THERMAL POWER STATION MAIN COOLING WATER SYSTEMS - TRIGGER ACTION RESPONSE PROTOCOLS (TARPS)

Section 11, Public Health Regulation 2022

Version History:

Version	Date	Amendments
1	July 2012	Original
2	September 2022	Public Health Regulation year, section numbers and correction of typographical errors.

PART A – Wallerawang and Mt Piper Power Stations

Introduction

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

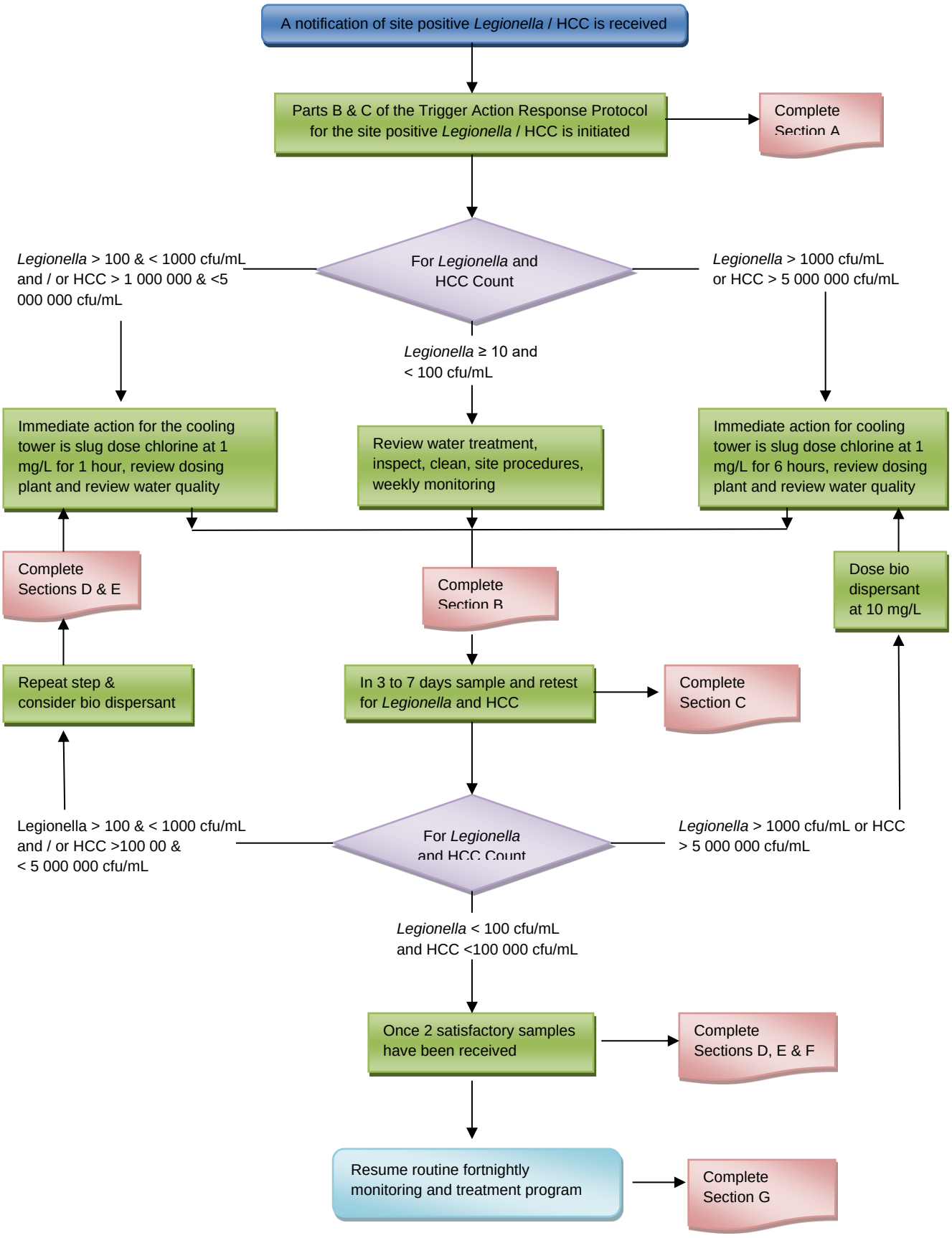
3.4 Commence weekly sampling for Legionella / HCC in three to seven days after step 3.1 [S*ection C*]

