Appendix 1: Inspection of evaporative cooling systems and other industrial and commercial water systems.

Inspection

The inspection procedure is set out in operational guidance http://www.hse.gov.uk/foi/internalops/og/ogprocedures/inspection/index.htm This OG is additional guidance for inspection of premises with legionella risks. The inspection may be a planned inspection or may be a result of a matter of potential major concern (mpmc).

Inspection comprises two stages:

1. Review of the documentation including the
    a) Notification of the evaporative cooling system
    b) Risk Assessment
    c) Written Scheme (including documentation of management arrangements)
    d) Monitoring Results (outcome of inspections and routine tests);

2. Physical examination of the
    a) Pack
    b) Pond
    c) Drift eliminators
    d) Other ancillary systems eg biocide dosing system

Review of Documentation

Inspectors are likely to be presented with a considerable wealth of paperwork and records going back over time. It is important that the review of this paperwork is approached in exactly the same way as any other issue would be approached ie by assessing the documentation overall then selecting an aspect and drilling down to enable judgement to be formed on compliance with standards eg L8 and benchmarks eg is the risk assessment suitable and sufficient? Inspectors will also be looking to identify any deficiencies eg failure to act on reports requiring remedial action eg pack replacement, failure to review why there are repeated failures of control (even although remedial action has been taken), or failure to consider whether dipslide readings are commensurate with other readings and practices.

Notification

Inspectors should first check with the dutyholder that their installation(s) has been notified to the LA under the Notification of Cooling Towers and Evaporative Condensers Regulations (NCTEC) 1992. If there have been any changes to the installation/s since initial notification, then the changes should also have been notified, eg additions and decommissioning.

Risk Assessment

It is important that the assessment considers the risk of the system as a whole, including all pipework and associated plant including pumps, heat exchangers and water softeners.

Assessment should not be over-reliant on the water treatment programme. Whilst this is likely to be a vital component in controlling risk, inspectors should ensure that all aspects of the management regime are appropriately addressed.

The assessment should identify and evaluate potential sources of risk. It should detail the means to prevent or reduce those risks and how exposure is to be controlled. In making the assessment, the characteristics of the plant, its use and location all need to be taken into account. This includes:

- the normal operating characteristics of the plant e.g. operating temperatures, the type of plant, process and system, operation of any control equipment;
- any unusual, but reasonably foreseeable, operating conditions eg breakdowns
- the presence of deadlegs, dual pumps, infrequently used pipework or ancillary plant;
- the age and condition of the system eg old or wooden towers, damaged or corroded system hardware;
- the source and condition of incoming water source;
- the likelihood of environmental or process contamination;
- proximity to buildings housing susceptible groups of people;
- proximity of exhaust stream to other buildings.

The risk assessment should be carried out by a competent person and should document the management arrangements required to ensure that the controls are implemented and continue to be effective.

Written Scheme

ACOP L8 gives practical advice on a written scheme which documents the measures that have been chosen to address the identified risks and achieve the necessary control. The written scheme sets out how controls are to be implemented and the organisational arrangements to ensure these are, and remain, effective. It is likely to comprise (or signpost to) a variety of documentation, including plans/schematics, the water treatment programme, cleaning/disinfection procedures and inspection and monitoring regimes. It

should clearly describe correct operation of the system to include shutdown procedures, operating cycles, maintenance frequencies and actions to deal with matters of concern e.g. breakdowns, abnormal/unexpected test results and/or unclean systems. The information should be well ordered and easy to follow to enable the dutyholder to check that the correct procedures are being followed and facilitate monitoring and review.

Monitoring results

Monitoring includes **all** checks on the effectiveness of the written scheme and should not be restricted to the results of chemical and microbiological testing.

Regular chemical monitoring provides information about biocide concentrations, the amount of solids suspended in the water and the degree to which scale and corrosion are being controlled.

Measurements of microbiological activity (dipslides or total viable counts (TVCs)) are used to indicate the overall bio-burden within the water and the effectiveness of the chemical treatment programme. Interpretation of microbiological results is not straightforward. It is more important to consider the trend of the results, as isolated sample results will be of little value when assessing the overall condition of the system.

Routine visual inspection of plant is often neglected or undertaken ineffectively. An effective visual inspection programme is key to identifying physical conditions favouring microbial growth or aid uncontrolled dispersion of aerosol. Records should provide evidence that the dutyholder is undertaking regular visual inspections, noting the condition of the pack, drift eliminators and pond water. Where deficiencies are found, the records should show what remedial action was taken and when.

