Stack Emissions Management
& Ambient Air Quality Monitoring Plan

Bluewaters Power Station

for

Griffin Power Pty Ltd and Griffin Power 2 Pty Ltd

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1. INTRODUCTION

1.1 BLUEWATERS POWER STATION PROPOSAL

Griffin Power Pty Ltd and Griffin Power 2 Pty Ltd (Griffin) proposes to commission and operate a coal-fired power station of up to 416 MW, called Bluewaters Power Station (Bluewaters). It will comprise two identical generating units, Phase I and Phase II, each with a generating capacity of up to 208 MW (net). It is to be located in the proposed Coolangatta Industrial estate immediately adjacent to Griffin Coal Ewington 1 mine development, and approximately 4 km north-east of Collie. The location of the Project in a regional context is shown in Figure 1.

Bluewaters I and II were both subject to a formal level of assessment, set at a Public Environmental Review (PER) under Part IV of the *Environmental Protection Act 1986*. The PER for Bluewaters I was released for public review in May 2004, with Ministerial approval granted in August 2005. The PER for Bluewaters II was released for public review in January 2005, with Ministerial approval granted in May 2006. Approval was obtained from the EPA to amend some characteristics of Bluewaters Project from the EPA on 18 September 2007. The key project characteristics are summarised in Table 1.

Table 1: Key Project Characteristics

Element	Description
General	
Project Purpose	To produce electricity to supply customers generally by the SWIS grid
Project Life	30 – 50 years (indicative only)
Power Plant Type	Subcritical coal fired power station
Power Generating Capacity	Bluewaters I: Up to 208 MW_e (net) Bluewaters II: Up to 208 MW_e (net)
Plant Thermal Efficiency	Bluewaters I: HHV 36.4% - LHV 38.5% Bluewaters II: HHV 36.4% - LHV 38.6%
Plant Operation	Base load operation 24 hours per day, 365 days per year
Shutdown Time	Plant maintenance shutdowns may be scheduled annually
Plant Facilities	
Stacks	2
Height of Stacks	100 m
Boiler	Balanced draft pulverised coal steam generator matched to steam turbine capacity
Steam Turbine	Tandem compound reheat steam turbine with synchronous alternator – 230 MW_e
Cooling Towers	2 sets
Liquid Fuel Storage Tanks	2 x 100,000 litres and 1 x 10,000 litres
Wastewater Treatment	Package treatment plant
Utilities	
Coal Supply	Bluewaters I: 0.97 Mtpa Bluewaters II: 0.97 Mtpa via truck or conveyor owned and operated by Griffin Coal Mining Company
Water Supply	Bluewaters I: 3.25 GL/yr Bluewaters II: 3.25 GL/yr sourced from mine dewatering at Ewington 1
Transmission Line Length	500 m to interconnection point with SWIS

Source: Data presented in this table modified from Griffin (2004) and Griffin (2005).

Further detailed information about the project specifications can be found in the Public Environmental Review documentation for Bluewaters I (Griffin, 2004) and Bluewaters II (Griffin, 2005).

1.2 SCOPE

The Ministerial approval for Bluewaters projects (Statements 000685 and 000724) requires the preparation and implementation of a range of commitments and measures to manage all relevant environmental factors, including the requirement to prepare a Stack Emissions Management and Ambient Air Quality Monitoring Plan (SEMAAQMP). A copy of the relevant Ministerial conditions is provided as Appendix A.

The objectives and scope of this Plan have been prepared in accordance with the Ministerial approval for the project.

The objectives of the plan are:

- to ensure that air emissions from the ongoing operation of the power stations are minimised;
- to ensure that high quality data are available to model and verify ambient air quality; and
- to ensure that an emissions control strategy is in place if required should Bluewaters Power Station Emissions result in an exceedance of the NEPM in Collie.

In order to achieve the above objectives, the plan addresses:

- ongoing management of air emissions during the operation of the power station;
- monitoring of air emissions;
- monitoring of ambient air quality; and
- public reporting of air emissions, ambient air quality and any complaints about air emissions.

The SEMAAQMP is intended to cover the ongoing operations of Bluewaters. The management of potential air quality impacts associated with construction and commissioning activities will be addressed through a separate plan developed in accordance with Griffin's Environmental Management System (EMS).

