Why the Focus?

Duncan Smith
HM Principal Specialist Inspector
Why the Focus?

• *Legionella* bacteria and Legionnaires’ disease known about for 40 years

• Legionnaires’ disease is foreseeable and preventable

• Case numbers are not reducing
Legionellosis Cases (E&W) 2007/16

[Bar chart showing the number of cases from 2007 to 2016, categorized as Pontiac fever, Non-pneumonic Legionellosis, and Legionnaires' disease.]
Legionnaires' Disease Cases (E&W) – 2014/16
How widespread is the disease?

- Cases reported in all industrialised countries
  - ~27,250 cases, ~2250 reported deaths (since 1995)
- ~350 cases per year in England and Wales
- ~25 cases per year in Scotland
- 50% travel associated
- 10-40% mortality
- World`s largest community outbreak occurred in Murcia, Spain 2001 (470 cases and 1 death)
Netherlands – 2002/12

Patients

1991 patients in total
392 patients with clinical isolate
41 patients with match
BOHS 14th March 2018

ATHLETES VILLAGE – OLYMPIC GAMES 2012

PAUL NOLAN WATER HYGIENE LTD

Paul Nolan  FIPlantE FSOE FIHEEM
IHEEM Registered Authorising Engineer (water)

www.legionellaguru.com
January 2012: I was asked if I would be the Authorising Engineer (water) for the games in July 2012.
18 months standing water
Was officially a construction site
Sign and AE (water) -- 6 Page contract

Lend Lease Facilities Management (EMEA) Limited
20 Triton Square
Regents Place
London
NW1 3BF

Dear Sir

Reference: Authorising Engineer Water (AEW), Athletes Village, Greenwich

We are pleased to appoint you as a consultant in connection with the Project upon the terms and conditions set out in this letter. This letter (together with its Schedules) and your acceptance will constitute the entire agreement between us and will replace any previous agreement between us relating to the Project and shall be deemed to have commenced with effect from the day when you first began to perform the Services.

You shall provide the services set out in Schedule 1 including any variation of such services pursuant to this appointment (the “Services”).

We shall pay you, in consideration of the performance of the Services and your duties under this appointment, the fee as set out in Schedule 2 (the “Fee”), which shall be valued, calculated, certified and paid as provided in Schedule 2. Such payment shall be inclusive of all your costs, charges, expenses and disbursements but exclusive of Value Added Tax. No payment by us shall be deemed to indicate satisfactory performance by you of the Services or your other obligations under this Agreement.

Limit of PI insurance cover
You will be covered by the AVFM Professional Indemnity Insurance. You will not be required to provide PI for this service.

Key Persons
For the purposes of this contract Paul Nolan will be the Authorising Engineer Water (AEW) on behalf of LLFM.

SCHEDULE 1
Details of the Services
Provide Authorising Engineer Water (AEW) services at the Athlete’s Village site, Stratford, London.
Services to include:
1. Attendance at the water quality steering group
2. Advice on water management matters related to the AV site only
Barcelona Olympic Games 1992 Athletes Village
Barcelona Olympic Games 1992 Athletes Village
Athletes Village
Rio Games Athletes Village 2016
Athletes Village

- 13 Buildings
- 10 floors (approx.) each building
- 2818 properties
- More than 30000 outlets
Athletes Village Construction Phase Security

- Everyday finger print access
- X Ray bag search
- Trained Dogs for Drugs, Alcohol. Explosives
- Stop and search random
- Limited pass access control
- 45 minutes to place of work
- Security staff were empowered above all
- No pre visit booked – no get on site
- Passes issued, were dated bound
- Site inductions were 4 hours for everyone
Athletes Village construction labour statistics

- 6500 workers per day
- 9 languages
- Full time interpreters
- Churn of 500 a week
- 4 year construction programme
- 1 fatality --- heart attack on site
Athletes Village Occupancy

Paralympian's Olympic Games
- 4302 athletes & trainers
- 503 events
- 164 countries

Olympic Games
- 16000 athletes & trainers
- 300 events
- 204 countries
Water Quality Team
Water Sampling and Temperature Monitoring
Flushing Regimes
Hyper - Disinfection
Filtration Shower Head Strategy
The ATHLETES VILLAGE, Water Quality Steering Group

- Independent data management by Aqualog System:
  - Sample points randomly generated
  - Automated data entry

- Independent water specialist = 2 water samplers

- Independent consultant overseeing hyper chlorination

- One water treatment company carrying out the commissioning hyper disinfection

- PALL Life Sciences

- 100 flushers
Athletes Village Water Sampling Strategy

Water Samples:
- 10,000 legionella
- 15,000 TVC, 22dg & 37dg
- 15,000 Pseudomonas spp.

Filtration strategy:
PALL 0.2 sterilising membrane shower heads fitted throughout the AV
5.2.3.9.2.1 Chlorine dioxide
21.0 mg/L chlorine dioxide (ClO2)

NOTE Chlorine dioxide has the advantage of being effective against biofilms.
5.2.3.9.2.1

21.0 mg/L chlorine dioxide (ClO₂)

NOTE Chlorine dioxide has the advantage of being effective against biofilms.
Chlorination – Disinfection

Is Hyper disinfection effective against biofilm ?

or is it just Hype ?

BS 8558:2011 was used at the AV
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011:
(legionella counts)
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011:
(legionella counts)

Building 2
Hyper disinfection BS8558:2011:
Building 3

Hyper disinfection BS8558:2011:

(legionella counts)

5200 100 1000
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011:
(legionella counts)

7000 8500 2500 2500 1000 500 1500
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011:
(legionella counts)
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011:
Non detected legionella

(legionella counts)
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011: Non detected legionella

(legionella counts)
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011: (legionella counts)
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011
(legionella counts)
Non detected legionella
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011:

(legionella counts)

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</tr>
</tbody>
</table>

Chlorination 28th June 2012

Building 10
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011:
Non detected legionella

(legionella counts)
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011: Non detected legionella

(legionella counts)
Hyper disinfection BS8558:2011:
Hyper disinfection BS8558:2011:
(legionella counts)
Lessons learnt?

- Was CLO2 effective in killing bacterium and biofilm - **NO** I would suggest
- Plastic pipework has a potential life cycle expectation shortfall
- Did mass flushing and temperature control regimes - work more effectively than Hyper disinfection — **YES**
- Legionella bacteria was not detected until the cold water hit 32 dg in the building
- TVC 22dg and 37dg were the same throughout all sampling results
- 5 buildings with no legionella detected
- qPCR and Rapid Technologies MUST be the way forward
Trichophyton mentagrophytes var. interdigitale
Legionella. The Healthcare sector - expectations versus reality
Legionella infects and kills people!

Between 2011 - 2015, **30,532** cases of Legionnaires’ disease were reported from 29 European countries.

Between 2014–2016:
- the total number of confirmed cases in the UK was **1070**
- the total number of confirmed cases in the UK with underlying medical conditions was **74%**
- the total number of reported deaths in the UK was **77**

In 2017:
- **693** cases were reported in the UK.

