PART A – Wallerawang and Mt Piper Power Stations

Introduction

Part A of this document applies only to the main water cooling systems of the thermal power stations of Wallerawang and Mt Piper. It only applies to the main industrial application and not to any comfort water cooling systems serving office or residential accommodation.

Part B of this document applies only to Bayswater Power Station in a similar sense.

AS/NZS 3666.3:2011 – Section 3.2 and 3.3 (Replacement)

3.2 Presence of Legionella
3.2.1 Monitoring: A representative sample of cooling water shall be taken in accordance with Appendix A (of AS/NZS 3666.3:2011), at least fortnightly when the system is in use, and assessed in accordance with 3.2.2.
3.2.2 Assessment: An examination for the presence of *Legionella* shall be carried out in accordance with AS/NZS 3896.
3.2.3 Control: If *Legionella* are detected ≥ 10 cfu/mL then either
   A) Trigger Action Response Protocol 1 (TARP 1) for an oxidising biocide of gas chlorine, sodium hypochlorite etc., or
   B) Trigger Action Response Protocol 2 (TARP 2) for chlorine dioxide,
   shall be implemented.

3.3 Presence of other Heterotrophic Microorganisms
3.3.1 Monitoring: A representative sample of cooling water shall be taken in accordance with Appendix A (of AS/NZS 3666.3:2011), at least fortnightly when the system is in use, and assessed in accordance with 3.2.2.
3.3.2 Assessment: A heterotrophic colony count (HCC) test shall be carried out in accordance with AS 4276.3.1 using the 35°C/37°C method.
3.3.3 Control: If the HCC result ≥ 100,000 cfu/mL then either
   A) Trigger Action Response Protocol 1 (TARP 1) for an oxidising biocide of gas chlorine, sodium hypochlorite etc., or
   B) Trigger Action Response Protocol 2 (TARP 2) for chlorine dioxide,
   shall be implemented.
TRIGGER ACTION RESPONSE PROTOCOL 1 (TARP 1) when using an oxidising biocide i.e. gas chlorine, sodium hypochlorite. To be used in conjunction with Form 1 and Flowchart 1.

A. Receipt of a National Association of Testing Authorities (NATA) certified report stating a *Legionella* count of ≥ 10 cfu/mL and/or a Heterotrophic Colony Count (HCC) ≥ 100,000 cfu/mL initiates TARP 1.

B. The appropriate trigger action response scenario for the site is initiated according to the sample results. [Section A on TARP Form 1 is then completed].

C. The following strategies are immediately activated:
   - Appropriate site-supervising staff are notified
   - Public access to the site is restricted
   - Staff in close proximity are to wear appropriate personal protective equipment (PPE)
   - Staff are made aware of Legionnaires’ disease symptoms and diagnostic actions
   - A health risk assessment for the public and staff of exposure to *Legionella* is to be conducted

1. Scenario One: Lowest *Legionella* Trigger Level
   *Legionella* count ≥ 10 and < 100 cfu/mL
   1.1 Review the water treatment hardware and program, including pH controls, levels of biocide and dosing plant reliability
   1.2 Inspect the tower basin and exposed plant items for obvious microbial growths
   1.3 Clean sources of debris collection such as pump suction screens
   1.4 Check site procedures
   1.5 *Legionella* monitoring is to be increased to weekly with sampling from the cooling system basin or return line in the circulation system until two consecutive sample results for *Legionella* of less than 10cfu/mL are received. Return to routine fortnightly monitoring

2. Scenario Two: Lower Trigger Level
   *Legionella* count ≥ 100 and < 1000 cfu/mL and/or HCC ≥ 100,000 and < 5,000,000 cfu/mL
   2.1 Slug dose of chlorine until a free chlorine residual of 1mg/L is reached and maintained for 1 hour
   2.2 Review dosing plant operation to ensure optimal operation and also review water quality parameters to determine any anomalies in water quality that may affect biological activity
   2.3 Record that this action has been completed on TARP Form 1 [Section B]
   2.4 Commence weekly sampling for Legionella / HCC in three to seven days after step 2.1 [Section C]
   2.5 If two consecutive weekly samples return readings of *Legionella* < 100 cfu/mL and HCC < 100,000 cfu/mL then return to routine fortnightly monitoring and treatment program [Sections D, E and F]
   2.6 If any sample returns *Legionella* between 100 and 1000 cfu/mL and/or HCC > 100,000 and < 500,000 cfu/mL then repeat steps 2.1 to 2.4 and consider the application of a biodispersant [Sections D and E]

3. Scenario Three: Upper Trigger Level
   For a *Legionella* count > 1000 cfu/mL and/or HCC > 5,000,000 cfu/mL
   3.1 Slug dose chlorine until a free chlorine residual of 1mg/L is reached and maintained for a minimum of 6 hours
   3.2 Review dosing plant operation to ensure optimal operation and also review water quality parameters to determine any anomalies in water quality that may affect biological activity
3.3 Advise/record action has been completed on TARP Form [Section B]

3.4 Commence weekly sampling for Legionella / HCC in three to seven days after step 3.1 [Section C]

3.5 If two consecutive samples return *Legionella* readings of < 100 cfu/mL or HCC < 100 000 cfu/mL then return to routine fortnightly monitoring and treatment program [Sections D, E and F]