3.5 If two consecutive samples return *Legionella* readings of < 100 cfu/mL or HCC < 100 000 cfu/ 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



TRIGGER ACTION RESPONSE PROTOCOL 1 FORM
(for use with TARP 1 Flowchart)

SITE TARGETS FOR CONTROL OF LEGIONELLA/HCC

Unit:	Legionella	*< 100 cfu/mL*
	HCC	*< 100,000 cfu/m*

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

Section A: NOTIFICATION OF POSITIVE LEGIONELLA / HCC

Reported by:		*Time of notification:*	: hrs on / /
Reported to:		*Reported origin:*	

	Target	Unit	Test result	Time of sample
Legionella (cfu/mL)	*<100*			: hrs on / /
HCC (cfu/mL)	*<100,000*			

Scenario Initiated: None / 1 / 2 / 3

Section B: ACTION UNDERTAKEN

Date / Time:

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

	Initiated dose	Rate	Duration	Residual
Chlorine				
Biodispersant				

Notes:

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

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

Reported by:		*Time of notification:*	: hrs on / /
Reported to:		*Reported origin:*	

	Target	Unit	Test result	Time of sample
Legionella (cfu/mL)	*<100*			: hrs on / /
HCC (cfu/mL)	*<100,000*			

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*

	Initiated dose	Rate	Duration
Chlorine			
Biodispersant			

Notes:

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

Action: Resample tower for second test

Reported to:		*Time of notification:*	: hrs on / /
Reported by:		*Reported origin:*	

	Target	Unit	Test result	Time of sample
Legionella (cfu/mL)	*< 100*			: hrs on / /
HCC (cfu/mL)	*< 100,000*			

Section F: FURTHER ACTION RQUIRED

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 10cfu/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]