1.3 STAKEHOLDER CONSULTATION

This SEMAAQMP has been developed in consultation with the following stakeholders:

- Department of Environment and Conservation (DEC) Air Quality Management Branch;
- EPA Service Unit;
- Department of Health;
- Department of Industry and Resources*;
- Department of Planning and Infrastructure*;
- Department of Consumer and Employment Protection*;
- Southwest Development Commission*;
- Shire of Collie*, and
- industry stakeholders* (Griffin Coal, Verve Energy, Premier Coal).

** Representatives of the Collie Basin Management Planning Group.*

The issues raised during consultation with the key stakeholders have been addressed within this Plan.

Following Griffin's presentation to the Collie Basin Management Planning Group and the Coal Futures Group on 18 April 2007, the Group provided a formal response indicating that both groups were satisfied with information provided (Appendix B).

Griffin presented the SEMAAQMP to the Griffin presented the SEM&AAQMP to the Collie Community Reference Group on 14 January 2009 at the Collie Shire offices.

A copy of the minutes from this meeting is provided as Appendix C.

2. REGIONAL CONTEXT

2.1 METEOROLOGY

The predominant winds in the Collie region are south easterly. These occur most frequently on summer mornings. Typically, west to north westerly winds occur during summer afternoons. In winter, strong west to south westerlies predominate during the passage of cold fronts. Wind strengths recorded in the morning range on average from 4 to 10 km/hr throughout the year. Typically, by the afternoon, wind strengths increase to 9 to 13 km/hr (SKM, 2002).

Figure 2 presents the windrose derived from Western Power's meteorological monitoring station in Collie during the period from May 1995 to May 2002.

2.2 SURROUNDING LAND USE

The land surrounding the Bluewaters project is primarily used for farming, forestry and by the coal and power industries. There is a significant area of State Forrest to the south of the Bluewaters project site, Collie Power Station is located immediately to the east, the Ewington II coal mine is located to the south east, and the proposed Ewington I mine site is located to the south. The area to the north of the Bluewaters project site is primarily farmland and plantation timber.

Towns in the vicinity of Bluewaters project include Collie, Cardiff and Shotts. There are also numerous residences located on privately owned farmland in the area. The locations of these towns, urban areas and residences are presented on Figure 1.

2.3 REGIONAL EMISSIONS

The Collie region has a number of significant sources of atmospheric emissions associated with mining, electricity generation and alumina refining, including:

- Muja Power Station;
- Collie Power Station;
- open-cut mines; and
- Worsley Alumina Refinery.

Emissions from these sources contribute to periodic elevated ambient concentrations of sulphur dioxide (SO_2), and to a lesser extent particulate matter (PM), nitrogen dioxide (NO_2) and ozone (O_3) concentrations in the Collie region.

In addition, other human activities such as agricultural development and the use of wood-fired heaters also contribute to particulate emissions in the Collie region.

2.4 AIR QUALITY AND METEOROLOGICAL MONITORING NETWORK

Ambient air quality and meteorological monitoring data are collected by Western Power, Worsley Alumina and the Bureau of Meteorology (BoM) in the Collie region.

Western Power currently operates one monitoring station located in Collie measuring ambient sulphur dioxide, PM_{10} and $PM_{2.5}$ concentrations, and meteorological data. Tapered Element Oscillating Microbalance (TEOM) equipment is used to measure ambient particulate concentrations.

Worsley Alumina undertakes ambient sulphur dioxide, oxides of nitrogen and Total Suspended Particulate (TSP) concentration monitoring as well as meteorological monitoring. Worsley's air quality monitoring sites are located within close proximity of its refinery, although two sites outside of Worsley's mining lease area have been established 8 km to the south south-east and 15 km west north-west of the refinery.

The BoM operates a standard automatic weather station located approximately 2 km east of Collie.

2.5 AIR QUALITY OF COLLIE

A review of published ambient air quality monitoring data for sulphur dioxide, particulate matter, oxides of nitrogen and ozone for the Collie region has been conducted. The review found that sulphur dioxide and PM_{10} concentrations measured in Collie comply with the ambient air quality Standards set out in the National Environmental Protection Measure (NEPM) for ambient air quality (NEPC, 1998).

There is insufficient published ambient air quality monitoring data available to adequately characterise nitrogen dioxide and ozone levels in the Collie region.

A summary of the NEPM Standards for sulphur dioxide and particulate matter is presented in Table 2.