3.6 If any sample returns *Legionella* between 100 and 1000 cfu/mL or HCC between 100,000 and 5,000,000 cfu/mL then return to step 2 and perform steps 2.1 to 2.4 [Sections D and E]

3.7 If re-test sample returns *Legionella* > 1000 cfu/mL and/or HCC > 5,000,000 cfu/mL, then repeat steps 3.1 to 3.3 and dose biodispersant to 10mg/L [Sections D and E]
Flowchart 1: TRIGGER ACTION RESPONSE PROTOCOL 1

A notification of site positive *Legionella* / HCC is received

Parts B & C of the Trigger Action Response Protocol for the site positive *Legionella* / HCC is initiated

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**For Legionella and HCC Count**

- **Legionella > 1000 cfu/mL or HCC > 5 000 000 cfu/mL**
  - Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 6 hours, review dosing plant and review water quality
  - Dose bio dispersant at 10 mg/L
  - Complete Section C

- **Legionella > 100 & < 1000 cfu/mL and / or HCC > 1 000 000 & <5 000 000 cfu/mL**
  - Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Section B

- **Legionella < 100 cfu/mL and HCC <100 000 cfu/mL**
  - In 3 to 7 days sample and retest for *Legionella* and HCC
  - Complete Section C

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**For Legionella and HCC Count**

- **Legionella > 100 & < 1000 cfu/mL and / or HCC > 100 00 & < 5 000 000 cfu/mL**
  - Repeat step & consider bio dispersant

---

**Legionella ≥ 10 and < 100 cfu/mL**

- Review water treatment, inspect, clean, site procedures, weekly monitoring
  - Complete Section B

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella > 1000 cfu/mL or HCC > 5 000 000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 6 hours, review dosing plant and review water quality
  - Dose bio dispersant at 10 mg/L
  - Complete Sections D, E & F

---

**Legionella ≥ 10 & < 100 cfu/mL**

- Review water treatment, inspect, clean, site procedures, weekly monitoring
  - Complete Section B

---

**Legionella < 100 cfu/mL and HCC <100 000 cfu/mL**

- In 3 to 7 days sample and retest for *Legionella* and HCC
  - Complete Section C

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella < 100 cfu/mL and HCC <100 000 cfu/mL**

- In 3 to 7 days sample and retest for *Legionella* and HCC
  - Complete Section C

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E

---

**Legionella ≥ 100 & < 1000 cfu/mL**

- Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality
  - Complete Sections D & E
### SITE TARGETS FOR CONTROL OF LEGIONELLA/HCC

<table>
<thead>
<tr>
<th>Unit</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella</td>
<td>&lt; 100 cfu/mL</td>
</tr>
<tr>
<td>HCC</td>
<td>&lt; 100,000 cfu/mL</td>
</tr>
</tbody>
</table>

*If results are above target Trigger Action Response Protocol 1 is initiated*

### Section A: NOTIFICATION OF POSITIVE LEGIONELLA / HCC

**Reported by:**

**Reported to:**

**Time of notification:**

**Reported origin:**

<table>
<thead>
<tr>
<th>Target</th>
<th>Unit</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella (cfu/mL)</td>
<td>&lt;100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCC (cfu/mL)</td>
<td>&lt;100,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scenario Initiated: None / 1 / 2 / 3

### Section B: ACTION UNDERTAKEN

**Date / Time:**

**Action:** Increase current dose of biocide to achieve 1ppm free residual

<table>
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<tr>
<th>Initiated dose</th>
<th>Rate</th>
<th>Duration</th>
<th>Residual</th>
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<tr>
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<tr>
<td>Biodispersant</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:

### Section C: RETEST RESULTS OF LEGIONELLA / HCC (2)

**Action:** Resample and retest to be taken between 3 and 7 days

**Reported by:**

**Reported to:**

**Time of notification:**

**Reported origin:**

<table>
<thead>
<tr>
<th>Target</th>
<th>Unit</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella (cfu/mL)</td>
<td>&lt;100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCC (cfu/mL)</td>
<td>&lt;100,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Section D: FURTHER ACTION UNDERTAKEN (IF NECESSARY)

Is further action required: YES / NO
If No: wait for second resample and test results
If Yes: Initiate response

Date/Time:

Action: Increase current dose of biocide to achieve 1ppm free residual

<table>
<thead>
<tr>
<th>Initiated dose</th>
<th>Rate</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine</td>
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<tr>
<td>Biodispersant</td>
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</table>

Notes:

Section E: RETEST RESULTS OF LEGIONELLA / HCC (2)

Action: Resample tower for second test

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<th>Reported to:</th>
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<th>Target</th>
<th>Unit</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella (cfu/mL)</td>
<td>&lt; 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCC (cfu/mL)</td>
<td>&lt; 100,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section F: FURTHER ACTION REQUIRED

Is further action required: YES / NO
If No: Go to Section G
If Yes: Initiate response and repeat process until two consecutive results return <100 cfu/mL and HCC < 100 000

Section G: ACKNOWLEDGEMENT OF TWO CONSECUTIVE SAMPLES RETURN READINGS OF NOT DETECTED

Date of not detected sample 1:
Date of not detected sample 2:

From: Date / time: To:

TARP COMPLETED - RETURN TO NORMAL ROUTINE
TRIGGER ACTION RESPONSE PROTOCOL 2 (TARP 2) when using Chlorine Dioxide as a biocide. To be used in conjunction with Form 2 and Flowchart 2

A. Receipt of a National Association of Testing Authorities (NATA) certified report stating a Legionella count of ≥ 10 cfu/mL and/or a Heterotrophic Colony Count (HCC) ≥ 100,000 cfu/mL initiates TARP 2.