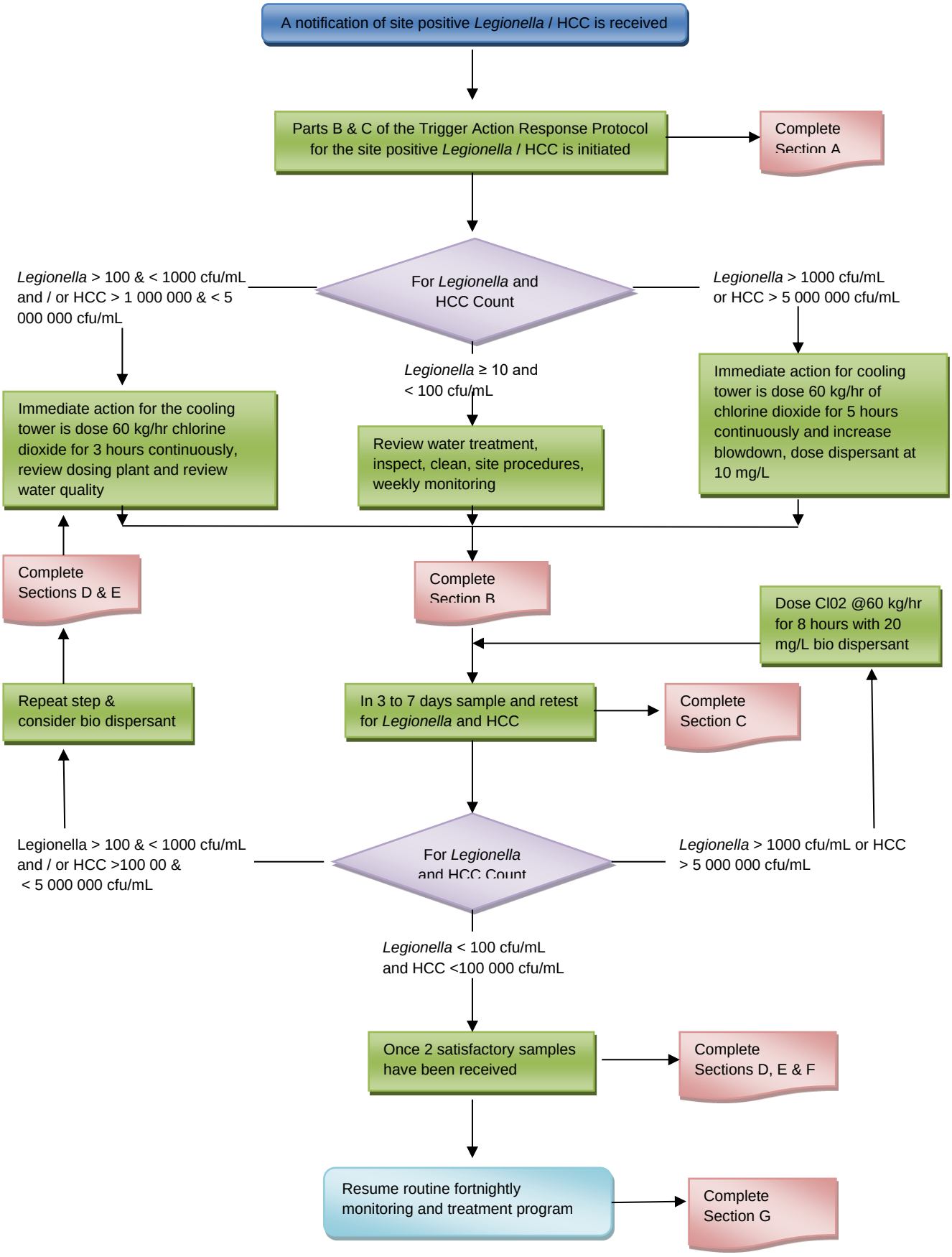
3.4 Commence weekly sampling for Legionella / HCC in three to seven days after step 3.1 [*section C*]

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



TRIGGER ACTION RESPONSE PROTOCOL 2 FORM
(for use with TARP 2 Flowchart)

SITE TARGETS FOR CONTROL OF LEGIONELLA/HCC

Unit:	Legionella	*< 100 cfu/mL*
	HCC	*< 100,000 cfu/mL*

If results are above target Trigger Action Response Protocol is initiated

Section A: NOTIFICATION OF POSITIVE LEGIONELLA / HCC

Received from:		*Time of notification:*	: hrs on / /
Received by:		*Reported origin:*	

	Target	Test result	Time of sample
Legionella (cfu/mL)	*< 100*		: hrs on / /
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*

	Initiated dose	Rate	Duration
Chlorine Dioxide		60kg/hr	3 hrs
Biodispersant		20 ppm	Slug dose

Notes:

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

Action: Resample to be undertaken within 3 to 7 days

Received from:		*Time of notification:*	: hrs on / /
Received by:		*Reported origin:*	

	Target	Test result	Time of sample
Legionella (cfu/mL)	*< 100*		: hrs on / /
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

	Initiated dose	Rate	Duration
Chlorine Dioxide		60kg/hr	hrs
Biodispersant		20 ppm	Slug Dose

Notes:

Section E: Resample Tower for Second Test

RETEST RESULTS OF LEGIONELLA / HCC (2)

Received from:		*Time of notification:*	: hrs on / /
Received by:		*Reported origin:*	

	Target	Test result	Time of sample
Legionella (cfu/mL)	*<100*		: hrs on / /
HCC (cfu/mL)	*< 100,000*		

Section F: FURTHER ACTION RQUIRED

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:		*Date / time:*	
To:			

TARP COMPLETED - RETURN TO NORMAL ROUTINE

THERMAL POWER STATION MAIN COOLING WATER SYSTEMS - TRIGGER ACTION RESPONSE PROTOCOLS (TARPS)

PART B – Bayswater Power Station

Introduction

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

3.2.1 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: A heterotrophic colony count (HCC) test shall be carried out in accordance with AS 4276.3.1 using the 35°C/37°C method.
3.2.3 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,

shall be implemented.