Table 2: Ambient Air Quality NEPM Standards

Pollutant	Status	Maximum Concentration	Averaging Period	Specified Goal
SO_2	Standard	0.20 ppm	1 hour	No more than 1 day per year exceeding standard by 2008
		0.08 ppm	1 day	No more than 1 day per year exceeding standard by 2008
		0.02 ppm	1 year	none
PM_{10}	Standard	50 µg/m^3	1 day	No more than 5 days per year exceeding standard by 2008
$PM_{2.5}$	Advisory Reporting Standard	25 µg/m^3	1 day	Gather data to facilitate a review of the Advisory Reporting Standard
		8 µg/m^3	1 year	

Ambient sulphur dioxide monitoring in Collie over the last five years indicates compliance with the NEPM Standards (Table 3). The highest 1-hour average sulphur dioxide concentration measured during this period approached just over half of the relevant NEPM Standard, whilst typically levels remained less than 10% of the NEPM Standards as indicated by the 90th percentile statistic.

Elevated sulphur dioxide concentrations in Collie are primarily attributable to the significant sources of atmospheric emissions associated with electricity generation in the Collie region.

Table 3: Summary of Ambient SO_2 Monitoring – Collie

Data Period	Maximum Concentration (ppm)	90th Percentile Concentration (ppm)
Maximum 1-hour Average		
2000	0.046	0.014
2001	0.109	0.016
2002	0.044	0.013
2003	0.053	0.016
2004	0.050	0.016
NEPM 1-hour Standard	0.20	
Maximum 24-hour Average		
2000	0.008	0.002
2001	0.020	0.003
2002	0.006	0.002
2003	0.007	0.003
2004	0.008	0.003
NEPM 24-hour Standard	0.08	

Source: *2004 Western Australia Air Monitoring Report (Supplementary)* (DoE 2005)

Ambient monitoring of particulates in Collie for a period of just over six years indicates compliance to the NEPM Standard for PM_{10} (Table 4). The highest 24-hour average PM_{10} concentration measured during this period was 125 µg/m^3 and is equal to 2.5 times the NEPM Standard. However the number of exceedances per year of the NEPM Standard complied with the allowable threshold of five exceedances per year. Typically 24-hour average PM_{10} concentrations remained less than approximately 50% of the NEPM Standard as indicated by the 90th percentile statistic.

In addition to the NEPM Standard for PM_{10}, the Air Quality NEPM sets an Advisory Reporting Standard for $PM_{2.5}$. The purpose of the Advisory Reporting Standard is to gather sufficient data nationally to facilitate a review of the standard as part of a broader review of the Air Quality NEPM. The published data indicates that there were ten days during which the $PM_{2.5}$ concentration measured in Collie was above the 24-hour Advisory Reporting Standard during the period 1 July 2003 and 30 June 2004 (SKM, 2005).

The high PM_{10} and $PM_{2.5}$ levels in Collie are often attributed to smoke from bushfires (either controlled or uncontrolled), and from wood-fired heaters during the winter months.

Table 4: Summary of Ambient Particulate Monitoring – Collie

Statistic	PM_{10}	$PM_{2.5}$ [1]
Years of Data	6.2	1.5
Number of Exceedances of the NEPM 24-hour Standard per Year	0 – 5	10
Average Number of Exceedances per Year	2.2	10
Maximum 24-hour Concentration (µg/m^3)	125	106
90 Percentile 24-hour Concentration (µg/m^3)	26.2	15.9
70 Percentile 24-hour Concentration (µg/m^3)	19.7	10.9
Annual Average Concentration (µg/m^3)	12.0 – 20.1	10.4
Average of all Data (µg/m^3)	17.2	10.4
NEPM 24-hour Standard (µg/m^3)	50	-
NEPM 24-hour Advisory Reporting Standard (µg/m^3)	-	25
NEPM Annual Advisory Reporting Standard (µg/m^3)	-	8

Source: (SKM 2005)

Notes:

1 Published $PM_{2.5}$ data available for the period 1/7/03 to 30/6/04 only.

2 Note statistics for PM_{10} and $PM_{2.5}$ include three separate days in 2001, 2003 and 2004 where the Collie TEOM monitors were overloaded with particulate, resulting in loss of valid data for the rest of the day. The values clearly indicate that exceedances of the relevant 24-hour NEPM Standard would have occurred with maximums probably higher than that reported in the table.

2.6 FUTURE AIR QUALITY MANAGEMENT FRAMEWORK FOR COLLIE

The DEC is working towards the development of an Air Quality Management Plan for Collie and a draft of this was released in March 2007. The goal of the plan is to develop an integrated action plan for the effective management of air emissions in Collie. Key recommendations included increasing public awareness and community education and a undertaking a study to define the appropriate buffer distances for the Coolangatta Industrial Estate in which Bluewaters Power Station is located.