B. The appropriate trigger action response scenario for the site is initiated. [Section A on TARP Form 2 is completed].

C. The following strategies are immediately activated:
   - Appropriate site-supervising staff are notified
   - Public access to the site is restricted
   - Staff in close proximity are to wear appropriate personal protective equipment (PPE)
   - Staff are made aware of Legionnaires’ disease symptoms and diagnostic actions
   - A health risk assessment for the public and staff of exposure to Legionella is to be conducted

1. Scenario One: Lower Legionella Trigger Level
   Legionella count ≥ 10 and < 100 cfu/mL
   1.1 Review the water treatment hardware and program, including pH controls, levels of biocide and dosing plant reliability
   1.2 Inspect the tower basin and exposed plant items for obvious microbial growths
   1.3 Clean sources of debris collection such as pump suction screens
   1.4 Check site procedures
   1.5 Legionella monitoring is to be increased to weekly with sampling from the cooling system basin or return line in the circulation system until two consecutive sample results for Legionella of less than 10 cfu/mL are received and return to normal monitoring

2. Scenario Two: Lower Trigger Level
   For a Legionella count ≥ 100 and < 1000 cfu/mL and/or HCC > 100,000 and < 5,000,000 cfu/mL
   2.1 Dose 60 kg/hr of chlorine dioxide for 3 hours (continuously)
   2.2 Review dosing plant operation to ensure optimal operation and also review water quality.
   2.3 Record action has been completed on TARP Form 2 [Section B]
   2.4 Commence weekly sampling for Legionella/HCC in three to seven days after step 2.1 [Section C]
   2.5 If two consecutive samples return readings of Legionella of < 100 cfu/mL and HCC < 100,000 cfu/mL return to routine fortnightly monitoring and treatment program [Sections D, E and F]
   2.6 If any sample returns Legionella between 100 and 1000 cfu/mL and/or HCC is between 100 000 and 5 000 000 cfu/mL then repeat steps 2.1 to 2.3 and consider the application of bio dispersant. [Sections D and E]

3. Scenario Three: Upper Trigger Level
   For a Legionella count > 1000 cfu/mL or HCC > 5 000 000 cfu/mL
   3.1 Dose 60 kg/hr of chlorine dioxide for 5 hours (continuously) and after dose increase blowdown (as high as possible)
   3.2 Dose bio-dispersant at 10mg/L
   3.3 Advise / record action has been completed on TARP Form 2 [Section B]
3.4 Commence weekly sampling for Legionella / HCC in three to seven days after step 3.1 [section C]

3.5 If two consecutive samples return readings of Legionella of < 100 cfu/mL and HCC < 100 000 cfu/mL return to routine fortnightly monitoring and treatment program [Sections D, E and F]

3.6 If any sample returns Legionella of between 100 and 1000 cfu/mL or HCC of between 100 000 and 5 000 000 cfu/mL then return to step 3.1 and perform steps 3.1 to 3.4 [Sections D and E]

3.7 If the first re-test sample returns Legionella >1000 cfu/mL and/or HCC > 5 000 000 cfu/mL, then dose 60kg/hr of chlorine dioxide for 8 hours and dose bio dispersant to 20 mg/L [Sections D and E]
Flowchart 2: TRIGGER ACTION RESPONSE PROTOCOL 2

A notification of site positive *Legionella* / HCC is received

Parts B & C of the Trigger Action Response Protocol for the site positive *Legionella* / HCC is initiated

**For Legionella and HCC Count**

- **Legionella > 100 & < 1000**
cfu/mL and / or HCC > 1 000 000 & < 5 000 000 cfu/mL:
  - Immediate action for the cooling tower is dose 60 kg/hr chlorine dioxide for 3 hours continuously, review dosing plant and review water quality

- **Legionella > 1000 cfu/mL** or HCC > 5 000 000 cfu/mL:
  - Immediate action for cooling tower is dose 60 kg/hr of chlorine dioxide for 5 hours continuously and increase blowdown, dose dispersant at 10 mg/L

- **Legionella ≥ 10 and < 100**
cfu/mL:
  - Review water treatment, inspect, clean, site procedures, weekly monitoring

- **Legionella < 100 cfu/mL** and HCC <100 000 cfu/mL:
  - Repeat step & consider bio dispersant

- **Legionella > 100 & < 1000 cfu/mL**
  and / or HCC >100 00 & < 5 000 000 cfu/mL:
  - Complete Sections D & E