Mismanaged and poorly maintained water systems can rapidly become colonised and become the source of major outbreaks of Legionnaires’ disease.
Healthcare water systems

The healthcare sector presents the greatest risks from Legionnaires’ disease and includes service providers such as:

- Ambulance services
- Care homes
- Children's services
- Clinics
- Community services
- Dentists
- GP’s and doctors
- Hospitals
- Hospices
- Mental health services
Healthcare water systems

The challenges for healthcare premises can be difficult:

- Often larger buildings with complex hot and cold water systems e.g. NHS premises and hospitals.
- Vulnerability of service users
Complex water systems

A range of issues distinguishes healthcare environments from most other building types.

Control of infection - the HCAI Code of Practice requires a WSG and a WSP to be in place.

Scalding issues - never events.

Temperature control - technical difficulties in maintaining the required temperatures.

Water treatment techniques - can be effective - the selection of a suitable system depends on system design, age, size, and water chemistry.
# Susceptibility of individuals

| Patients of increased susceptibility | | Patients of very high susceptibility |
|-------------------------------------|----------------------------------|
| Diabetes                           | Head /Neck Cancer                |
| Respiratory Disease                | Bone Marrow Transplant           |
| Cancer                             | Renal Dialysis                   |
| Kidney Disease                     | Leukaemia                        |
| Immuno-Suppressant drugs (e.g. Steroids) | Organ Transplant                |
| Alcoholism                         | AIDS                             |
| Smokers                            |                                  |
| Elderly (Above 50)                 |                                  |
Legal drivers and guidance

  - enable secondary legislation and guidance
- Health and Social Care Act 2008 (Regulated Activities) Regulations
- ACoP (L8) 2013 and HSG274 2014
- HTM 04-01 (Parts A, B and C) - Safe water in healthcare premises 2016
- BS 8580:2010 - Water quality – Risk assessment for Legionella control

Failure to comply with the law can result in criminal prosecution including fines of up to £20,000 per breach and up to 2 years imprisonment.
Operational challenges

HTM 04-01 - a holistic management of water systems via WSGs, WSPs.

HSG274 part 2 states that “The formation of a WSG and implementation of a WSP complements the requirements in the Approved Code of Practice Legionnaires’ disease.”
Operational challenges

Given the known high risks in healthcare and the recommended sector specific guidance available, you would expect the highest quality of work to be carried out

- wouldn’t you?
Operational challenges – risk assessment

A Legionella risk assessment is a legal requirement

The key to any successful Legionella management programme is a robust, high quality risk assessment and comprehensive scheme of control.

Without a good quality risk assessment the scheme of control/logbooks may be inappropriate, incorrect, lacking.

Most healthcare organisations will contract out these services.
Risk Assessments
Risk Assessments

[Images of hazardous situations]
Risk Assessments
Risk Assessments

Simples !
Where to get help! — risk assessments

The LCA CoC for Service Providers is a voluntary scheme

367 members, 87% provide risk assessment services

Members pay between £1362 - £2082 per annum

Association with the HSE

Many contracts require LCA members
Problems ! – risk assessments

Clients have a lack of knowledge and training on what to expect and sales people are very good

Service providers “cut corners” to remain competitive

Guidance is not fully implemented

LCA audits focus on service delivery and procedures expected to be in place

Competence of assessors is questionable

Often we see a conflict of interest from service providers

Result = Poor Risk Assessments
Where to get help! — risk assessments

LRA produced in July 2017 from a LCA member who’s Category Types include Legionella Risk Assessment Services.

As an AE I have seen inadequacies in a number of areas:

- No next review date
- The disclaimer that the RA “only includes areas within the scope of the assessment” has not been adhered to (see * below)
- No identification of key personnel, both staff and contractors, and their competence (Ref. BS8580)
- Incorrect schematic diagrams – no hot and cold water outlets listed*, no identification of who produced the document
- Incomplete asset register – no hot and cold water outlets listed*
- *The vast majority of hazards have not been evaluated and the risk arising from these assessed. I would estimate that less than 5% of outlets were tested given the site has over 950 daily users. From the 11 outlets tested only 3 gave a direct hot water temperature. 8 gave a blended outlet temperature from a TMV.
- No identification of sentinel outlets
- No evidence that the assessment has been reviewed prior to issue and signed by the reviewer prior to issue
- The risk scoring system references BS8558 2011 (which has been withdrawn and does not reference a risk scoring system.)
- No guidance re emergency procedures
- No identification of infrequently used outlets
- Only site specific recommendations are provided for cold water storage cisterns, all other recommendations are generic.
- Site specific recommendations made regarding CWST storage temperatures were designated a “HIGH PRIORITY” for one CWST “due to temps over 20 degrees all year round” The temperature recorded from the cistern was 17.7°C and all outlets fed were between 17.2°C – 17.9°C. This was not a high priority risk.
In reality - If this is the level of service that duty holders can expect, then the LCA should be very concerned and the HSE should review their association with the LCA.
Contractor quality & competence

The facts:

- The responsibility for the management of the risk always belongs to site.

- 43% of HSE prosecutions result from poor risk assessment.

- 50% of HSE prosecutions result from poor scheme of control.

- If the HSE find you in material breach of health and safety law they can charge you £124 per hour to put things right under FFI.
Contractor quality & competence

From knowledge and experience, in my opinion:

As the primary source of service providers the LCA need to up their game and:

- Focus on quality & competence rather than capability
- Improve audits and assessment of risk assessors and assessments
- Remove members that do not comply

Or should we be looking to other organisations to improve the quality & competence of service providers ??
HSE Social Care Improvement Notices - 2009-2013

Caveat on data: this is operational data which has not been validated and is not official HSE statistics

Legionella 23%
**Legionella outbreaks and HSE investigations; an analysis of contributory factors**

**PROSECUTION DATA**

The search as described in 2.2 also identified details of prosecutions brought by HSE against companies for failure of Legionella control.

The search identified 14 separate cases, and these were classified by HSL into agreed categories of industry sector, water system type and failure to comply. Because the reasons for prosecution often included more than one failure, combined data are presented as collective failings.
Some of the healthcare prosecutions 2009 - 2015

Wallasey care home ordered to pay £40k over pneumonia risk
Date: 23 August 2013  Fined £6,525 plus £33,475 costs

Hospital trust sentenced over fatal Legionnaires' disease and patient window fall
Date: 4 September 2013  Fined £100K plus £162K costs

Hospital trust fined for legionella control failings
Date: 11 June 2015  Fined £50K plus £38,705.60 costs

Health board fined £24,000 over Legionnaires case
Date: January 2012  Fined £24K

Manchester care home fined over Legionnaires’ risk
Date: Thursday, April 1, 2010 – 5:00 pm  Fined £5K plus £3,607 costs

Liverpool hospital fined over Legionella
Date: 08 October 2009  Fined £35K plus £12,862 costs

Company fined for inadequate Legionella assessments at Welsh care homes
Date: Thursday, August 6, 2009  Fined £24K plus £17,276 costs

£512,450
Management of Legionella

In reality - Is Legionella in healthcare being managed competently?

