



Sellafield Ltd

Organisational Learning with Cooling Tower Management

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Sellafield Ltd

What is Sellafield Ltd

Sellafield Ltd is the company responsible for safely delivering decommissioning of the UK's nuclear legacy as well as fuel recycling and the management of low, intermediate, and high level nuclear waste activities on behalf of the Nuclear Decommissioning Authority.

General facts

The Sellafield site measures 6 sq kilometres

Over 10,000 employees at Sellafield Ltd

Over 1,000 nuclear facilities on the Sellafield site

Largest nuclear site in Europe



Unique Challenges for Cooling Tower Management

Sellafield site has 12 cooling towers of various different designs and capacities.

Systems designed between 1950-2010

System Volumes from 1m³ – 2600m³

Cooling tower with 1-5 cell, all towers of different design



The biggest challenge is system of unique design that provide primary cooling to radiological inventory. The cooling circuit can not be turned off or chemically treated due to potential corrosion issues to storage vessels.

Previous Improvement Work

- New Water Services Contractor
- Cleaning Method Statements and Standards
- Competence assessment of Legionella Responsible Person
- New Risk assessments – delivered in house to improve understanding of system and constraints
- Improve/Increased sampling regimes (monthly legionella culture)
- Emergency Response Arrangement, high legionella count and local outbreak

Improvement Notice

In July 2016 Sellafield Ltd received an Improvement Notice.

The regulator found that the company had ‘failed to ensure employees and persons not in our employ are not exposed to legionella bacteria or, where this not reasonably practicable, exposure is adequately controlled; because you have failed to maintain the cooling tower in a clean condition and in a state of good repair, namely nutrient sources for bacteria were observed to be present within the tower and part of the cooling tower were observed to be in an unsatisfactory state of repair for minimising legionella growth and release’.

Organisational Awakening

- Improvements had been short-lived and sporadic across the cooling towers.
- Improvements driven by Central Team and not 'owned' locally.
- Competent Legionella Responsible Persons had moved roles.
- Issue and shortfalls were not being reported and therefore not escalated to management.
- Where escalated, management did not appreciate the significance of the shortfalls and action appropriately.

Process Safety Approach to Cooling Towers

“Measurement leads to confidence”

- Identify key element providing protection
 - Assets
 - Dosing equipment – availability/calibration
 - Packing – cleanliness/damage
 - Drift – cleanliness/damage
 - Spray Ring
 - RCW Pipework
 - Maintenance
 - Cleaning schedule - schedule
 - Pump/Equipment Maintenance – schedule
 - Monitoring
 - Sampling/Inspections - schedule/results
 - Risk Assessment – currency/findings
 - Competency
 - Training/Competency – training/assessment completed