Physical examination

Physical examination is an important component of an effective inspection. For inspection purposes, the fan should be turned off for 30 minutes before approaching the installation. Physical inspection **should not** be attempted where the installation cannot be switched off. Check for air inlets and openable windows in close proximity to the tower exhaust air stream, where any aerosol drift could be drawn in. The risk assessment should recognise these matters and the controls and monitoring levels should reflect the situation accordingly.

For crossflow towers where the existing documentation indicates that risk is being adequately controlled, only the fan needs to be turned off. For counterflow towers, the airflow moves vertically upwards through the packing, making it difficult to observe the packing without getting wet, and therefore it may be necessary to switch the circulation pump off as well.

Usually, switching off the fan should not cause problems for the dutyholder but if this is the case, a revisit may be necessary when the tower is not in use

or during a scheduled shutdown period. However, switching both fan and pump off can be problematic for operators in some instances. If pumps continue to circulate system water, at least some cooling can be maintained (which may be critical in some cases) and the absence of the airstream means that production of fine, breathable, droplets is greatly reduced. A scheduled revisit may be necessary.

In an outbreak situation, the expectation is that the device will be voluntarily shutdown for the purposes of inspection, unless shutdown presents a greater safety risk.

Inspectors should check that safe access is available for plant situated at height to facilitate inspection given that drift eliminators are often sited on top of the device. (see internal guidance http://intranet/yourhealthsafety/visiting-staff/visiting.htm for further information on general precautions NB HSE only). If there are problems with gaining safe access to the installation, then enforcement action should be considered. (If access is difficult for inspection then it will also present difficulties for examination and maintenance by the dutyholder, indicating that it is not effectively carried out.)

Removable hatches or viewing panels may be utilised to allow internal components to be viewed, but no attempt should be made to dismantle any part of the installation.

The components to be inspected will include;

- **Pack -** (Note these are not present in evaporative condensers). Look for scale build - up on surfaces, silt deposits, algal growth. When inspecting crossflow towers (where the fan only has been switched off), uneven water flow may be an indicator of scale build-up within the structure.

- **Pond -** These should be screened to reduce windage, minimise solar heat gain and prevent ingress of organic matter or debris. Look at the condition of the sump water for the presence of microbial growth or cloudiness from dissolved salts and biofilm.

- **Drift Eliminators -** Check to see that these are well fitted and free from damage. Extensive localised wetting of surfaces close to the exhaust stream with evidence of algal growth and scale deposition indicates ineffective control of drift. (Note: drift eliminators can only *limit* rather than *eliminate* the amount of cooling water in the exhaust air stream). If possible, view from below to see if daylight is visible which indicates misalignment or physical damage.

- **Biocide Dosing -** Where there is automatic dosing equipment**,** check that the reservoir is not empty and that the dosing delivery tubing is connected and not split or otherwise damaged. The chemicals used can be checked and compared with the details provided in the written

scheme. The sampling and dosing points can also be checked when on site.

Water Treatment Companies

Many dutyholders contract out activities in relation to the maintenance and control of risk from water systems to specialist water treatment companies (WTCs). Services provided range from risk assessment, water management, supply of chemicals, analytical services to cleaning/disinfection. It is important that the dutyholder maintains managerial responsibility for the installation(s) as their legal responsibility cannot be delegated. The written scheme should define roles and responsibilities, lines of communication and reporting arrangements.

Many WTCs are members of the Legionella Control Association (LCA) and are governed by their Code of Conduct http://www.conduct.org.uk/index.html.

However, the dutyholder must nevertheless make reasonable enquiries into the competence of any service provider contracted for the purposes of legionella control. The ACoP also places duties on suppliers of services, including WTCs, to ensure the competence of their staff and the efficacy of services provided to control or prevent the risk of exposure to legionella bacteria. Where deficiencies in such services are identified, appropriate enforcement action against the service provider should be considered.

Legislation

Duties under HSW extend to risks from legionella arising from work activities. Legionella bacteria come under the scope of Control of Substances Hazardous to Health Regulations 2002 (as amended) (COSHH). The Management of Health and Safety at Work Regulations 1999 (MHSWR) are also relevant to control of legionella bacteria and ACOP L8 Legionnaires' disease: the control of legionella bacteria provides the basic framework for dutyholders.