In my opinion - NO!
Regulation

The CQC are the independent regulator of health and social care in England
Memorandum of Understanding (MoU) between CQC and the HSE - December 2017

CQC take the lead:

- severe scalding
- patient/service user develops Legionnaires’ disease
- complaint received that the hot and cold water system in a residential care home is not being properly maintained

HSE/LAs take the lead:

- staff member develops Legionnaires’ disease

Factors tending towards HSE/LA taking the lead:

- failings by a water treatment company.
Questions posed to the CQC:

What Legionella training and experience do CQC inspectors have to allow them to make competent assessment of Legionella management issues during inspections?

What do inspectors want to know/see/inspect with regard to Legionella management from providers?

Do inspectors routinely request evidence of competent Legionella management and if not what instigates such a request?
How many Legionella specialist advisors do the CQC employ?

How many Legionella specialist advisors have been used during inspections of healthcare premises?
Response from the CQC dated February 2018:

“To date we haven’t done any targeted recruitment to attract Legionella specialists specifically, however as our role is changing we are developing our approach to recruitment, training and relationships with other organisations.”

“there are contact details on our website if anyone wishes to submit questions.”
In reality - Is Legionella management being regulated competently?

In my opinion - I doubt it!
Legionella Management

Steve Mount  BSc (hons)  MWMSoc  CBiol  MIBiol

IHEEM Registered AE (Water)

City & Guilds accredited trainer

Legionella Risk Consultant

Mobile: 0778 752 4066  
Email: stphmount@yahoo.co.uk  
www.stevemountassociates.com
Remote Environments and Practical Enforcement

Bob Drummond
Energy Division
Offshore Occupational Health
Remote Environments and Practical Enforcement

- Background
- Where I work
- How I carry out my work
- Some findings
- Summary
BACKGROUND

• 10 years in Energy Division
• Offshore Occupational Health Inspector
• Work streams include looking at how dutyholders control bacterial growth in the potable water systems on offshore installations.
• Legislative basis is seeking compliance with COSHH Regs. 2002
• Enforcement criteria.
Remote Environments
Normally Unmanned Installations

Usually day visits only. 14 days every two or three months.

Different set of problems.
Expectations

Competent staff and monitoring records which demonstrate:-

- **Temperature** – below 20°C and above 50°C.
- **Biocide** – Free Chlorine levels are maintained between 0.2 – 1.0ppm (preferably 0.5ppm).
- **Routine maintenance and examination** completed on schedule.
Legionella Risk Assessments

• My first port of call
• Quality varies
• Short notice of inspection topic
• In house v consultants
• Risk Assessment recommendations
<table>
<thead>
<tr>
<th>Column Heading</th>
<th>Analysis</th>
<th>Acceptable Limits</th>
<th>Frequency</th>
<th>Examples of Sample Location</th>
<th>Transition Times</th>
<th>Sample Storage Temperatures</th>
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<tr>
<td>Water Microbiology</td>
<td>Enterococci</td>
<td>0 MPN</td>
<td>Quarterly</td>
<td>Galley/Tea points</td>
<td>24 hours</td>
<td>2 – 8°C</td>
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<tr>
<td></td>
<td>E.coli</td>
<td>0 cfu/ml</td>
<td></td>
<td>Nearest &amp; furthest cold outlets</td>
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<td></td>
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<tr>
<td></td>
<td>Coliforms</td>
<td>0 cfu/ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>TVC@22°C</td>
<td>300 at 27°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TVC@37°C</td>
<td>100 at 37°C</td>
<td></td>
<td></td>
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<tr>
<td>Legionella</td>
<td>&lt;100cry/L</td>
<td>Quarterly</td>
<td>Cabin Shower points</td>
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<td>48 hours</td>
<td>Room Temperature</td>
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<td>Galley</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Spray washers</td>
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<td>Deadlegs</td>
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<td></td>
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<td>Utility hoses</td>
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<td></td>
<td>Emergency Showers</td>
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<td></td>
<td></td>
<td>Calorifier drains</td>
<td></td>
<td></td>
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<tr>
<td>Hydrocarbon</td>
<td>&lt;10ug/L</td>
<td>Six monthly</td>
<td>Cold water storage tanks</td>
<td></td>
<td>72 hours</td>
<td>2 – 8°C</td>
</tr>
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</table>
| Additional Microbiologi
cal Parameters |                           | Quarterly                         | Dive chambers |                                             | 24 hours         | 2 – 8°C                     |
Monitoring Records 1

Note the response to low levels of free chlorine!

<table>
<thead>
<tr>
<th>Time</th>
<th>Sample Point</th>
<th>Actual</th>
<th>Hypochlorite Added</th>
<th>Cold Temp</th>
<th>Hot Temp</th>
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<td>0.2</td>
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<td>20.8c</td>
<td>62.3c</td>
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Bunkering Operations
Bunkering stations
Potable Water Storage Tanks
Biocide Dosing

Mechanical Dosing

Manual Dosing
UV Sterilisers
Calorifiers
Why?
Deadlegs and little used outlets
# Case Study 1

**October 2009 - April 2010**

## Water dispensers

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<th>Total Colony Count per ml (72 hrs with checks at 24°C)</th>
<th>Coliforms MPN/100ml</th>
<th>E.Coli MPN/100ml</th>
<th>Enterococci MPN/100ml</th>
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## Safety shower

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## Cabins

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Case Study 2

2010 Legionella Tests

Previous HSE Visit November 2010 and HSE Inspector allocated to cabin D211.

Chemical clean of system completed March 2011.

Routine OH visit June 2011
### Case Study 3

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<td>Laundry Sink</td>
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<td>Safety Shower via Cold</td>
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<td>C Tank</td>
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<td></td>
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<td>Upper Deck Safety Shower via Cold</td>
<td>&gt;1000</td>
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<td>Lower Deck Safety Shower via Cold</td>
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<tr>
<td>Pot Water Tank 5500A Drain via Cold</td>
<td>480 cfu Detected in 900 ml</td>
<td>Not Detected in 1 L</td>
<td>Not Detected in 900 ml</td>
<td>Not Detected in 1 L</td>
<td>Not Detected in 900 ml</td>
<td>Not Detected in 1 L</td>
<td>Not Detected in 900 ml</td>
<td>Not Detected in 1 L</td>
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<tr>
<td>Mezz Deck Safety Shower via Cold</td>
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<td>0</td>
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</tbody>
</table>

*Not Detected in 900 ml*
Safety Showers and Eye Baths

Is this a possible solution?
Summary

128 Offshore Installations visited

6 Improvement Notices issued 2008-2010

Safety Notice HID5-2010-1 issued May 2010.

36 of 51 dutyholders responded. 15 and poor responses received a visit. 3 further IN’s to date.

Step change in the Offshore Industry’s approach to legionella control

Risk of legionella on Offshore Installations substantially reduced.
Thank you for listening

A camel can work for a whole week without drinking
A man can drink for a whole week without working
Microbiological sampling and analysis

BOHS March 2018

Brian Crook
Overview of presentation

• Terminology;
• How *Legionella* survives in water;
• How that affects *Legionella* sampling and detection;
• Traditional vs newer methods.
Important considerations & terminology

- Quantitative - leads to numeric value (that can be compared to set limits)
- Semi-quantitative – leads to indicative numeric value. (can be used for comparison but less accurate)
- Qualitative – shows presence or absence but not quantity
- Specificity- how accurately detects target organism
- Sensitivity- how much of target population is detected
• *Legionella* incorporated into biofilm - allows protection from disinfection.