  - Dose ClO2 @60 kg/hr for 8 hours with 20 mg/L bio dispersant

- **Legionella ≥ 10 and < 100**
cfu/mL:
  - Complete Section B

- **Legionella ≥ 10 and < 100**
cfu/mL:
  - Complete Section C

- **Legionella ≥ 10 and < 100**
cfu/mL:
  - Complete Sections D, E & F

- **Legionella ≥ 10 and < 100**
cfu/mL:
  - Complete Section G

- **Legionella > 100 & < 1000**
cfu/mL and / or HCC >100 00 & < 5 000 000 cfu/mL:
  - Complete Section A

- **Legionella < 100 cfu/mL** and HCC <100 000 cfu/mL:
  - Resume routine fortnightly monitoring and treatment program
TRIGGER ACTION RESPONSE PROTOCOL 2 FORM  
(for use with TARP 2 Flowchart)

SITE TARGETS FOR CONTROL OF LEGIONELLA/HCC

<table>
<thead>
<tr>
<th>Unit</th>
<th>Target</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella</td>
<td>&lt; 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCC</td>
<td>&lt; 100,000</td>
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</tbody>
</table>

If results are above target Trigger Action Response Protocol is initiated

Section A: NOTIFICATION OF POSITIVE LEGIONELLA / HCC

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<th>Received from:</th>
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<th>Reported origin:</th>
</tr>
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<tbody>
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<table>
<thead>
<tr>
<th>Target</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella (cfu/mL)</td>
<td>&lt; 100</td>
<td></td>
</tr>
<tr>
<td>HCC (cfu/mL)</td>
<td>&lt; 100,000</td>
<td></td>
</tr>
</tbody>
</table>

Scenario Initiated: None / 1 / 2 / 3

Section B: ACTION UNDERTAKEN

Date / Time: 
Action: Double current dose of biocide and addition of bio-dispersant

<table>
<thead>
<tr>
<th>Initiated dose</th>
<th>Rate</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine Dioxide</td>
<td>60kg/hr</td>
<td>3 hrs</td>
</tr>
<tr>
<td>Biodispersant</td>
<td>20 ppm</td>
<td>Slug dose</td>
</tr>
</tbody>
</table>

Notes:

Section C: RETEST RESULTS OF LEGIONELLA / HCC (2)

Action: Resample to be undertaken within 3 to 7 days

<table>
<thead>
<tr>
<th>Received from:</th>
<th>Time of notification:</th>
<th>Reported origin:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received by:</td>
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<table>
<thead>
<tr>
<th>Target</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella (cfu/mL)</td>
<td>&lt; 100</td>
<td></td>
</tr>
<tr>
<td>HCC (cfu/mL)</td>
<td>&lt; 100,000</td>
<td></td>
</tr>
</tbody>
</table>
Section D: FURTHER ACTION UNDERTAKEN (IF NECESSARY)

Further action required: yes / no

If No: wait for second resample and test results
If Yes: Initiate response

Date / Time:
Action: Double current dose of biocide and addition of bio-dispersant

<table>
<thead>
<tr>
<th>Initiated dose</th>
<th>Rate</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine Dioxide</td>
<td>60kg/hr</td>
<td>hrs</td>
</tr>
<tr>
<td>Biodispersant</td>
<td>20 ppm</td>
<td>Slug Dose</td>
</tr>
</tbody>
</table>

Notes:

Section E: Resample Tower for Second Test

RETEST RESULTS OF LEGIONELLA / HCC (2)

Received from:
Received by:
Time of notification:
Reported origin:

<table>
<thead>
<tr>
<th>Target</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella (cfu/mL)</td>
<td>&lt;100</td>
<td></td>
</tr>
<tr>
<td>HCC (cfu/mL)</td>
<td>&lt; 100,000</td>
<td></td>
</tr>
</tbody>
</table>

Section F: FURTHER ACTION REQUIRED

Is further action required: YES / NO

If No: Go to Section G
If Yes: Initiate response and repeat process until two consecutive results return <100 cfu/mL and HPC < 100,000 cfu/mL

Section G: ACKNOWLEDGEMENT OF TWO CONSECUTIVE SAMPLES RETURN READINGS OF NOT DETECTED

Date of not detected sample 1:
Date of not detected sample 2:

From:
To:
Date / time:

TARP COMPLETED - RETURN TO NORMAL ROUTINE
 PART B – Bayswater Power Station

Introduction

Part B of this document applies only to the main water cooling systems of the thermal power station of Bayswater. It only applies to the main industrial application and not to any comfort water cooling systems serving office or residential accommodation.

Part A of this document applies to the thermal power stations of Wallerawang and Mt Piper.

AS/NZS 3666.3:2011 – Section 3.2 and 3.3 (Replacement)

3.2 Presence of Legionella

3.2.1 Monitoring: A representative sample of cooling water shall be taken in accordance with Appendix A, at least fortnightly when the system is in use, and assessed in accordance with 3.2.2.

3.2.2 Assessment: An examination for the presence of Legionella shall be carried out in accordance with AS/NZS 3896.

3.2.3 Control: If Legionella are detected ≥ 10 cfu/mL then implement either of the following:

A) Trigger Action Response Protocol 3 (TARP 3) for an oxidising biocide of gas chlorine, sodium hypochlorite etc., or

B) Trigger Action Response Protocol 4 (TARP 4) for chlorine dioxide,

3.3 Presence of other Heterotrophic Microorganisms

3.3.1 Monitoring: A representative sample of cooling water shall be taken in accordance with Appendix A, at least fortnightly when the system is in use, and assessed in accordance with 3.2.2.