Phase One – Single Plant Proof of Concept

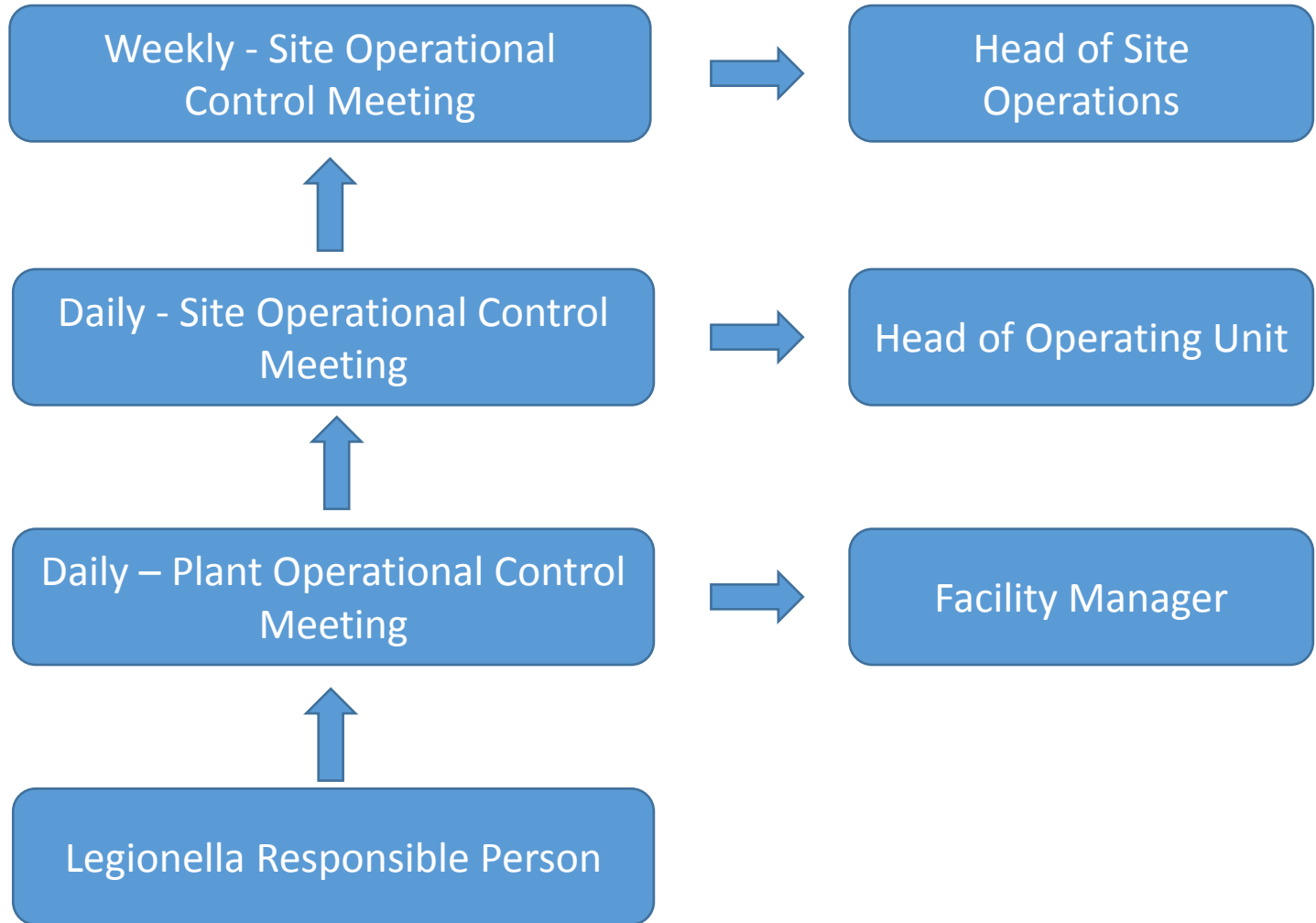
Cooling Tower Safety Dashboard

	ISSUES	ACTIONS
<p>Drift Elimination</p> <ul style="list-style-type: none"> Good – Drift Eliminator clean in good condition and correctly placed Probably Acceptable – Light mineral deposit assessed, Drift Eliminator in good condition and correctly placed Caution – Significant Deposits, might be biological, Drift Eliminator in good condition and correctly placed High Risk – Heavy mineral or biological deposits, assessment/inspection not undertaken in the last 6 months, Drift Eliminator not in good condition, Drift Eliminator not correctly placed 		
<p>Cooling Tower Packing</p> <ul style="list-style-type: none"> Good – Packing clean and in good condition without damage Probably Acceptable – Light Mineral Deposits, packing in good condition without damage Caution – Significant Deposits, might be biological, packing degraded but does not cause disruption to water flow High Risk – Heavy mineral or biological deposits, packing degraded and causing disruption to water flow 		
<p>Cooling Tower Distribution System (spray ring)</p> <ul style="list-style-type: none"> Good – Distribution system in good condition Caution – Distribution system with minor faults not affecting water distribution or circulation High Risk – Distribution system with minor faults affecting water distribution or circulation 		
<p>Recirculated Cold Water System Pipework</p> <ul style="list-style-type: none"> Good – Cooling System Pipework clean with no deadlegs or erosion Probably Acceptable – Cooling System clean with small deadlegs and slight erosion Caution – Cooling System not clean, medium deadlegs, or medium erosion High Risk – Cooling System Pipework not clean, large deadlegs, or high levels of erosion 		
<p>Cooling Tower Maintenance</p> <ul style="list-style-type: none"> Good – All required maintenance and inspection completed (water treatment inspection, water replacement, scaling equipment servicing etc) Caution – Lack of preventive maintenance at risk of erosion High Risk – Lack of preventive maintenance with up to 3 months 		
<p>Biological Growth and Biofilm Control</p> <ul style="list-style-type: none"> Good – Automatic Chemical Dosing System/automatic Oxidiser with no known faults Caution – "Flush" or Manual Dosing System in use or automatic chemical dosing system/automatic oxidiser with known faults High Risk – Any of the biofilm control processes not working 		
<p>Cooling System Monitoring</p> <ul style="list-style-type: none"> Good – All cooling monitoring in place (paper form H202/16 Form) Probably Acceptable – No gap in the monitoring (anniversary frequency compliance check) – gap in the monitoring procedure "Caution" High Risk – No use of the monitoring procedure High Risk or gap in the monitoring procedure 		
<p>Legionella Risk Assessment</p> <ul style="list-style-type: none"> Good – Risk Assessment dated within last 3 years, no significant change in risk since the assessment was done Caution – Risk Assessment dated 03 years ago, no significant change in risk since the assessment was done High Risk – No Legionella Risk Assessment or assessment not done for 3 years 		
<p>Legionella Manual</p> <ul style="list-style-type: none"> Good – Cooling Tower operations in line with Manual when relevant (water quality of Risk Assessment and H202/16) Caution – Cooling Tower operations in line with Manual but possible not fully compliant (in accordance with H202/16) High Risk – Cooling Tower operations not in line with Manual or no Legionella Manual in place 		
<p>Legionella Responsible Person</p> <ul style="list-style-type: none"> Good – Legionella Responsible Person and Deputy Available to support Caution – Only one of Legionella Responsible Person or Deputy are available High Risk – Neither the Legionella Responsible Person or Deputy are available 		
	<p>GOOD</p> <p>PROBABLY ACCEPTABLE</p> <p>CAUTION</p> <p>HIGH RISK</p>	