• Dormancy allows *Legionella* to survive until enter next protozoa.

• Dormant *Legionella* are non-culturable but viable – NCBV - that is, alive but cannot grow on agar plate. They can still be pathogenic.
Sampling for *Legionella*

- Analysis depends on good sampling strategy;
- Sampling based on BS 7592 Sampling for Legionella bacteria in water systems – Code of practice;
- Use combination of representative locations and higher risk sentinel points; sample timing;
- Water samples - at least 1 litre, more is better, with biocide neutraliser;
- Stored dark and at room temperature;
- Revised BS EN ISO 11731 Water Quality – Enumeration of Legionella – possible confusion over storage conditions.
Culture-based detection of *Legionella*

- Water samples filtered to concentrate then resuspended from filter;
- Acid treated to help remove non-*Legionella* competing bacteria;
- Selective agar plates (nutrients to preferentially grow *Legionella*) inoculated and incubated;
- Emerging colonies counted (colony-forming units – cfu) and calculated as per litre of water sampled.
Culture – advantages

- Universally familiar microbiological technique;
- UKAS accredited analysis;
- Results easily interpreted according to L8 – compare to guideline concentrations and alert levels;
- Detects only culturable bacteria which shows their potential to grow and infect (see other methods later for context).
Culture – limitations

• Slow ~ 1-2 weeks;
• Poor recovery;
• Can be out-competed;
• Designed to detect *L. pneumophila* not all *Legionella*;
• Doesn’t detect NCBV – possible under-estimation of cell numbers capable of infecting.
Legionella detection by PCR

What is PCR?

- PCR = Polymerase chain reaction;
- Same as used in forensics to detect DNA;
- DNA (deoxyribose nucleic acid) is part of the building blocks of the cells of all living things;
- Parts of the DNA sequence can be identified that are unique to a family of living organisms, to a species, to a subspecies (e.g., serotype) or an individual;
- PCR can be designed to detect a minute quantity of the target DNA sequence in a sample and amplify it to a more measureable amount.
**Legionella detection by PCR contd.**

How PCR works

- Acts like a ‘genetic photocopier’;
- Uses small piece of DNA called a primer that is manufactured to match target e.g., *Legionella pneumophila* or *Legionella* species;
- If target DNA present, primer sticks and amplifies the target DNA by doubling the quantity;
- Repeated doubling (2; 4; 8; 16 etc.) over a number of cycles – each takes about a minute;
- Using a fluorescent dye the quantity of target DNA present can be calculated against a standard curve.
Quantitative PCR (qPCR)

- Typical screen shot from qPCR
- Upward curving plots indicate positive control or sample
- Cycle number (also referred to as Ct value) at which plot curves upwards is proportionate to number of DNA copies in original samples - smaller Ct = more DNA
Legionella PCR - advantages

• Quantitative – expressed as Genomic Units (GU);

• Good specificity / sensitivity;

• Measures all DNA present therefore both culturable and NCBV (but see later);

• Rapid (same day results);

• Allows quicker intervention;

• Has been UKAS accredited / AFNOR validated.
Future application of *Legionella* PCR

**Ability to link environmental with clinical isolates:**

- 2014 case of LD in a neonate after home birth in a heated birthing pool;
- *Legionella* spp detected and characterised by qPCR;
- Sequence Based Typing linked environmental and clinical sequence (*L. pneumophila* sg-1 ST48).

(Collins et al, Epidemiol Infect 2016; 144: 796-802)
Legionella PCR - limitations

• Measures all DNA therefore live and dead Legionella;

• Results (GU/litre) tend to be much higher than culture (cfu/litre);

• Process can be inhibited (inhibitors in water);

• Can produce both false negatives & false positives.
Further work on PCR testing

• PCR results (GU/litre) cannot be compared to the alert / action levels set in L8 (cfu/litre) – no direct read-across for reasons above;

• Alert / action levels for PCR have been suggested following ring trial of European labs;

• More work is needed to validate these proposed action levels;

• HSE funded a PHE project to address the above..................
Out of 2009 samples analysed:

- 1451 from hot and cold water systems;
- 338 from cooling towers;
- 84 from spa pools;
- 106 from ships;
- 130 from other water systems (including birthing pools, paper mills, rivers, garden water systems etc.)
PHE comparison of culture and PCR

Each sample analysed:

- By standard culture method
- Legionella qPCR that simultaneously detects Legionella species DNA and DNA sequences unique to Legionella pneumophila
- If Legionella pneumophila detected, second PCR run to detect Legionella pneumophila serogroup 1.
HSE/PHE study of paper mill process water

HSE project to assess the potential for Legionella contamination:

• 80 water samples taken from representative areas of process in 9 paper mills;
• Most samples contained high levels of bacteria;
• Only 3/80 yielded detectable Legionella by culture;
• 56/80 yielded detectable Legionella spp. by qPCR;
• 6/80 yielded detectable Legionella pneumophila by qPCR and none were detected as sg-1;
• qPCR – detectable Legionella could be ‘old DNA’ but showed evidence that the bacteria had been in the process water;
• Full report available soon on HSE website (Research Report 1105).
PHE comparison of culture and PCR: findings

• Overall negative predictive value (the ability of a negative qPCR result to predict a negative culture result) was 99.3% for Legionella species and 99.6% for L pneumophila

• The positive predictive value (ability of positive qPCR result to predict positive culture result) was lower - 22% for Legionella species and 33% for L pneumophila

• However, less than 0.25% samples were found to be culture positive but PCR negative

• Highlighted the potential benefit of PCR as a negative screening assay for both routine and public health testing which could be valuable in outbreaks and incidents.
HSE’s current position for PCR testing

• The PHE study confirmed a lack of correlation between culture (cfu/litre) and PCR (GU/litre) results for any of the water systems tested;

• Alert / action levels for PCR have been proposed that are consistent with previously published work;

• HSE have released a position statement.......
HSE’s position statement for Legionella PCR

It recognises the benefits of PCR testing based on ISO 12869:2012 standard as being:

• Rapid detection of *Legionella* bacteria;

• Indication of the effectiveness of cleaning and disinfection;

• Complementary tool for the rapid routine monitoring of legionella trends at dutyholder sites;

But acknowledges the current limitation:

• Interpretation of results.
Other/ emerging detection methods

- ScanVit
- Mapping tools
- WAKE UP!
- Bio Alarm
- Hydrosense
- Casp/Microslide
Dipslide based detection

- Type of agar dipslide that detects *Legionella* species & *L pneumophila* by culturing;
- Quantitative.

Points to remember:
- Must use correct dipslide;
- Must concentrate water sample or scrape biofilm;
- Must use incubator;
- Must incubate 14-21 days;
- Results can be interpreted against L8 as quantitative;
- Recovery is likely to be poor - out competed / sensitivity of agar.
Immunochromatographic assays

- Rapid semi-quantitative test strip similar to pregnancy test;
- Positive test occurs when a specified level of *Legionella* detected – colour change.