3.3.2 Assessment: A heterotrophic colony count (HCC) test shall be carried out in accordance with AS 4276.3.1 using the 35°C/37°C method.

3.3.3 Control: If the HCC result ≥ 100,000 cfu/mL then implement either of the following:

A) Trigger Action Response Protocol 3 (TARP 3) for an oxidising biocide of gas chlorine, sodium hypochlorite etc, or

B) Trigger Action Response Protocol 4 (TARP 4) for chlorine dioxide.
TRIGGER ACTION RESPONSE PROTOCOL 3 (TARP 3) when using an oxidising biocide i.e. gas chlorine, sodium hypochlorite. To be used in conjunction with Form 3 and Flowchart 3.

A. Receipt of a National Association of Testing Authorities (NATA) certified report stating a Legionella count of ≥ 10 cfu/mL and/or a Heterotrophic Colony Count (HCC) ≥ 100,000 cfu/mL initiates TARP 3.

B. The appropriate trigger action response scenario for the site is initiated according to the sample results. [Section A on TARP Form 3 is then completed].

C. The following strategies are immediately activated:
   • Appropriate site-supervising staff are notified
   • Public access to the site is restricted
   • Staff in close proximity are to wear appropriate personal protective equipment (PPE)
   • Staff are made aware of Legionnaires’ disease symptoms and diagnostic actions
   • A health risk assessment for the public and staff of exposure to Legionella is to be conducted

1. Scenario One: Lowest Legionella Trigger Level
   Legionella count ≥ 10 and < 100 cfu/mL
   1.1 Review the water treatment hardware and program, including pH controls, levels of biocide and dosing plant reliability
   1.2 Inspect the tower basin and exposed plant items for obvious microbial growths
   1.3 Clean sources of debris collection such as pump suction screens
   1.4 Check site procedures
   1.5 Legionella monitoring is to be increased to weekly with sampling from the cooling system basin or return line in the circulation system until two consecutive sample results for Legionella of less than 10 cfu/mL are received. Return to routine fortnightly monitoring

2. Scenario Two: Lower Trigger Level
   Legionella count ≥ 100 and < 300 cfu/mL and/or HCC ≥ 100,000 and < 3,000,000 cfu/mL
   2.1 Consider slug dose of chlorine until a free chlorine residual of 1mg/L is reached and maintained for 1 hour based on assessment of multiple biological count results, trends, plant condition, residual chlorine levels and visible biological growth. (Slug dose to a free chlorine residual of 1mg/L is not mandatory in response to only one sample result in this range)
   2.2 Review dosing plant operation to ensure optimal operation and also review water quality parameters to determine any anomalies in water quality that may affect biological activity
   2.3 Record that this action has been completed on TARP Form 3 [Section B]
   2.4 Commence weekly sampling for Legionella / HCC in three to seven days after step 2.1 [Section C]
   2.5 If two consecutive weekly samples return readings of Legionella < 100 cfu/mL and HCC < 100,000 cfu/mL then return to routine fortnightly monitoring and treatment program [Sections D, E and F]
   2.6 If any sample returns Legionella between 100 and 1000 cfu/mL and/or HCC > 100,000 and < 500,000 cfu/mL then initiate Scenario 3 and consider the application of a biodispersant [Sections D and E]
3. Scenario Three: Middle Trigger Level
Legionella count ≥ 300 and < 1,000 cfu/mL and/or HCC ≥ 300,000 and < 5,000,000 cfu/mL

3.1 Slug dose of chlorine until a free chlorine residual of 1 mg/L is reached and maintained for 1 hour

3.2 Review dosing plant operation to ensure optimal operation and also review water quality parameters to determine any anomalies in water quality that may affect biological activity

3.3 Record that this action has been completed on TARP Form 3 [Section B]

3.4 Commence weekly sampling for Legionella / HCC in three to seven days after step 3.1 [Section C]

3.5 If two consecutive weekly samples return readings of Legionella < 100 cfu/mL and HCC < 100,000 cfu/mL then return to routine fortnightly monitoring and treatment program [Sections D, E and F]

3.6 If any sample returns Legionella between 300 and 1,000 cfu/mL and/or HCC > 300,000 and < 5,000,000 cfu/mL then repeat steps 3.1 to 3.4 and consider the application of a biodispersant [Sections D and E]

4. Scenario Four: Upper Trigger Level
For a Legionella count > 1,000 cfu/mL and/or HCC > 5,000,000 cfu/mL

4.1 Slug dose chlorine until a free chlorine residual of 1 mg/L is reached and maintained for a minimum of 1 hour, recording dose rate and time to reach 1 mg/L free chlorine residual

4.2 Repeat the slug dose 24 hours later in accordance with 4.1

4.3 Assess the effectiveness of the two slug doses by comparing the relative times taken to reach 1 mg/L free chlorine residual

4.4 Review dosing plant operation to ensure optimal operation and also review water quality parameters to determine any anomalies in water quality that may affect biological activity