Griffin is willing to work together with Government and other industry to consider any relevant recommendations arising from the Strategic Framework for Air Quality Management in Collie including the provision of its monitoring (emission and ambient) data to assist with the development and implementation of the Collie Air Quality Management Framework.

3. NATURE OF EMISSIONS

The nature of atmospheric emissions from Bluewaters Power Station is similar to other coal fired power stations in that they are primarily of products of combustion such as sulphur dioxide, oxides of nitrogen (NO_x) and carbon monoxide (CO); particulate matter; low levels of Volatile Organic Compounds (VOCs) and fluorides; and trace amounts of heavy metals, Polycyclic Aromatic Hydrocarbons (PAHs), and possibly Persistent Organic Pollutants (POPs) such as dioxins and furans.

Previous modelling undertaken as part of the PER approvals process as well as subsequent updates to modelling undertaken as part of the Section 45C Amendment of air quality impacts for the revised emission parameters have shown that the major pollutant of concern in the Collie air shed to which Bluewaters Power Station will contribute, is SO_2.

Particulate matter emitted from other sources has also historically been a concern but the shutdown of Muja A and B power stations (which were the major industrial source of particulate matter emissions in the region) will result in a significant reduction in the ambient particulate matter concentrations such that they are well below the nominated guideline value. Modelling for all of the other pollutants including metals, VOC's and other criteria pollutants, predicted concentrations well below relevant nominated guideline values.

Table 5 presents a summary of the estimated SO_2 concentration and annual mass emission rate released to atmosphere from Bluewaters Power Station based on the data presented in the Section 45C. To enable comparison, Table 5 also presents the total SO_2 annual emission estimate for existing Collie sources, as reported to the National Pollutant Inventory (NPI) for the 2004/2005 reporting period.

Table 5: Comparison of SO_2 Estimates b/w Bluewaters and Existing Sources

Pollutant	Bluewaters (I and II)			Existing Collie Sources (Muja C+D, Collie A and All Worsley)
	Emission Concentration (1)	Mass Emission Rate	Existing Collie Sources (%)	Mass Emission Rate
SO_2	1,172 mg/Nm^3 (1)	14,500 tpa	25%	57,375 tpa

Notes:
(1) Referenced to 7% oxygen; dry basis.

The data presented in Table 5 indicate that emissions of SO_2 from Bluewaters Power Station are estimated to contribute an additional 25% to sulphur dioxide emissions in the Collie air shed by existing industrial sources on an annual basis. Bluewaters Power Station will generate a total of 416 MW (net) compared to the existing regional generation of 1,424 MW, providing a 29% increase in generating capacity compared to the 25% increase in SO_2 emissions.

3.1 AIR QUALITY MODELLING

A number of air dispersion modelling studies have been undertaken to assess the potential air quality impacts of Bluewaters Power Station in isolation, and potential cumulative impacts arising from Bluewaters Power Station and other existing and approved industry in the Collie region. The most recent of these studies includes that undertaken by ENVIRON (2007) as part of the Section 45C Amendment for Bluewaters Power Station. The revised parameters included:

- an approximate 4% increase in both Bluewaters I and II net power from 200 MW to 208 MW per unit as a result of the generating units selected at the tendering stage of the project;
- a reduction in the maximum sulphur content of the coal, resulting in lower peak sulphur dioxide emission rates;
- the separation of the Bluewaters I and II stacks; and
- the modification of the stack parameters to reflect more up to date information provided by the equipment supplier.

Table 6 presents a summary of the modelling results predicted over the modelled domain and in Collie for SO_2, including the maximum and 9th highest predicted ground level concentrations and the number of days predicted to exceed the NEPM Standard.