Points to remember:
- Only detects *L. pneumophila* serogroup 1;
- 4 different kits: Field test does not require concentration so relatively insensitive test with high detection cut off;
- Others designed for DWS, high suspended solids & biofilm. Cut off at equiv. 100cfu/L
Immunomagnetic bead technology

• Qualitative / semi-quantitative method

• Uses magnetic beads coated with enzyme linked antibody to capture *Legionella* from concentrated water samples.

• Produces colour according to level of detection (order of magnitude)

• Can compare to colour card or detect in laboratory using spectrophotometer

• Only detects *L. pneumophila*

• Specificity / sensitivity not validated
ATP - metry

- Adenosine tri-phosphate (ATP) is energy carrier in all living organisms.
- Good indicator of microbial activity
- Often used as measure of surface hygiene by food hygienists / EHOs.
- Samples collected on swab or water comb and placed in luminometer.
- Luminometer measures amount of light emitted following chemical reaction.
- Results are given in Relative Luminescence Units (RLU)
ATP – metry – points to remember

• ATP-metry does NOT measure Legionella. It is a measure of biomass.

• ATP-metry monitors all ATP present not just living microbes.

• Used to map hot spots & trends in microbial contamination

• Certain chemicals in water systems can affect the chemical reaction.
## Detection methods summarised

<table>
<thead>
<tr>
<th>Features</th>
<th>Culture</th>
<th>PCR</th>
<th>Microslide</th>
<th>Immuno-chromatography</th>
<th>Immuno-magnetic bead</th>
<th>Gene probe</th>
<th>ATP -metry</th>
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<td>Detects all Legionella live or dead</td>
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Summary - *Legionella* detection

- At present there is no substitute for culture for routine testing.

- Other methods complement culture by being able to rapidly monitor trends in *Legionella* or microbial contamination.

- Interpretation of results may be difficult and false negatives may be observed using the less well validated methods.

- However, the use of a secondary monitoring method may enable more rapid intervention when a problem is identified.
Any questions?

Health and Safety Executive Science Division, Buxton. Our commercial work delivers high quality science to meet the needs of industry and government in the UK and overseas. Our commercial customers can commission services and research using our state-of-the-art scientific laboratory in Buxton, as well as analytical expertise from other parts of HSE’s science base.
Cooling Tower
Regulatory Interventions

Duncan Smith
HM Principal Specialist Inspector
Contents

• What have HSE done?
• What are HSE doing now?
• What are HSE plans for the future?
HSE cannot tackle everything at once.
HSE will focus major effort on conditions with:

– widespread prevalence;
– the largest lost-time and economic cost consequences;
– life-limiting or life-altering impacts.
2013/14 intervention

- Targeted using NCTEC notifications
- HSE/ONR inspected 1906 sites
- LAs intervened with 576 sites
- Significant stakeholder engagement
13/14 findings

• Significant benefits from combined intervention approach
• Comprehensive compliance picture for cooling towers and evaporative condensers
• Improved inspector competence
• Updating/validation of NCTEC register
13/14 HSE detailed results

- 1360 stakeholders attended events where HSE spoke
- Enforcement at 33% of sites
- 400 INs and 11 PNs served on legionella control & management
- Further 100 INs served on related issues e.g. work at height
<table>
<thead>
<tr>
<th>PNs Served</th>
<th>Available notes relating to issue of PN</th>
</tr>
</thead>
</table>
| 1          | - No paperwork post 2010  
            | - No dipslides or biocide on site  
            | - No visits from water treatment company |
| 2          | - Packs of 2 towers damaged  
            | - Algae/biofilm growing from both packs |
| 1          | - Dense debris – tower could go out of control at any time  
            | - Water treatment company endoscope inspection aborted as pack so heavily scaled |
| 1          | - Multiple control failures  
            | - Little confidence in management  
            | - Concern regarding tower potential for growing legionella |
- Cooling tower heavily contaminated

- Management of tower is poor
- Build-up of foul on pack
- Bottom of pond can’t be seen
- No drift eliminators
- Aerosol venting towards another company and residential area

- Tower completely overgrown and in poor state
- Tower not been looked at in years
- Poor condition and lack or control and maintenance

- Measures not in place to control growth of legionella

- Cooling tower dirty
- Positive legionella results
- Drift eliminators damaged
13/14 results

• LA officers took enforcement at 21% of sites

• HSE took enforcement action against 20+ service providers

• Proactive prosecutions taken against 4 dutyholders and 1 service provider
Legionella control in evaporative cooling systems: underlying causes of breaches in health and safety compliance

Prepared by the Health and Safety Executive

Research report RR1118
http://www.hse.gov.uk/research/rrhtm/rr1118.htm

underlying causes of breaches from 13/14 intervention
Breakdown of INs

Percentages of INs served under each Topic:

- IN for Risk Assessment: 53%
- IN for Written Control Scheme: 23%
- IN for Implementation of Control Scheme: 23%
- IN for Record Keeping: 1%
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<th>Failings</th>
<th>Number</th>
<th>% of category</th>
<th>% of all failings</th>
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<td>46</td>
<td>40.4</td>
<td>9.2</td>
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<tr>
<td>1.7 Does not cover all risk factors + 1.4 Not sufficient – no other details given</td>
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<td>30.7</td>
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<td><strong>Written control scheme:</strong>&lt;br&gt;n = 136</td>
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<td>2.1 absent</td>
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<td>28.7</td>
<td>7.8</td>
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<tr>
<td>2.3 inadequate information + 2.10 lack of procedure detail + 2.4 and 2.6 and 2.7 inadequacies in descriptions of system operation and schematic diagram</td>
<td>65</td>
<td>47.8</td>
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<td><strong>Implementation of Control Scheme</strong>&lt;br&gt;n = 247</td>
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<td>3.7 Cooling Tower not clean/no cleaning of system</td>
<td>76</td>
<td>30.8</td>
<td>15.2</td>
</tr>
<tr>
<td>3.2 Lack of training</td>
<td>69</td>
<td>27.9</td>
<td>13.8</td>
</tr>
<tr>
<td>3.8 Drift eliminators missing/dirty/misaligned/damaged/not checked</td>
<td>37</td>
<td>15.0</td>
<td>7.4</td>
</tr>
<tr>
<td>3.4 Monitoring checks late or missed or incorrect + 3.3 Physical inspections late or missed</td>
<td>31</td>
<td>12.6</td>
<td>6.2</td>
</tr>
</tbody>
</table>
2016/17 intervention

• 300 sites randomly selected from 13/14 cohort

• 100 sites where enforcement action taken in 13/14

• 100 sites not inspected in 13/14
16/17 findings

• Compared to 13/14……

  – 9.2% reduction in non-compliance for randomly selected sites

  – 33% of sites with previous enforcement required further enforcement

  – 37% of new sites required enforcement
2017/18 intervention

- 100 sites where enforcement taken in 13/14 or 16/17

- Have service providers contributed to breaches?
IEEs for Service Providers

• Actions under HSW 3(1) against service providers where their action or inaction has created risk

• Suggested enforcement action for specific examples
• Service providers should ensure they have the ability, experience, instruction, information, training and resources to carry out their tasks competently and safely

• Examples:
  – Risk assessors should inform their clients that they need to have the installation turned off and access arrangements in place to facilitate a physical inspection. This may mean coordinating it with a shut down or clean and disinfection
L8 ACOP para 76(d)

• Service provider failed to inform dutyholder of any deficiencies or limitations in their system/written scheme

• Examples:
  – Failure to write appropriate actions on a water treatment service report despite adverse microbiological results
  – Failure to provide an inspection report where adverse levels of fouling (Caution or High Risk) seen at pre-clean inspection i.e. where changes in the water treatment programme or frequency/type of cleaning are likely
Measures intended to control the risk of exposure to legionella bacteria should be so designed and implemented that they will be safe and without risks to health.