Phase Two – Refinement and site roll-out

Cooling Towers Legionella Safety Dashboard - draft						
NAME		28/09/2016 00:00				
Legionella SAFETY		SAFETY ENVELOPE RANGES		LEGIONELLA PROTECTION SYSTEMS SAFETY BARRIERS		
Cooling Tower Water Treatment Programme	<p>Cooling Water Quality</p> <p>Legionella (cfu/l) 0 Corrosion (ppb) 0</p> <p>Bacteria (cfu/ml) 1,000+94 TC 0</p> <p>SEE GUIDANCE METRIC FOR CRITERIA</p> <p>GOOD</p>	Water Treatment Sample Taken	Water Treatment Sample Analysis Healthy	Corrosion monitoring Healthy		
		1 GOOD	2 GOOD	3 PROBABLY ACCEPTABLE		
Asset Condition and Inspection Regime	SEE GUIDANCE METRIC FOR CRITERIA	Packing Condition Healthy	Drift Eliminator Healthy	Distribution Healthy	Dosing System Healthy	
		6 CAUTION	7 CAUTION	8 GOOD	9 GOOD	
Legionella Management	SEE GUIDANCE FOR METRIC	Sluice gates and drain valves (segregation) Healthy	Civil Structure Healthy	Pipe work healthy and dead leg management	R1 make up/ Purge healthy	
		11 CAUTION	12 CAUTION	13 CAUTION	14 GOOD	
		Legionella Risk Assessment In Date	Legionella Cooling Tower Manual in Date	Legionella Responsible Person SQEP'd	Cooling System TBOM	
		16 GOOD	17 GOOD	18 GOOD	19 PROBABLY ACCEPTABLE	
UNIQUE NUMBER	LEVE CDH/ODM TITLE	REVIEW DATE	BARRIER COMMENTS		CONTROL	DATE RAISED
			3	No corrosion coupon monitoring	Corrosion inhibitor and corrosion product monitoring in place and acceptable	
			6	Endoscopic inspections indicate significant deposits within packing of Cell A	Cell A & E cleared. Chemical cleaning regime ongoing	
			7	Areas of drift not cleared and minor damage	Chemical clean ongoing	
			10	Cleaning schedule slipped	Cleaning regime ongoing	
			11	Cell D sluice gate failed closed	Work request in to repair	
			12	Known timber degradation	Civil inspections ongoing and work initiated to replace degraded timbers 2017	
			13	BCI has identified evidence of deadlegs not being managed appropriately	Cooling tower deadlegs are being managed. Walkdown of Thorp required	
			15	RAS pumps are off resulting in reduced water movement within pumping basin / transfer channel	Cleaning regime ongoing	
			19	TBOM did not consider legionella management	WSE in place, SE to revise TBOM	
<p>KEY</p> <p>GREEN GOOD</p> <p>YELLOW PROBABLY ACCEPTABLE</p> <p>AMBER CAUTION</p> <p>RED HIGH RISK</p>			<p>NUMBER OF HIGH RISK LEGIONELLA ASSET 0</p> <p>POSITIVE LEGIONELLA RESULTS IN LAST 4 SAMPLES 1</p> <p>NUMBER OF CAUTION LEGIONELLA RISK ASSET 7</p> <p>CDM 0</p> <p>BACTERIA DIP SLIDE GREATER THAN 10E+4 N LAST 4 SAMPLES 1</p> <p>ODM 0</p>			

Clear Route of Visibility



Additional Improvements

- Additional legionella training for facility and site management.
- Legionella Sponsorship Forum, to engage, share, and engender competition to improve legionella control between facilities/OU managers.
- Lowered internal defect/sample result reporting threshold to highlight degraded standards.
- Implemented robust 6 monthly inspection programme by SME.
- Benchmarked with external companies, taking senior facility management.