Table 6: Summary of Air Dispersion Modelling Results for SO_2

Pollutant	Location	Modelled Parameter	Averaging Period	Units	Bluewaters in Isolation	Background Sources (1)	Cumulative Impact of Bluewaters and Background Sources (1)
Sulphur dioxide	Modelled Domain	Maximum GLC	1-hour	µg/m^3	780	1,054	1,054
		9th Highest GLC			329	427	441
		NEPM Standard			571	571	571
		Exceedance Days		days	1	2	2
		Maximum GLC	24 Hour	µg/m^3	184	198	258
		NEPM Standard			227	227	227
		Exceedance Days		days	0	0	1
	Collie	Maximum GLC	1-hour	µg/m^3	234	305	307
		9th Highest GLC			179	134	204
		NEPM Standard			571	571	571
		Exceedance Days		days	0	0	0
		Maximum GLC	24 Hour	µg/m^3	33	34	38
		NEPM Standard			227	227	227
		Exceedance Days		days	0	0	0

Notes:

1 Background Sources include: Muja C-D, Collie A, Worsley Power Station and Boiler Expansion
"GLC" Ground Level Concentration

From the results presented in Table 6 it can be seen that:

- SO_2 emissions from the Bluewaters project in isolation and cumulatively are predicted to result in one and two days respectively during which the NEPM 1-hour Standard is exceeded over the modelled domain. Isolated exceedances of the NEPM 1-hour Standard are predicted to occur over rural residences located to the north of Collie for the modelled year (see Figure 4). It should be noted however, that the air dispersion modelling was conducted over the period of a single year and as such the locations of the predicted exceedances may shift from year to year;
- cumulative SO_2 emissions from the Bluewaters project and background sources do not result in further increases in the maximum number of days where the NEPM 1 hour Standard is predicted to be exceeded compared with existing levels across the model domain. However, it should be noted that the Bluewaters project, when considered in isolation, is predicted to result in elevated SO_2 concentrations in a number of locations, but particularly to the north of Collie (see Figure 3);
- the SO_2 emissions from the Bluewaters project result in no increase to the maximum 1-hour average ground level concentration predicted across the model domain, which occurs to the southeast of Collie and is due to the emissions from the Muja Power Station. The emissions from the Bluewaters project are predicted to result in increased SO_2 concentrations to the north and northeast of Collie as evidenced by the predicted exceedance of the NEPM 1-hour standard to the north and northeast of Collie; and
- the predicted exceedance of the NEPM 1-hour standard to the north of Collie is an isolated event and was associated with a fumigation event predicted by the model. The second and third highest 1-hour average concentrations predicted across the model as a result of the Bluewaters project emissions considered in isolation were 510 µg/m^3 and 329 µg/m^3 which are both below the NEPM standard. Fumigation events are expected when considering the dispersion of emission from tall stacks. As noted above, the location of the predicted exceedances is likely to change from year to year as meteorological conditions will vary.

The Bluewaters Power Station emissions are not predicted to contribute to any non compliances of the NEPM goal across the model domain.

Contours of the maximum and 9th highest predicted 1-hour average, and maximum 24-hour average ground level concentration of sulphur dioxide associated with emissions from Bluewaters Power Station in isolation, and the cumulative impacts with existing and approved industry, are presented as Figures 3 and 4. While the maximum predicted 1-hour average concentrations have been presented, air dispersion modelling typically use the predicted 9th highest (i.e. 99.9th percentile) 1-hour average concentrations to represent the realistic maximum concentration. The CSIRO (2005) state, for example, that:

> "These yearly maximum 1-hour average concentrations represent the most extreme hour in the year with respect to ground-level concentrations. In a different year with different meteorology the location and magnitude of these yearly maximum 1-hour average concentrations could change. This is why the 9th highest concentration (99.9th percentile) or robust highest concentration (RHC) is often chosen as the key statistic to represent the extremes, rather than the modelled or observed maximum."

The results of the air dispersion modelling have been used to assist with the design of the ambient air quality monitoring program to be implemented by Griffin (refer to Section 5.2).

4. ONGOING MANAGEMENT MEASURES

4.1 TECHNOLOGY

To ensure the effective management of atmospheric emissions from Bluewaters Power Station, Griffin has used a combination of best practicable technology appropriate to the size of the plant to optimise the thermal efficiency of the generating units, and minimise the production and release of atmospheric pollutants from the plant.

The thermal efficiency of the power plant is defined as the ratio of energy sent out to useful energy in. Improving plant thermal efficiency has benefits on two fronts as fuel consumption is reduced, the cost of generation is reduced, and emissions per kWh are also reduced. Use of state of the art coal technology results in Bluewaters having a higher thermal efficiency than older sub-critical plants and will result in less emission per unit of energy produced when compared with similar older coal fired units.

Low NOx burners, combined with staged combustion and over-fire air technology will be employed to minimise the emissions of oxides of nitrogen. Through the installation of low NOx burners, oxides of nitrogen emissions from Bluewaters Power Station will not exceed 500 mg/Nm^3 (as NO_2 at 7% O_2 reference level, dry).

