information
Andorra	National	Ministry of public health	2002	Regulation for prevention and control of Legionellosis	Daily to annual	The owner; the local authority can verify at any time	Monthly	Yes	Yes	National authority	By periodic inspection
Belgium (Flanders)	Regional	Ministry of public health	2007	Regulation for prevention of Legionellosis in public places	No	[No response]	At least twice a year	No	Yes	Regional authority	Owner sends results
Belgium (Wallonie)	Regional	Ministry of the environment	2005	Regulation imbedded in the conditions for building permission	Yes, but not predefined	[No response]	Every two months; if negative, every three months	Yes	No	-	By the environmental permit
France	National	Ministry of the environment	2004	Concerns all cooling towers with evaporative cooling systems	Every two years by Ministry appointed company	Maintenance company certified by the Ministry of Health; the local authority can inspect	Monthly or bimonthly	Yes	Yes	Local authority	Owners sends results annually
Malta	National	Ministry of public health	2006	Regulation for registration of cooling towers and evaporative condensers	Variable, according to checklist in regulation	The owner; the health authority can conduct their own monitoring if desired	Colony counts, monthly; Legionella every six months	Yes	Yes	National authority	Owner sends results and audit inspections are conducted
The Netherlands	National	1. Ministry of Employment (if employee may be exposed to cooling tower aerosols) 2. Ministry of Environment (if the surrounding area [but not the employee] is exposed to cooling tower aerosols)	1. Ministry of Employment: 2004, amended 2007 2. Ministry of Environment: January 2009	1. Regulations for prevention are embedded in company risk analyses 2. Regulation for registration of new cooling towers. Also, local authorities may impose prevention legislation on cooling tower owners	Yes, but no period specified	1. The employer; inspection should ensure compliance. 2. The owner; local authorities should ensure compliance of the owner	Recommended; frequency depends on location of the tower (monthly, every three months or every six months)	No	Partly	Local authority	Owners are requested to register by the local authority
Norway	National	Ministry of public health	2005	Regulation to minimise the risk of spread of Legionella from aerosol generating equipment	Every six months	The owner	Colony counts, monthly;	Yes	Yes	Local authority	Owner sends results
Russia	Regional	Dept. of industrial construction	Not stated	Regulation for cooling towers and evaporative condensers of public objects	No	[No response]	Yes, planned ministry of public health	Not known	Yes	Local authority	Not stated
Spain	National	Ministry of public health	2001, amended 2003	Regulation for prevention and control of Legionellosis	No official inspections	The owner should have a maintenance programme in place.	Colony counts monthly; Legionella every three months	Yes	Yes	Regional authority	Owners have to inform authority
UK (England and Wales)	National	Department of Employment	1992	Regulation for cooling towers and evaporative condensers	No, but other legislation require inspection by the owners	The owner; enforcing authorities should ensure compliance of the owner	No, but other legislation require monitoring; colony counts, weekly; Legionella every three months	Yes	Yes	Local authority	Owners have to inform authority
UK (Northern Ireland)	National	Department of Enterprise, Trade and Investment	1994	Regulation for cooling towers and evaporative condensers	Twice a year	The owner; enforcing authorities should ensure compliance of the owner	Colony counts, weekly; Legionella every three months	Yes	Yes	Local authority	Owner sends results
UK (Scotland)	National	Department of Trade and Industry	1992	Regulation for cooling towers and evaporative condensers	Periodic inspection	The owner should have a management system in place	Depends on level of compliance with code of practice	Yes	Yes	Local authority	Business occupier is requested to register with local authority

standards. Of these 25 countries or regions, only one country (Luxembourg) and one region (Brussels) have a register of wet cooling systems, and because Brussels' register includes only new systems, it is not comprehensive.