TRIGGER ACTION RESPONSE PROTOCOL 3 (TARP 3) when using an oxidising biocide i.e., gas chlorine or 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 1mg/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 1mg/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*]

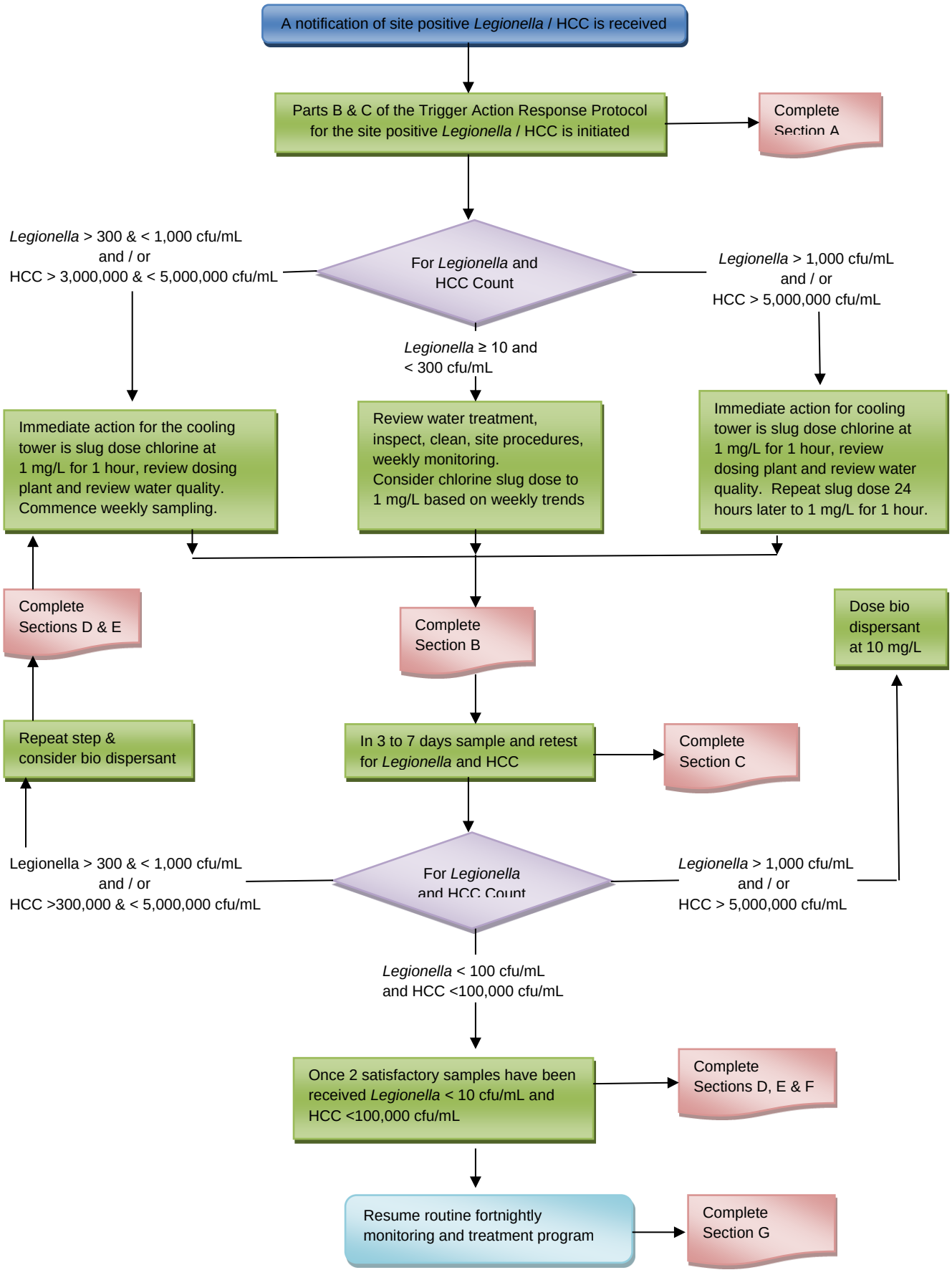
4.6 Commence weekly sampling for Legionella / HCC in three to seven days after step 4.1 [S*ection C*]