Particulate emissions will be controlled through the installation of fabric filters in the exhaust system. The operation of fabric filters involves passing dust laden gases through the semi porous medium of woven or felted cloth making up the individual filter bags. Fabric filter technology has been selected over alternative dust control technology as it is able to achieve superior dust collection efficiency for smaller sized dust particles (including sub micron sized particles). Particulate emissions from Bluewaters Power Station will not exceed 42 mg/Nm^3 (at 7% O_2 reference level, dry).

Griffin is committed to ensuring that it keeps abreast of technology advances which reduce emissions by Research and Development projects. In addition Griffin continues to contribute financial support to the Cooperative Research Centre (CRC) for Coal in Sustainable Development for further investigation into clean coal technologies.

4.2 COAL SUPPLY

Collie coal, and in particular the coal from Ewington 1 coal mine which will be used to fire Bluewaters Power Station, is low in sulphur and hence results in the generation of less sulphur dioxide emissions than other coal resources. Griffin has indicated that through a range of processes employed at the mine, coal with a maximum sulphur content of 0.38% can be provided to the power station. This coal sulphur level can be achieved through a single or combination of different mechanisms which include:

1. selective mining;
2. blending;
3. washing the coal; and/or
4. beneficiation that removes the higher sulphur pyritic coal.

In addition Griffin intends to test the effectiveness of other methods of reducing the sulphur content in the pulverised coal including in-mill beneficiation that removes the higher sulphur pyritic coal. This would permit the power station to accept higher then 0.38% sulphur coal but ensure that the sulphur dioxide emissions do not exceed 229.9 g/s (averaged over an hour) from a unit operating at full load (MCR) by removing sulphur during the grinding process at the power station. The 0.38% coal will only be supplied when both BW I and II are operational prior to that, BW I may operate on a higher sulphur content coal – as outlined in the Section 45C. The effectiveness of the in-mill beneficiation will be tested in the early stages of operation of Bluewaters.

In order to ensure that Bluewaters Power Station receives coal with a maximum sulphur content of 0.38%, Griffin will:

1. put in place contractual arrangements with its current and any other future coal supplier stating that the maximum sulphur content of the coal that can be accepted by the power station will be 0.38%. This will require any supplier of coal to measure and record the coal sulphur content before it is transported to Bluewaters; and
2. measure the sulphur content of the coal before it is sent to the power station stockpiles. Any coal that exceeds the 0.38% sulphur content threshold will be sent to a separate stockpile and not used within the power station.

4.3 PLANT OPERATIONS AND MAINTENANCE

Griffin will ensure the Low NOx burners and fabric filters are maintained so as to provide optimal emissions reduction. Further the concentrations of carbon monoxide, sulphur dioxide, oxides of nitrogen and particulates (as indicated by opacity) emitted in the exhaust gases will be monitored on a continuous basis. This will ensure emission limits are not exceeded on an ongoing basis.

The robust design of the burners and an effective burner maintenance program will ensure the efficiency of the Low NOx burners in terms of minimising emissions of oxides of nitrogen. As such, Griffin will implement a comprehensive burner maintenance program that will involve inspection and necessary maintenance, if any, at each unit outage, typically every one to two years.

Fabric filters installed to control particulate emissions will be fitted with leak detection to enable broken filter bags to be promptly identified, isolated and repaired. To facilitate effective operation and maintenance of the fabric filters, an inventory of essential equipment spares will be maintained on site at all times.

Table 7 outlines the plant operating and maintenance guidelines that will be implemented by Griffin to ensure the effective ongoing management of atmospheric emissions from the Bluewaters project.