Occupiers have a duty under the Notification of Cooling Towers and Evaporative Condensers Regulations 1992 (NCTEC) to notify LAs of cooling towers and evaporative condensers on their premises except where they contain no water that is exposed to air, and/or their water or electricity supply is not connected. The main purpose of notification is to assist in identifying where such devices are located in the event of an outbreak of legionellosis.

Indicators of compliance

The following indicators (Table 1) are provided to illustrate what successful compliance should look like for each inspection topic. A judgement needs to be made on the overall picture of compliance in each area and accordingly, it is this that should determine the initial enforcement expectation.

1. Risk assessment

Requirement	Relevant legislation/guidance
Suitable and sufficient risk assessment and significant findings recorded (and written down if the site has five or more employees)	MHSW Regulation 3(1); COSHH Regulation 6(1)(a); L8 ACoP paragraph 23
Clear review date and arrangements to ensure review , both routine and in circumstances when there may be reason to suspect that the assessment is no longer valid e.g.: • changes to the operating parameters; • results of routine checks on control measures that indicate that the measures are no longer effective; or • possible cases of legionelloses associated with the system	MHSW Regulation 3(3); COSHH Regulation 6(3); L8 ACoP paragraph 27
Evidence that employees have contributed to, or have been consulted	COSHH ACoP paragraph 84; L8 guidance paragraph 36
Document is site- and system-specific, considers: • source of the supply cooling water (see record keeping); • periodicity of use of the cooling system; • potential sources of contamination (process and environmental) that could influence the risk of operation of the system; • unusual, but foreseeable operating conditions e.g., breakdowns.	L8 guidance paragraph 33
Considers all components of the evaporative cooling system including all associated pipework, pumps, feed tanks, valves, heat exchangers, as well as the tower itself	L8 guidance paragraph 21
Provides sufficient information for decisions to be made on measures to prevent or adequately control the risks from exposure to legionella	COSHH Regulation 6(2); L8 guidance paragraph 28(b)
Note: there are a number of organisations that provide accreditation for activities related to control of legionella risk, including risk assessment. The United Kingdom Accreditation Service (UKAS) accredit companies in this field. Accreditation may provide some assurance that the risk assessment is suitable and sufficient but inspectors should not rely on this and should use	

Requirement	Relevant legislation/guidance
their own knowledge and discretion to form an opinion on the adequacy of individual assessments	

2. Written scheme of control

Requirement	Relevant legislation/guidance
There is a scheme for controlling the risks from exposure to legionella that is consistent with the findings of the risk assessment	COSHH Regulation 7(3), Regulation 6(4)(b); L8 ACoP paragraph 53 requires the scheme to be written down and ACoP paragraph 66(c) requires the record of the scheme to be kept; MHSW Regulation 5(1), 5(2) requires arrangements to be written down where there are 5 or more employees
Contains an up to date description of the cooling system and a schematic diagram that covers: all cooling towers and/or evaporative condensers; all system control valves; all standby equipment, e.g., spare pumps; the location of system bleed valves; all associated storage tanks; all associated pipework; the location of chemical dosing points and/or injection points; the location of the system drain valve; the origin of the water supply; any parts that may be temporarily out of use	L8 ACoP paragraph 53(b)
Contains instructions for operating the system including safe start up and shut down procedures, including for safe start up for those in intermittent use e.g., routine circulation of treatment chemicals throughout the system or drain down, and arrangements to operate standby equipment on a rotational basis	L8 ACoP paragraph 53(b)
Contains details of precautions to be taken to control the risk of exposure to legionella, e.g., chemical dosing, cleaning and maintenance procedures	L8 ACoP paragraph 53(c)
Contains details of checks to ensure that the cooling system continues to operate safely and efficacy of control measures: e.g., visual checks, water quality checks, monitoring biocide levels, monitoring microbiological activity, and instructions on the remedial	COSHH Regulation 9(1)(b) and 9(2)(b); L8 ACoP paragraph, 53(d) and 9(e)

actions to be taken if the scheme is shown not to be effective	
Arrangements include instructions for checking performance of the system and component parts, instructions for inspecting accessible parts of the system for damage and signs of contamination, monitoring activities to ensure that the control scheme remains effective	L8 guidance paragraph 61