4.5 Advise/record action has been completed on TARP 3 Form [Section B]

4.6 Commence weekly sampling for Legionella / HCC in three to seven days after step 4.1 [Section C]

4.7 If two consecutive samples return Legionella readings of < 100 cfu/mL or HCC < 100,000 cfu/mL, then return to Scenario 1. [Sections D, E and F]

4.8 If any sample returns Legionella between 100 and 1,000 cfu/mL or HCC between 100,000 and 5,000,000 cfu/mL then return to Scenario 3 and perform steps 3.1 to 3.4 [Sections D and E]

4.9 If re-test sample returns Legionella > 1000 cfu/mL and/or HCC > 5,000,000 cfu/mL, then repeat steps 4.1 to 4.3 and dose biodispersant to 10 mg/L [Sections D and E]
Flowchart 1: TRIGGER ACTION RESPONSE PROTOCOL 3

A notification of site positive Legionella / HCC is received

Parts B & C of the Trigger Action Response Protocol for the site positive Legionella / HCC is initiated

Complete Section A

For Legionella and HCC Count

Legionella > 300 & < 1,000 cfu/mL

HCC > 3,000,000 & < 5,000,000 cfu/mL

Immediate action for the cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality. Commence weekly sampling.

Complete Sections D & E

Repeat step & consider bio dispersant

Legionella > 300 & < 1,000 cfu/mL

HCC > 300,000 & < 5,000,000 cfu/mL

For Legionella and HCC Count

Legionella ≥ 10 and < 300 cfu/mL

Review water treatment, inspect, clean, site procedures, weekly monitoring. Consider chlorine slug dose to 1 mg/L based on weekly trends

Complete Section B

Immediate action for cooling tower is slug dose chlorine at 1 mg/L for 1 hour, review dosing plant and review water quality. Repeat slug dose 24 hours later to 1 mg/L for 1 hour.

Complete Sections D, E & F

Dose bio dispersant at 10 mg/L

Legionella > 1,000 cfu/mL

HCC > 5,000,000 cfu/mL

In 3 to 7 days sample and retest for Legionella and HCC

Complete Section C

Legionella ≥ 10 and < 300 cfu/mL

HCC >300,000 & < 5,000,000 cfu/mL

For Legionella and HCC Count

Legionella < 100 cfu/mL

HCC <100,000 cfu/mL

Once 2 satisfactory samples have been received Legionella < 10 cfu/mL and HCC <100,000 cfu/mL

Complete Sections D, E & F

Resume routine fortnightly monitoring and treatment program

Complete Section G

Legionella > 1,000 cfu/mL

HCC > 5,000,000 cfu/mL

Legionella > 1,000 cfu/mL

HCC > 5,000,000 cfu/mL

Complete Section C

Legionella ≥ 10 and < 300 cfu/mL

HCC >300,000 & < 5,000,000 cfu/mL

For Legionella and HCC Count

Legionella < 100 cfu/mL

HCC <100,000 cfu/mL

Once 2 satisfactory samples have been received Legionella < 10 cfu/mL and HCC <100,000 cfu/mL

Complete Sections D, E & F

Resume routine fortnightly monitoring and treatment program

Complete Section G
TRIGGER ACTION RESPONSE PROTOCOL 3 FORM
(for use with TARP 3 Flowchart)

SITE TARGETS FOR CONTROL OF LEGIONELLA/HCC

<table>
<thead>
<tr>
<th>Unit</th>
<th>Legionella</th>
<th>HCC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 100 cfu/mL</td>
<td>&lt; 100,000 cfu/mL</td>
</tr>
</tbody>
</table>

*If results are above target Trigger Action Response Protocol 1 is initiated*

Section A: NOTIFICATION OF POSITIVE LEGIONELLA / HCC

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<thead>
<tr>
<th>Reported by:</th>
<th>Time of notification:</th>
<th>Reported origin:</th>
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</thead>
<tbody>
<tr>
<td></td>
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<table>
<thead>
<tr>
<th>Target</th>
<th>Unit</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella (cfu/mL)</td>
<td>&lt;100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCC (cfu/mL)</td>
<td>&lt;100,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scenario Initiated: None / 1 / 2 / 3

Section B: ACTION UNDERTAKEN

Date / Time:

*Action: Increase current dose of biocide to achieve 1ppm free residual*

<table>
<thead>
<tr>
<th>Initiated dose</th>
<th>Rate</th>
<th>Duration</th>
<th>Residual</th>
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</tr>
<tr>
<td>Biodispersant</td>
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Notes:

Section C: RETEST RESULTS OF LEGIONELLA / HCC (2)

*Action: Resample and retest to be taken between 3 and 7 days*

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<th>Time of notification:</th>
<th>Reported origin:</th>
</tr>
</thead>
<tbody>
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</table>

<table>
<thead>
<tr>
<th>Target</th>
<th>Unit</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legionella (cfu/mL)</td>
<td>&lt;100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCC (cfu/mL)</td>
<td>&lt;100,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
Section D: FURTHER ACTION UNDERTAKEN (IF NECESSARY)
Is further action required: YES / NO
If No: wait for second resample and test results
If Yes: Initiate response
Date/Time:

Action: Increase current dose of biocide to achieve 1ppm free residual

<table>
<thead>
<tr>
<th>Initiated dose</th>
<th>Rate</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td>Chlorine</td>
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<td></td>
</tr>
<tr>
<td>Biodispersant</td>
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</table>