Table 7: Plant Operating and Maintenance Guidelines

Emission	Activity	Frequency/Timing
SO_2	• Blend coal feedstock to maintain the sulphur content at or below 0.38%. • Use of results of continuous emission monitoring to ensure that SO_2 emission rate does not exceed 229.9 g/s (averaged over an hour) per unit. • Use the continuous ambient sulphur dioxide monitoring data at nominated locations to identify if ambient SO_2 concentrations approach or exceed the NEPM standard of 571 µg/m^3. Should this occur and be attributable to the Bluewaters project then develop and implement measures to reduce emissions during these periods.	Continuous
NOx	• Use of results of continuous emissions monitoring to identify when concentrations approach the NOx emission specification of 500 mg/Nm^3 (as NO_2 at 7% O_2 reference level, dry), and initiate corrective action.	Continuously monitor emissions. Initiate corrective action immediately.
NOx	• Implement comprehensive burner maintenance program, including regular inspection and maintenance overhauls if required.	After the first year of operation, and then nominally every 1 to 2 years
Particulates	• Use of results of continuous emissions monitoring to identify when concentrations approach the particulate emission specification of 42 mg/Nm^3 (at 7% O_2 reference level, dry), and initiate corrective action.	Continuously monitor emissions. Initiate corrective action immediately.
CO	• Use of results of continuous emissions monitoring to identify when concentrations approach the carbon monoxide emission specification of 500 mg/Nm^3 (at 7% O_2 reference level, dry), and initiate corrective action.	Continuously monitor emissions. Initiate corrective action immediately.

Real-time emissions monitoring data will be available to power plant operators, who will be required to monitor the trends in the concentration of SO_2, NOx, particulates and CO on a continuous basis. This will provide Griffin with the ability to immediately identify if the concentration of a given pollutant moves outside of the desirable range and starts to trend towards the levels specified in Table 7, and as such anticipate the need for corrective action. Further, where it becomes evident that the corrective action is unlikely to ensure emission concentrations do not exceed the critical levels, Griffin and its contracted Power Station Operator, Transfield Worley Power Services (TWPS), will implement reductions in power generation so as to ensure the emission concentrations do not exceed the levels specified in Table 7.

5. MONITORING PROGRAMS

5.1 EMISSIONS MONITORING PROGRAM

The emissions monitoring program to be implemented for Bluewaters Power Station will include monitoring for the following compounds:

- Sulphur dioxide;
- Particulates (including TSP, PM_{10} and $PM_{2.5}$ particle size fractions);
- Oxides of nitrogen (including NO and NO_2);
- Carbon monoxide;
- Volatile Organic Compounds;
- Metals (including arsenic, cadmium, chromium, lead and mercury);
- Fluorides;
- PAHs; and
- Dioxins and Furans.

The compounds included in the emissions monitoring program cover the criteria pollutants of significance with respect to regional air quality impacts in Collie, as well as those compounds present in the emissions at very low levels that are potentially hazardous to human health.

A Continuous Emissions Monitoring System (CEMS) will be installed to measure the concentration of sulphur dioxide, oxides of nitrogen, carbon monoxide and particulates (opacity measurements will be used as an indicator of particulate loading) on a continuous basis, as discussed in Section 4.3.

In addition, in order to verify the accuracy of mass emission estimates used as the basis for the air quality assessments for the Bluewaters project, a manual stack testing program will be undertaken by TWPS, during the first twelve months of operation (i.e. post commissioning) that covers all of the compounds listed above, and will include quarterly testing of the criteria pollutants (sulphur dioxide, particulates, oxides of nitrogen, carbon monoxide). Following the first twelve months of operation, ongoing annual testing will be conducted by TWPS for the criteria pollutants (sulphur dioxide, particulates, oxides of nitrogen, carbon monoxide), VOCs and potentially other compounds for which ongoing monitoring is deemed to be warranted based on analysis of the first twelve months monitoring results (on the advice of an Air Quality expert and as agreed with the Department of Environment and Conservation (DEC)).

The United States Environmental Protection Agency (USEPA) has published a comprehensive list of methods for measuring air emissions from industrial processes. The USEPA Methods are thoroughly validated, well documented, and are widely recognised by regulatory agencies and stack testing practitioners throughout Australia and internationally. The USEPA Methods will therefore be used as the basis for the stack testing methods to be applied for the emissions monitoring program, including:

- USEPA Method 6 *Determination of Sulphur Dioxide Emissions from Stationary Sources* (or a USEPA Method 6A – 6C alternative);
- USEPA Method 5 *Determination of Particulate Matter Emissions from Stationary Sources;*
- USEPA Method 7 *Determination of Nitrogen Oxides Emissions from Stationary Sources* (or a USEPA Method 7A – 7E alternative);

- USEPA Method 10 *Determination of Carbon Monoxide Emissions from Stationary Sources*;
- USEPA Method 18 *Measurement of Gaseous Organic Compound Emissions by Gas Chromatography*;
- USEPA Method 29 *Determination of Metals Emissions from Stationary Sources;*
- USEPA Method 13B *Determination of Total Fluoride Emissions from Stationary Sources (Specific Ion Electrode Method)*;
- Method 0010 *Modified Method 5 Sampling Train* and USEPA SW-846 *Test Method for Evaluating Solid Waste, Physical/Chemical Methods*; and
- USEPA Method 0023A *Sampling Method for Polychlorinated Dibenzo-p-dioxins and Polychlorinated dibenzofuran Emissions from Stationary Sources*.