Example:
- Cleaning activities judged to be ineffective
- Jet washing packing when others in the vicinity
The future?

• Depending on 17/18 intervention results
  – Service provider HQ visits in Q4 18/19
  – Targeted cooling tower visits in later years (TBC)
Take home message

HSE will keep the focus on cooling towers until we have confidence that compliance is sustained and health risks are reduced
Thank you for your attention

Questions?

duncan.smith@hse.gov.uk
Ensuring a Good Standard of Service From Your Water Treatment Contractor
Overview of Sellafield Ltd
Reliance on Contractors

400 + Contracting Companies Support Sellafield

Up to 5000 Employees
strong Partnership

Sellafield Ltd

Water Treatment Contractor

Risk Assessor

FM Services
Sellafield has been in operation with a nuclear agenda since the 1950’s which has given rise to a unique legacy. 60 years of reprocessing operations at Sellafield has built not only a nuclear legacy, but also a legionella risk legacy in our nuclear cooling provision.
Our Future

We recognise that the future still presents legionella risk that needs to be managed through the lifecycle of all our facilities.

Sellafield Ltd is already moving towards and committed to a more proactive approach to not only the legacy risks but the full site risk lifecycle.

Proactive Risk Management
"it is the overall responsibility of the competent person to ensure that the service provider carries out their work to the required standards."
contractor Qualities

- Competence
- Challenging Attitude
- Innovation
- Quality
- Professional Standards
- Leadership
- Resourceful

Contractor
As Was Supporting Structure

The contract model in support of Legionella risk management was 10 FTE’s
As Is Supporting Structure

Our water contractor, HCS is growing to meet our increasing demand reaching 30 in October 2017 from 6 in 2015

The contract model in support of Legionella risk management now runs to 30 FTE’s
Changing Contractor

• Recognised as a risk area in 2012 HSE intervention

• **Risk assessment review trigger includes ‘changes to key personnel’**

• **Is a risky business**
  • Loss of competence
  • Loss of records
  • Interruption in schedule
  • Loss of equipment

• Often commercial driven.

• **But can also be positive**
  • Underperforming contractor
  • Fresh set of eyes
Contractor *Selection*

- *Intelligent customer role*
- *Do your homework!*
  - Accreditations.
  - Quality/working procedures.
  - Examples of reports.
  - Customer references.
  - Regulatory action.
  - Safety performance.
  - Contracts of a similar size and complexity.
  - Standard of works.

"The threat of Legionella to businesses can be critical."
Contract Scoping

• Give yourself plenty of time to get it right
• Good Scoping covers all contracts let for legionella control
  • Risk assessment through to tower new build.
  • Main water treatment contract.
  • Tower builds/refurbishment.
• Look at the finer detail, does it include:
  • All your systems?
  • All the tasks for delivery?
  • Response times to breakdowns?
  • What about out of hours response?
• What standards to work to and certification required.
• Agree deliverables
  • e.g. 30 days for any technical reports
  • What are the penalties for not delivering
• Requirement to manage subcontractors
Contract **Role out**

- **Equipment, everything including mop and bucket.**
- **What if everyone leaves?**
  - Contingency arrangements.
- **Work shadowing.**
- **Look out for early indicators.**
  - Mistakes in documentation.
  - Listen to what they tell you.
- **Visit RP, tower familiarity.**
- **Procedures for all aspects of work.**
- **Demonstration of competence of individuals.**
- **Transfer of records.**
- **Ask for proof, check it has been complete.**
- **Any uncertainty don’t go live**
Regular performance Review Meetings

- Agree standard format up front.
- Monitor performance criteria.
- Overcome hurdles for delivery.
- Auditing/compliance programme
  - Internal and customer based.
  - Covering all aspects of their work.
  - Review non compliance.
  - Improvement programme.
- Agree deliverables and dates
Treatment System and Workmanship

*Legionella* can live and grow in biofilm

- Water
- Pipe wall
- Biofilm-associated bacteria
- Free-floating bacteria
- Secreted slime

Cross section of pipe
Designing Treatment Systems

• Design risk assessment.
• Fully Validated against system.
  • Risks V Treatment Provided.
• Understanding the design.
• Back up.

• Maintenance.
• Human factors.
• Availability of spares.
• Operational Costs.
Commissioning **Treatment System**

- Full in-situ validation, meeting performance criteria.
- Testing of all system components.
- Extended period of commissioning.
- Test all modes of failure.
- Maintenance requirements and intervals defined.
- Conduct maintenance as part of commissioning.
- Technical support.
- Do not sign off until 100% happy.
- Build competence of operations team.
Operating **Treatment Systems**

- *Is it just a box of tricks?*
- *Undertake an operation risk assessment.*
- *Update Written Scheme.*
  - *Routine inspections.*
  - *Action levels defined.*
  - *Communications channels defined.*

  - **Subcontractor contract scope**
    - *Response time*
    - *Critical Spares*
    - *Documents in place*
Quality of Workmanship

- Contract scoping again.
- Using correct access methods.
- Check all areas.
- Check pack and drift tightly fitting.
- Left clean.
- Ensure system rechecked after a period of operation.
Risk Assessments
**Pre Risk Assessments**

**Introduction**

This document has been complied to assist the client in the understanding of the site requirements placed upon the Engineer/Risk Assessor when undertaking the required site based works. This should therefore allow the respective client/s to compile all the required information in advance of the scheduled survey date, thereby making the whole data gathering exercise more efficient for all concerned. The following explanation should also provide the client with an understanding of the services to be inspected and the information which needs to be retrieved when evaluating these items.

**GENEX**

As part of the water management service provision to the site GENEX have been selected as an impartial service provider to undertake Water Hygiene and Legionella Risk Assessments. GENEX are an experienced consultancy based water service provider with a wealth of experience and are accredited under the Legionella Control Association. To ensure impartiality GENEX have only been selected to provide the required risk assessments and all subsequent monitoring activities will be delivered by a separate service provider.