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 10mg/L [*Sections D and E*]

Flowchart 1: TRIGGER ACTION RESPONSE PROTOCOL 3



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

SITE TARGETS FOR CONTROL OF LEGIONELLA/HCC

Unit:	Legionella	*< 100 cfu/mL*
	HCC	*< 100,000 cfu/mL*

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

Section A: NOTIFICATION OF POSITIVE LEGIONELLA / HCC

Reported by:		*Time of notification:*	: hrs on / /
Reported to:		*Reported origin:*	

	Target	Unit	Test result	Time of sample
Legionella (cfu/mL)	*<100*			: hrs on / /
HCC (cfu/mL)	*<100,000*			

Scenario Initiated: None / 1 / 2 / 3

Section B: ACTION UNDERTAKEN

Date / Time:

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

	Initiated dose	Rate	Duration	Residual
Chlorine				
Biodispersant				

Notes:

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

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

Reported by:		*Time of notification:*	: hrs on / /
Reported to:		*Reported origin:*	

	Target	Unit	Test result	Time of sample
Legionella (cfu/mL)	*<100*			: hrs on / /
HPC (cfu/mL)	*<100,000*			

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

	Initiated dose	Rate	Duration
Chlorine			
Biodispersant			

Notes:

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

Action: Resample tower for second test

Reported to:		*Time of notification:*	: hrs on / /
Reported by:		*Reported origin:*	

	Target	Unit	Test result	Time of sample
Legionella (cfu/mL)	*< 100*			: hrs on / /
HCC (cfu/mL)	*< 100,000*			

Section F: FURTHER ACTION RQUIRED

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 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

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*]