3. Implementing the scheme of control

Requirement	Relevant legislation/guidance
Clear and up to date management structure for control of legionella risks	MHSW Regulation 5
A person has been appointed by the duty holder to take managerial responsibility for the implementation of the written scheme of control: 'responsible person'	L8 ACoP paragraph 39
The responsible person has an appointed deputy	L8 guidance paragraph 47
Contact details of the responsible person and the deputy are readily available in case of emergency	L8 guidance paragraph 47
Roles and responsibilities of external contractors engaged in legionella control activities are clearly defined in writing. Demarcation between contactor and operator, and roles within scheme of control are clearly defined. *Responsibility for ensuring that the control scheme is implemented remains with the responsible person*	L8 ACoP paragraph 41
Roles and responsibilities of all employees engaged in legionella control activities are clearly defined in writing	L8 guidance paragraphs 43, 46, 49 and 83
Arrangements to ensure that roles and responsibilities of those engaged in legionella control are reviewed regularly and whenever there is a change to the arrangements	L8 ACoP paragraph 42
All employees engaged in the scheme of control have received training tailored to suit the demands of the tasks required of them and training records are kept: (*Note: Accreditation of courses*	MHSW Regulation 5 ACoP paragraph 34(c); L8 ACoP paragraph 40

Requirement	Relevant legislation/guidance
is provided by a number of organisations including the British Occupational Hygiene Society (BOHS), City and Guilds, the Water Management Society (WMS). Often, the site's water treatment company provides the training for staff – whilst this might not be accredited, it may be fit for purpose. Inspectors will need to assess on an individual basis).	
Arrangements in place to ensure training needs of those with responsibilities for legionella control are assessed and reviewed regularly	MHSW Regulation 13 ACoP paragraph 80
Checks have been made on the competence of external contractors (including those that may have been involved in performing the risk assessment and in preparing the scheme of control).	. L8 ACoP paragraph 41

4. Record Keeping

Requirement	Relevant legislation/guidance
Record of the significant findings of the risk assessment for the operation of evaporative cooling plant	COSHH Regulation 6(4)(a) (applies where there are 5 or more employees); MHSW Regulation 3(6)(a); L8 ACoP paragraph 66(b)
Record of circumstances under which the risk assessment and the scheme of control should be reviewed.	L8 guidance paragraph 38
Records that identify the person or persons responsible for conducting the risk assessment, managing, and implementing the scheme of control. Include dates they were produced and arrangements in place to ensure they are retained for the period they remain current and at least two years after that	L8 ACoP paragraph 66(a) and 67
Records of any monitoring data, inspections and checks that have been undertaken (see below)	COSHH Regulation 9(4)
These records include the dates that they were produced and arrangements are in place to ensure that they are retained for at least five years	MHSW Regulation 5 ACoP paragraph 37; L8 ACoP paragraph 66(d) and 67
There are records of monitoring data that	L8 guidance paragraph 69

Requirement	Relevant legislation/guidance
document: • by name and position, the people responsible for carrying out the various tasks under the written scheme • their responsibilities and lines of communication; • records of the schematic drawing of the system; • the precautionary measures that have been carried that include sufficient detail to show that they were carried out correctly (e.g., when dip slide tests are performed, the location of the testing point and the time that tests are undertaken are documented and signed by the person performing the operation - details of where and when to perform such tests are informed by the risk assessment and are included in the written scheme of control); • remedial work required and carried out on the system and the dates of completion; • a log of visits by contractors, consultants and other personnel; • cleaning and disinfection procedures together with reports and certificates (as well as the evidence used to determine the extent of cleaning required and to support the efficacy of the cleaning procedure, e.g., using photographic images); • results of chemical analysis of the water; • notification to the Local Authority of the intention to operate a cooling tower and/or an evaporative condenser; • up to date training records of personnel; • details of the current state of operation of the system (e.g., when the system or plant is in use	

Requirement	Relevant legislation/guidance
and, if not in use, whether it is drained down is recorded and; are signed or bear some other form of authentication	
Note on chemical analysis: these records should include the chemical analyses undertaken, such as measurements of pH, hardness, suspended solids which provide an indication of the propensity for the system to develop problems due to corrosion, build up of scale and fouling, respectively. Because iron promotes the growth of Legionella, levels of soluble iron in the system water should also be monitored. These tests require specialist knowledge and/or equipment and are usually conducted by water treatment companies and their findings should influence the water treatment regime in place. Routine tests such as those used to monitor levels of oxidising biocides circulating within the system are simple and are usually performed by appropriately trained on-site staff rather than water treatment specialists. Non-oxidising biocide levels in cooling water are difficult to measure, however, levels can be estimated on the basis use, i.e., quantities remaining in the dosing drum.	