**Description and Methodology of Proposed Works**

In order to undertake a comprehensive Legionella Risk Assessment to any site it is mandatory requirement to review the current documentation and service provision. Therefore, before any physical inspection works are commenced, GENEX intend to hold an introduction and evaluation meeting with each Responsible Person (RP) to review the following information:

**Pre Site-inspection Data Gathering**

1. Agree the Building/Site scope of works.
2. Identify any restricted/hazardous areas (in terms of access).
3. Identify any historic control problems in relation to Legionella control.
4. Identify any alterations to the site activities or services since last Risk Assessment/Review.
5. Obtain where possible copy of existing schematic drawings or floor plans (confirmation as to permission to remove from site may be required).
6. Review the existing Risk Assessment.
7. Review the existing Legionella control parameters and log books.
8. Review training records for relevant staff.
9. A review/discussion of building activities and explanation of plant/services and function.
10. Assess need for all services installations.
11. Establish building occupancy patterns and numbers of occupants.
12. Establish susceptibility of occupants.

**Site Survey**

Upon completion of the above activities, a full site survey will be completed. It is kindly requested that the Responsible Person be available for this stage of the work so as to ensure that all areas have been identified and surveyed and that any areas of concern have been adequately addressed. As part of the site survey works access to the following areas will need to be inspected (where possible):

- Incoming water supply points.
- Hot water generation plant.
- Cold water storage tanks.
- Process Plant applications.
- All Water outlets.
- Roof voids / Suspended ceilings containing pipework.

**Active Area Risk Assessment Requirements**

As a reference within the appropriate documentation/risk assessment, photographs will be taken on all areas where problems are suspected/identified. Due the associated issues in taking cameras in and out of Active areas it is preferred if the LRP can provide a camera and any photos taken on this device then shared with One FM.

**Post Site Survey Works**

Upon completion of the above and prior to leaving site, a summary of the prime findings will be discussed with each RP so as to ensure that any risks are both identified and understood.

**Check List**

| Building: | .......................................................... |
| Drawings / Service Schematics: | ☐ ....................................................... |
| Previous Risk Assessments: | ☐ .......................................................... |
| Previous legionella monitoring records / Log books: | ☐ .......................................................... |
| Camera: | ☐ .......................................................... |
| Site Classification: | Clean ☐ Active ☐ |
| PPE requirements: | .......................................................... |
| Meeting Arrangements: | .......................................................... |
| Comments: | .......................................................... |
Undertaking Risk Assessments

Access to Records

- Previous risk assessment
- Management arrangements
- Written scheme
- Non conformances
- System maintenance/modification
- Monitoring results

- Camera
- Monitoring equipment
- Tools to access behind panels
- Safety equipment
Post Survey Feedback

YOU'RE DOING GREAT!

FEEDBACK

EMAIL

RESPONSIBLE PERSON

Sellafield Ltd
Risk Assessment Report
Reliable **Sampling**

**Legionella Testing in 4 Simple Steps**

**STEP 1**
- We send you a Testing Kit:
  - Simple Instructions
  - Water sample bottle(s)
  - FREE courier collection bag

**STEP 2**
- You fill the bottles from hot water taps & shower heads in your building.

**STEP 3**
- Contact us to arrange FREE collection of the samples

**STEP 4**
- The samples are tested in our UKAS approved laboratory and you receive a Certificate. Simple!

- **If only it was so simple.**
- **You should be advised to have a sample plan**
  - Why, what, where, how & when.
  - Know your response before you sample
  - Understand limitations
Sample Collection
Sample Storage and Transport

- Varies depending on what monitoring for

<table>
<thead>
<tr>
<th>Sample handling and storage</th>
<th>Total Viable Count</th>
<th>E.coli &amp; coliforms</th>
<th>Pseudomonas</th>
<th>Sulphate reducing bacteria</th>
<th>Nitrite reducing bacteria</th>
<th>Legionella Culture</th>
<th>Legionella PCR</th>
<th>Legionella immuno assay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled</td>
<td>Chilled</td>
<td>Chilled</td>
<td>Chilled</td>
<td>Chilled</td>
<td>Chilled</td>
<td>Ambient</td>
<td>Ambient</td>
<td>Ambient</td>
</tr>
</tbody>
</table>

- New onsite facility
Reliable Chemical Analysis

- Site chemical analysis has come a long way
- Look at monitoring conditions.
- Procedures, quality checks, standards in date, appropriately stored.
- Consistency between chemists, e.g. sample collection.
- Documented methodology.
- Equipment calibrated.
- How long does it take them?
- Typed report rather than hand written.
Accurate Routine Monitoring

- Analysis sheet

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analysis</th>
<th>Clarity</th>
<th>Conductivity</th>
<th>pH</th>
<th>Total Alkalinity</th>
<th>Hardness</th>
<th>Chloride</th>
<th>Iron (total)</th>
<th>Nitrate Inhibitor</th>
<th>Diode</th>
<th>Temp</th>
<th>Dipside</th>
<th>Chloride Nitrate</th>
<th>Langelier Sat Index</th>
<th>Conc. Factor</th>
<th>Calcium Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MU</td>
<td>Clear</td>
<td>31.08</td>
<td>20.21</td>
<td>11</td>
<td>2.7</td>
<td>&lt;0.1</td>
<td>5.5</td>
<td>&lt;10^2</td>
<td>Prime lab 2</td>
<td>Student 3</td>
<td>Prime lab 1</td>
<td>Drop Test ±5-10%</td>
<td>Photometer ±5-10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>Clear</td>
<td>60.78</td>
<td>50.23</td>
<td>11</td>
<td>13.2</td>
<td>&lt;0.1</td>
<td>0.52</td>
<td>&lt;10^3</td>
<td>Prime lab 3</td>
<td>Prime lab 2</td>
<td>Prime lab 1</td>
<td>±0.8°C</td>
<td>46 Hrs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All other results are satisfactory at present

*Mild steel corrosion monitoring not carried out as awaiting new probes*

Please note the Langeliers Saturation Index is recorded for HCS information only and has no bearing on the system condition

The Langeliers Saturation Index is a calculated number used to predict the calcium carbonate stability of water.

Corrosion probe determination of stainless and mild steel corrosion rates

<table>
<thead>
<tr>
<th>System Condition</th>
<th>304L</th>
<th>316L</th>
<th>Mild Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion Rate mpy</td>
<td>0.01</td>
<td>0.01</td>
<td>N/A</td>
</tr>
<tr>
<td>Pitting Tendency mpy</td>
<td>0.00</td>
<td>0.02</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Corrosion Monitoring

- Nitrate reserves - 0.5x chloride level acceptable for up to a month.