Notes:

Section E: RETEST RESULTS OF LEGIONELLA / HCC (2)
Action: Resample tower for second test

<table>
<thead>
<tr>
<th>Legionella (cfu/mL)</th>
<th>Unit</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 100</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>HCC (cfu/mL)</th>
<th>Unit</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 100,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section F: FURTHER ACTION REQUIRED
Is further action required: YES / NO
If No: Go to Section G
If Yes: Initiate response and repeat process until two consecutive results return <100 cfu/mL and HCC < 100 000

Section G: ACKNOWLEDGEMENT OF TWO CONSECUTIVE SAMPLES RETURN READINGS OF NOT DETECTED
Date of not detected sample 1:  
Date of not detected sample 2:  
From:  
To:  
Date / time:  

TARP COMPLETED - RETURN TO NORMAL ROUTINE
TRIGGER ACTION RESPONSE PROTOCOL 4 (TARP 4) when using Chlorine Dioxide as a biocide. To be used in conjunction with Form 4 and Flowchart 4

A. Receipt of a National Association of Testing Authorities (NATA) certified report stating a Legionella count of ≥ 10 cfu/mL and/or a Heterotrophic Colony Count (HCC) ≥ 100,000 cfu/mL initiates TARP 4.

B. The appropriate trigger action response scenario for the site is initiated. [Section A on TARP Form 4 is completed].

C. The following strategies are immediately activated:
   • Appropriate site-supervising staff are notified
   • Public access to the site is restricted
   • Staff in close proximity are to wear appropriate personal protective equipment (PPE)
   • Staff are made aware of Legionnaires’ disease symptoms and diagnostic actions
   • A health risk assessment for the public and staff of exposure to Legionella is to be conducted

1. Scenario One: Lower Legionella Trigger Level
   Legionella count ≥ 10 and < 100 cfu/mL
   1.1 Review the water treatment hardware and program, including pH controls, levels of biocide and dosing plant reliability
   1.2 Inspect the tower basin and exposed plant items for obvious microbial growths
   1.3 Clean sources of debris collection such as pump suction screens
   1.4 Check site procedures
   1.5 Legionella monitoring is to be increased to weekly with sampling from the cooling system basin or return line in the circulation system until two consecutive sample results for Legionella of less than 10 cfu/mL are received. Return to routine fortnightly monitoring.

2. Scenario Two: Lower Trigger Level
   Legionella count ≥ 100 and < 300 cfu/mL and/or HCC ≥ 100,000 and < 3,000,000 cfu/mL
   2.1 Consider dose of 60 kg/hr of chlorine dioxide for 3 hours (continuously) based on assessment of multiple biological count results, trends, plant condition, and visible biological growth. (Dose of chlorine dioxide is not mandatory in response to only one sample result in this range)
   2.2 Review dosing plant operation to ensure optimal operation and also review water quality parameters to determine any anomalies in water quality that may affect biological activity
   2.3 Record action has been completed on TARP Form 4 [Section B]
   2.4 Commence weekly sampling for Legionella/HCC in three to seven days after step 2.1 [Section C]
   2.5 If two consecutive samples return readings of Legionella of < 100 cfu/mL and HCC < 100,000 cfu/mL return to routine fortnightly monitoring and treatment program [Sections D, E and F]
   2.6 If any sample returns Legionella between 100 and 1000 cfu/mL and/or HCC > 100,000 and < 500,000 cfu/mL then initiate Scenario 3 and consider the application of a biodispersant [Sections D and E]

3. Scenario Three: Middle Trigger Level
   Legionella count ≥ 300 and < 1,000 cfu/mL and/or HCC ≥ 300,000 and < 5,000,000 cfu/mL
   3.1 Dose of 60 kg/hr of chlorine dioxide for 3 hours (continuously)
   3.2 Review dosing plant operation to ensure optimal operation and also review water quality parameters to determine any anomalies in water quality that may affect biological activity
3.3 Record that this action has been completed on TARP Form 4 [Section B]

3.4 Commence weekly sampling for Legionella / HCC in three to seven days after step 3.1 [Section C]

3.5 If two consecutive weekly samples return readings of Legionella < 100 cfu/mL and HCC < 100,000 cfu/mL then return to routine fortnightly monitoring and treatment program [Sections D, E and F]

3.6 If any sample returns Legionella between 300 and 1,000 cfu/mL and/or HCC > 300,000 and < 5,000,000 cfu/mL then repeat steps 3.1 to 3.4 and consider the application of a biodispersant [Sections D and E]

4. Scenario Four: Upper Trigger Level
For a Legionella count > 1,000 cfu/mL and/or HCC > 5,000,000 cfu/mL

4.1 Dose 60 kg/hr of chlorine dioxide for 5 hours (continuously) and after dose increase blowdown (as high as possible)

4.2 Dose bio-dispersant at 10 mg/L

4.3 Review dosing plant operation to ensure optimal operation and also review water quality parameters to determine any anomalies in water quality that may affect biological activity