Discussion

Minimising the number of cases of legionellosis caused by wet cooling systems should be an important target for public health authorities¹. A preliminary risk assessment by Ambroise et al. [9] showed that exposure through cooling towers led to more cases of Legionnaires' disease (by a factor of 100-130) than exposure during showering, whilst Lock et al. detailed the high cost of an outbreak of Legionnaires' disease caused by a cooling tower [10]. The EWGLI annual dataset (Table 1) shows that between 2002 and 2007 there were an average of 7.3 outbreaks caused by wet cooling systems each year, involving 1,175 cases (an average of 195.8 cases per year and 26.7 per outbreak). In comparison, 215 outbreaks (35.8 per year) with 784 cases were associated with water systems (an average of 130.7 cases per year and 3.6 per outbreak) [6,7]. It should be noted that a large number of outbreaks are never properly attributed to sources [7], and that the larger ones (often associated with wet cooling systems) are more likely to be attributed to a source than smaller outbreaks [3,11,12].

In most of the countries or regions that have regulations for the registration of wet cooling systems, these were introduced following the recognition of outbreaks caused by such devices. Regulations were introduced in England, Wales and Scotland in 1992 [13] following Public Enquiries resulting from the Stafford hospital outbreak [14] and the BBC outbreak [15], both of which were caused by cooling towers. After a big outbreak in a town near Madrid in 1997 [16], the first regional law was issued in Spain. This was followed by laws in many other regions of Spain and by a national law in 2001 (later revised in 2003). In France a number of outbreaks, including the 2003 outbreak in Lens [3], led to specific regulations in 2004; in Norway regulations to minimise the risk of spread of *legionella* from aerosolizing equipment followed an outbreak caused by an air washer [4]. In the Netherlands a cooling tower related outbreak in Amsterdam in 2006 [17] was the impetus for the introduction of specific rules.

Of those eleven countries or regions that experienced wet cooling system outbreaks which were reported to EWGLI between 2002 and 2007 (Table 1), three reported having no legislation for registering wet cooling systems (Italy, Portugal and Sweden). However, the three countries or regions that have reported the most outbreaks over this period (Spain, France and England and Wales) all have legislation. These three countries or regions require frequent microbiological monitoring, keep a register of towers and impose penalties for unregistered systems. The only area where they may have less rigid legislation than countries or regions with fewer outbreaks is in regards to periodic monitoring. Spain suffers from the highest number of outbreaks and does not require periodic official inspection of systems, but there are different levels of response following positive *Legionella* spp. counts depending upon how infected the system is. France only requires inspections every two years, and England and Wales do not have a set frequency for inspections by local authorities (however the obligation to monitor rests with the wet cooling system owners and the enforcing authorities should ensure that they fulfil this obligation) [18].

It is difficult to draw solid conclusions from this data because there are many differences in ascertainment, data collection, and reporting systems between countries. Nevertheless, there is enough evidence to suggest that developing water safety plans for wet cooling systems, including system assessment, monitoring and management, is the preferred approach for managing the health risks associated with exposure to *Legionella* spp. [19,20]. Specific legislation is needed to ensure that authorities responsible for the safety of water systems or buildings develop and follow water safety plans. Most outbreaks associated with wet cooling systems are preventable, and such legislation could therefore lead to a substantial reduction in morbidity and mortality from Legionnaires' disease.

Regulations for the registration of wet cooling systems should also be required by health systems. During an outbreak of legionellosis, identifying and containing the source as quickly as possible should be one of the initial aims of an outbreak control team. In order to achieve this, improving surveillance to ensure the rapid detection of cases and clusters is important, but a register of wet cooling systems can also be an invaluable starting point and speed up the process considerably [21]. At present only 12 European countries or regions have specific legislation for this. Several EWGLI collaborating countries that do not currently have such legislation have suggested that European Community (EC) regulations for the registration of wet cooling systems and the prevention of legionellosis are required, and that the European Centre for Disease Prevention and Control (ECDC) should take the initiative to propose such regulations.

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List of responding EWGLINET collaborating centres: Andorra, Austria, Belgium (Wallonie, Brussels Capital and Flanders), Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, UK (England and Wales, Northern Ireland and Scotland)

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