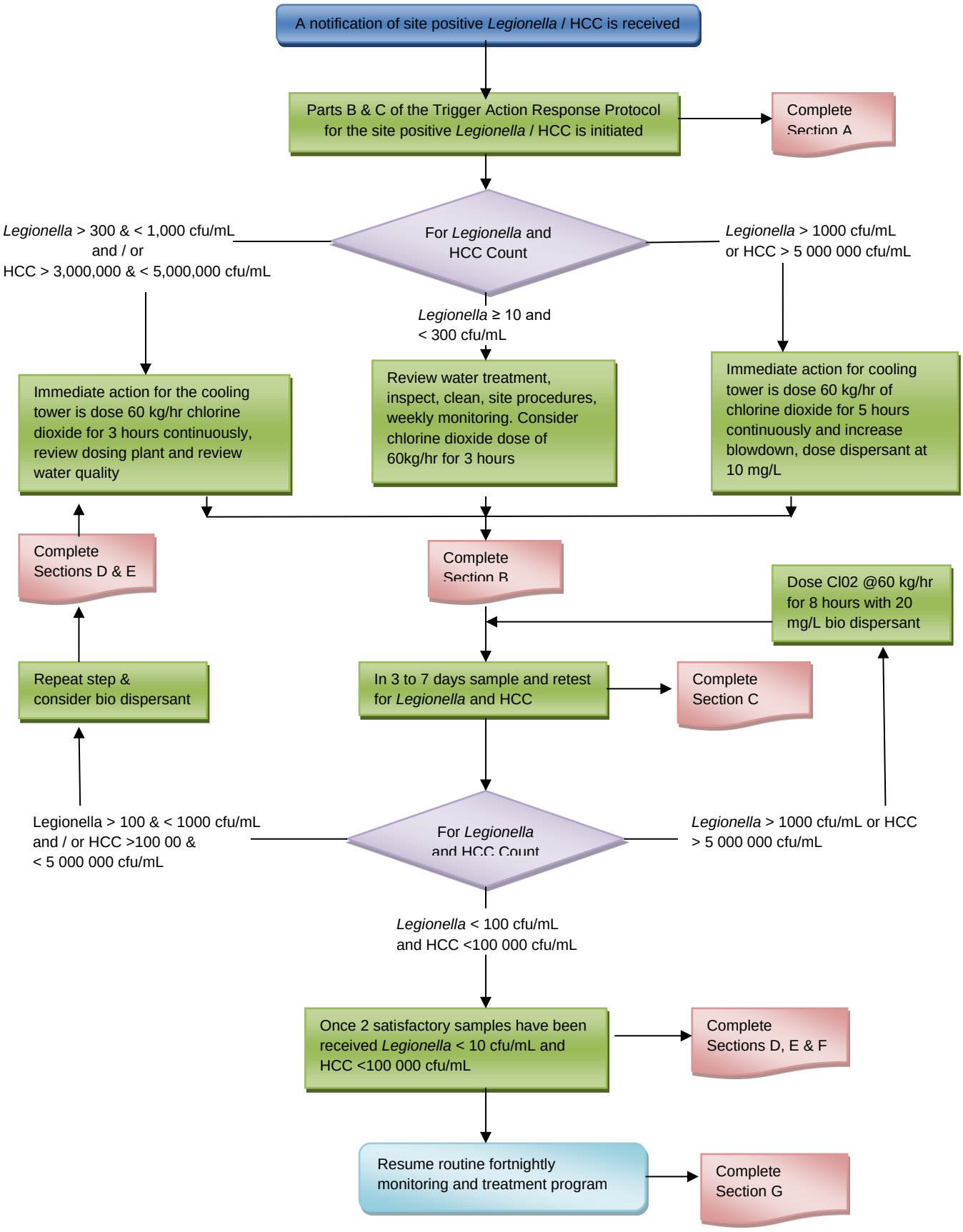
4.5 Commence weekly sampling for Legionella / HCC in three to seven days after step 4.1 [S*ection C*]

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*]

Flowchart 4: TRIGGER ACTION RESPONSE PROTOCOL 4



TRIGGER ACTION RESPONSE PROTOCOL 4 FORM
(for use with TARP 4 Flowchart)

SITE TARGETS FOR CONTROL OF LEGIONELLA/HCC

Unit:	Legionella	*< 100 cfu/mL*
	HCC	*< 100,000 cfu/mL*

If results are above target Trigger Action Response Protocol is initiated

Section A: NOTIFICATION OF POSITIVE LEGIONELLA / HCC

Received from:		*Time of notification:*	: hrs on / /
Received by:		*Reported origin:*	

	Target	Test result	Time of sample
Legionella (cfu/mL)	*< 100*		: hrs on / /
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

	Initiated dose	Rate	Duration
Chlorine Dioxide		60kg/hr	3 hrs
Biodispersant		20 ppm	Slug dose

Notes:

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

Action: Resample to be undertaken within 3 to 7 days

Received from:		*Time of notification:*	: hrs on / /
Received by:		*Reported origin:*	

	Target	Test result	Time of sample
Legionella (cfu/mL)	*< 100*		: hrs on / /
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

	Initiated dose	Rate	Duration
Chlorine Dioxide		60kg/hr	hrs
Biodispersant		20 ppm	Slug Dose

Notes:

Section E: Resample Tower for Second Test

RETEST RESULTS OF LEGIONELLA / HCC (2)

Received from:		*Time of notification:*	: hrs on / /
Received by:		*Reported origin:*	

	Target	Test result	Time of sample
Legionella (cfu/mL)	*<100*		: hrs on / /
HCC (cfu/mL)	*< 100,000*		

Section F: FURTHER ACTION RQUIRED

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:		*Date / time:*	
To:			

TARP COMPLETED - RETURN TO NORMAL ROUTINE