4.4 Advise/record action has been completed on TARP 4 Form [Section B]

4.5 Commence weekly sampling for Legionella / HCC in three to seven days after step 4.1 [Section C]

4.6 If two consecutive samples return Legionella readings of < 100 cfu/mL or HCC < 100,000 cfu/mL, then return to Scenario 1. [Sections D, E and F]

4.7 If any sample returns Legionella between 100 and 1,000 cfu/mL or HCC between 100,000 and 5,000,000 cfu/mL then return to Scenario 3 and perform steps 3.1 to 3.4 [Sections D and E]

4.8 If the first re-test sample returns Legionella >1,000 cfu/mL and/or HCC > 5,000,000 cfu/mL, then dose 60 kg/hr of chlorine dioxide for 8 hours and dose biodispersant to 20 mg/L [Sections D and E]
A notification of site positive *Legionella* / HCC is received

Parts B & C of the Trigger Action Response Protocol for the site positive *Legionella* / HCC is initiated

**For Legionella and HCC Count**

- **Legionella > 300 & < 1,000 cfu/mL** and / or **HCC > 3,000,000 & < 5,000,000 cfu/mL**
  - Immediate action for the cooling tower is dose 60 kg/hr chlorine dioxide for 3 hours continuously, review dosing plant and review water quality
  - Complete Sections D & E

- **Legionella > 100 & < 1000 cfu/mL** and / or **HCC >100 00 & < 5 000 000 cfu/mL**
  - Repeat step & consider bio dispersant

- **For Legionella and HCC**
  - **Legionella >1000 cfu/mL** or **HCC > 5 000 000 cfu/mL**
    - Immediate action for cooling tower is dose 60 kg/hr of chlorine dioxide for 5 hours continuously and increase blowdown, dose dispersant at 10 mg/L
    - Complete Sections B & C
  - **Legionella > 10 and < 300 cfu/mL**
    - Review water treatment, inspect, clean, site procedures, weekly monitoring. Consider chlorine dioxide dose of 60kg/hr for 3 hours
    - Complete Section B
  - **Legionella < 100 cfu/mL** and **HCC <100 000 cfu/mL**
    - Complete Sections C

- **In 3 to 7 days sample and retest for Legionella and HCC**
  - **Legionella < 10 cfu/mL** and **HCC <100 000 cfu/mL**
    - Complete Sections D, E & F
  - Once 2 satisfactory samples have been received *Legionella < 10 cfu/mL and HCC <100 000 cfu/mL*
    - Complete Sections D, E & F

*Resume routine fortnightly monitoring and treatment program*
/site targets for control of legionella/hcc

<table>
<thead>
<tr>
<th>Unit</th>
<th>Legionella (cfu/mL) &lt; 100</th>
<th>HCC (cfu/mL) &lt; 100,000</th>
</tr>
</thead>
</table>

If results are above target Trigger Action Response Protocol is initiated

section a: notification of positive legionella / hcc

received from: 
received by: 
time of notification: hrs on / /
reported origin: 

target test result time of sample

legionella (cfu/mL) < 100
hcc (cfu/mL) < 100,000

scenario initiated: none / 1 / 2 / 3

section b: action undertaken

date / time: 
action: double current dose of biocide and addition of bio-dispersant

<table>
<thead>
<tr>
<th>initiated dose</th>
<th>rate</th>
<th>duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>chlorine dioxide</td>
<td>60kg/hr</td>
<td>3 hrs</td>
</tr>
<tr>
<td>biodispersant</td>
<td>20 ppm</td>
<td>slug dose</td>
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</tbody>
</table>

notes:

section c: retest results of legionella / hcc (2)

action: resample to be undertaken within 3 to 7 days

time of notification: hrs on / /
reported origin: 

target test result time of sample

legionella (cfu/mL) < 100
hcc (cfu/mL) < 100,000

section d: further action undertaken (if necessary)

further action required: yes / no
if no: wait for second resample and test results
if yes: initiate response

date / time: 
action: double current dose of biocide and addition of bio-dispersant

<table>
<thead>
<tr>
<th>initiated dose</th>
<th>rate</th>
<th>duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>chlorine dioxide</td>
<td>60kg/hr</td>
<td>hrs</td>
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<tr>
<td>biodispersant</td>
<td>20 ppm</td>
<td>slug dose</td>
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</table>

notes:
Section E: Resample Tower for Second Test

RETEST RESULTS OF LEGIONELLA / HCC (2)

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<th>Received by:</th>
<th>Time of notification:</th>
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</table>

<table>
<thead>
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<th>Legionella (cfu/mL)</th>
<th>HCC (cfu/mL)</th>
<th>Target</th>
<th>Test result</th>
<th>Time of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100</td>
<td>&lt; 100,000</td>
<td></td>
<td></td>
<td>: hrs on / /</td>
</tr>
</tbody>
</table>

Section F: FURTHER ACTION REQUIRED
Is further action required: YES / NO
If No: Go to Section G
If Yes: Initiate response and repeat process until two consecutive results return <100 cfu/mL and HCC < 100,000 cfu/mL

Section G: ACKNOWLEDGEMENT OF TWO CONSECUTIVE SAMPLES RETURN READINGS OF NOT DETECTED
Date of not detected sample 1: 
Date of not detected sample 2: 
From: 
To: 
Date / time: 

TARP COMPLETED - RETURN TO NORMAL ROUTINE