# up to 2mg/l is acceptable for <24 hours
Appropriate Storage Arrangements

- Check storage arrangements
- Good Indicator of working standards
Accurate *Cleaning and Disinfection*

- **General System Inspection**
- **Drift Eliminator**
- **Distribution system**
- **Fill pack support, internal structures**
- **Packing**
- **Heat exchanger**
- **Base/tank/pond**

- *Access is the key, effort, time and cost.*
- *Site visit pre clean, ensuring access is available*
Cooling Tower Cleaning

- Introduce peer review
- Legionella responsible person, what does good look like?
Cooling Tower Chlorinations

- **Observations**
  - *Poor detail, no information on system configuration*
  - *Error in results reporting.*
  - *pH and chlorine levels*

<table>
<thead>
<tr>
<th>Time</th>
<th>PH</th>
<th>Quantity Added</th>
<th>PPM Measured</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:30</td>
<td>6.5</td>
<td>6.25 litres</td>
<td>0</td>
<td>EXTRA 2 LITRES ADDED TO MAINTAIN 5 ppm.</td>
</tr>
<tr>
<td>12:45</td>
<td>8.5</td>
<td>0</td>
<td>5</td>
<td>EXTRA 2 LITRES ADDED TO MAINTAIN 5 ppm.</td>
</tr>
<tr>
<td>13:45</td>
<td>8.2</td>
<td>0</td>
<td>5</td>
<td>EXTRA 2 LITRES ADDED TO MAINTAIN 5 ppm.</td>
</tr>
<tr>
<td>14:45</td>
<td>7.6</td>
<td>2 litres</td>
<td>5</td>
<td>EXTRA 2 LITRES ADDED TO MAINTAIN 5 ppm.</td>
</tr>
<tr>
<td>15:45</td>
<td>7.9</td>
<td>0</td>
<td>5</td>
<td>EXTRA 2 LITRES ADDED TO MAINTAIN 5 ppm.</td>
</tr>
<tr>
<td>16:45</td>
<td>7.5</td>
<td>2 litres</td>
<td>4</td>
<td>EXTRA 2 LITRES ADDED TO MAINTAIN 5 ppm.</td>
</tr>
<tr>
<td>17:45</td>
<td>7.7</td>
<td>0</td>
<td>5</td>
<td>EXTRA 2 LITRES ADDED TO MAINTAIN 5 ppm.</td>
</tr>
<tr>
<td>18:30</td>
<td>7.5</td>
<td>0</td>
<td>5</td>
<td>CHLORINE LEFT IN SYSTEM.</td>
</tr>
</tbody>
</table>

- **Improvements**
  - *Legionella responsible person training and accountability*
Compliance

- System Compliance Auditing.
  - Includes all aspect of system.

- Needs To Be Comprehensive

- Auditing By Customer
  - Intelligent customer role.

- Cannot Just Rely On Accreditations, LCA/UKAS.

- Service Provider Audit Programme
  - All aspects of service delivery.
  - Include subcontractor.
Questions?
Legionella Control Association

History and Relevance

Matt Morse LCA Chairman
What is the LCA?

Membership standards association

- Exist to promote and raise standards in legionella control
- Members commit to the code of conduct and service standards
- End users can complain to the LCA about members
What is the LCA?

We audit our members for compliance – management systems

- Companies unable to demonstrate sound procedures are excluded
- Marginal quality providers helped to improve
- Good quality providers accepted as members
What is the LCA?

We don’t:
• Quality assure service provision
• Guarantee service quality

We do:
• Ensure members have suitable procedures in place and inspect evidence of their use
• Investigate all legitimate complaints
What the LCA is Not

The LCA is not:

- A regulator – we can only support/discipline our members
- A trade association – we do not lobby or promote members commercial interests
- A commercial organisation
Structure

Management Committee

Assessors

Secretariat
The Beginning

• The LCA has its roots following the Corby outbreak

• Prior to this:
  • Most couldn’t even spell legionella!
  • Not much was done with domestic H&C
  • Biocides were added to towers for primarily engineering reasons
The Original Green Cooling Technology!
Corby

- Several outbreaks from cooling plant between September 1996 and July 1998
  - 48 samples from 33 systems
  - 17 positive for legionella
  - 11 positive $>10^4$ legionella
  - 8 different systems
  - 5 different companies
  - Many unregistered towers
GILD

• Group Investigating Legionnaires’ Disease was set up following outbreaks
• Phil Hope MP for Corby campaigned for improvement in the industry
• Water Treatment Companies remember being berated and called “window salesmen” and to “get their house in order”
HSE meetings February & May 1998
4 main problem areas highlighted:
  • Inadequate Risk Assessments
  • Training
  • Management - systems and staff
  • Monitoring - systems and staff
• HSE - “self-regulate or statutory regulation”
Code of Conduct

- BACS & WMS encouraged to draw up industry code of conduct to cover:
  - Requirements for contracts
  - ‘Matters of Evident Concern’
  - Self-auditing of contract performance
  - Training standards for staff
• Consultation period with Industry
• CoC issued June 1999
• Code of Conduct Association formed
• First organisations registered July 1999
• L8 referring to CoC Jan 2001
Code of Conduct
Original Purpose

- Raise standards among Service Providers
- Help buyers choose a competent supplier
Original Principles

• Provides guidance to clients on standard of service they should expect

• Responsibility for legal compliance rests with owner/operator and service provider

• Designed to help owner/operator select competent service provider
Looking Forward (from 2001)

1. Broadening the representation
2. Tightening standards
3. Supporting the industry
4. Review Code of Conduct
Intervening Years

• Auditing of members procedures
• The Code of Conduct was developed
• Guide to assessing competence introduced
• Standards for Service Delivery introduced
Benefit of LCA
Service Standards

• There are standards and guidance for legionella control from BSI and HSE
• BS0 dictates BSI language
• HSWA dictates underlying legal requirements for HSE guidance
• LCA are able to use the imperative in LCA member standards for service delivery
L8 2013 and HSG274

• Project initiated within LCA, WMSoc and BACS in April 2011
• LCA MC and assessors contributed
• Service Standards revised to reflect new guidance
• Held HSE/LCA stakeholder events
• Industry standards improved
Test More, Trust Less

• In the early years members made a stated commitment
• Move to ever more frequent audits
• More stringent penalties
• Tightened standards
• Move to Limited Company status as penalties were used
Did We Achieve Aims

1. Broadening the representation
2. Tightening standards
3. Supporting the industry
4. Review Code of Conduct
Did We Achieve Aims

1. Broadening the representation
   
   - Yes
   - WMSoc now elect 4 MC members
   - BACS now elect 4 MC members
   - Independents elect 4 MC members
   - HSE and EHO represented
Did We Achieve Aims

1. Broadening the representation
   • From a range of company sizes
   • Treatment, hygiene, laboratory, etc.
   • All volunteers
   • All unpaid
   • Working to improve the industry they work in
Did We Achieve Aims

2. Tightening standards
   • The code has been continually revised
   • Service standards introduced
   • Auditing to seek evidence of commitments in use
   • Disciplinary action
Did We Achieve Aims

3. Supporting the industry
   • Assessors support applicants and members
   • Help developing and using quality procedures
   • Inclusive up to a point
   • Contributions to guidance development
Did We Achieve Aims

4. Review Code of Conduct
   • Done many times over the years

   So the original aims of the organisation have been met
Future

- Not going forwards is standing still
- Do we have too many members?
- Are we too inclusive?
- Future plans under development or consideration are:
• Sub category for healthcare premises under legionella risk assessment
• Vertical auditing to site level
• Auditing of members legionella risk assessment templates
• A suggestions forum for members input
• Encourage confidential complaints
This is a thing of the past but there is still much room for improvement
Thank you

Matt Morse
LCA Chairman
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matt.morse@bms-ltd.co.uk