Prior to commencement of the emissions monitoring program, advice on the most appropriate test methods to apply given the conditions of the Bluewaters stack discharge will be sought from a suitably qualified stack testing consultant.

In addition to the measurement of pollutant concentrations, additional measurements and supporting information will be gathered during each stack testing campaign to assist with interpretation of the measurement data, such as:

- emission exit velocity and/or volumetric flow rate;
- emissions exit temperature;
- emission moisture;
- generating unit operating throughout;
- status of pollution control equipment; and
- details of coal composition (e.g. sulphur content).

Atmospheric emissions from Bluewaters Power Station will be discharged via two separate 100 m tall stacks; one servicing Bluewaters I and the other servicing Bluewaters II. Sampling ports will be installed on each of the plant, located in duct work between the fabric filter discharge and the ID fans, and will be configured to comply with Australian Standard AS 4323.1-1995 *Stationary Source Emissions Method 1: Selection of Sampling Positions* to enable manual stack testing. The sampling inlet for the CEMS will also be located between the fabric filter discharge and the ID fans.

5.2 AMBIENT MONITORING PROGRAM

5.2.1 Overview

Within the context of this SEMAAQMP, the key findings of the air dispersion modelling assessment completed for the Bluewaters project (refer to Section 3.1) include:

- sulphur dioxide is the most critical pollutant in terms of compliance to the NEPM Standards in Collie;
- the emissions of sulphur dioxide from Bluewaters are predicted to increase the maximum 1-hour average concentrations in and to the north and northeast of Collie;
- ground level concentrations of nitrogen dioxide, carbon monoxide and ozone in Collie are predicted to comfortably comply with the NEPM standards; and

- ground level concentrations of mercury, PAHs and fluoride are predicted to comply with the relevant World Health Organisation (WHO)[1] ambient air quality guidelines and the Australian and New Zealand Environment and Conservation Council (ANZECC) goal.

Accordingly, the results of the air quality assessment indicate that in order to ensure that high quality data are available to model and verify the ambient air quality impacts associated with the Bluewaters project that ambient sulphur dioxide monitoring should be undertaken within Collie and at a location to the north of Collie.

An ambient sulphur dioxide monitoring station is already established in Collie and is operated on behalf of Collie and Muja Power Stations. Griffin proposes to contribute to the cost of operating and maintaining this existing ambient sulphur dioxide monitoring station on an ongoing basis.

Griffin will also establish an ambient monitoring station at a location to the north of Collie in the vicinity of residences in that area to monitor ambient SO_2 concentrations.

The ambient sulphur dioxide concentration monitoring data will be made available to the Bluewaters Power Station control room on a real time basis. Griffin believes that that the existing Collie monitoring station collects 10-minute averages and the new monitoring station will be configured to record 1-minute average data as requested by the DEC. Should Griffin not be able to arrange real time access to the current Collie monitoring station data, then it will establish its own SO_2 monitoring station in Collie.

In the event that the ambient SO_2 monitoring records an exceedance of the NEPM 1-hour standard and this is attributed to the Bluewaters project, then Griffin and TWPS will develop and implement an air quality control strategy with the primary objective of preventing a reoccurrence of these elevated concentrations.

Griffin will also install and operate a SODAR to measure wind speed and wind direction at various heights above the ground. Typically SODARs are configured to produce 10 to 15-minute averages. These upper air wind data would be used as part of any investigation that is undertaken should an exceedance of the NEPM 1-hour standard occur. The location for the SODAR has not selected at this stage, but it is anticipated that it ill be located near the Bluewaters Power Station or between the Bluewaters Power Station and Collie.

The Power Station Operator (TWPS) will arrange for the ambient data to be reviewed by qualified personnel in conjunction with the Bluewaters I and II continuous emissions monitoring data to assess the actual impacts of the power station emissions.

5.2.2 Air Quality Control Strategy

[1] For PAH's, the 1 in 1,000,000 *de minimis* risk level is typically applied by DoH for health risk assessment purposes

If an Air Quality Control Strategy (AQCS) is required to be developed (as a result of an exceedance of the 571 µg/m^3 1-hour standard in Collie or at the proposed monitoring station to the north of Collie, and that the exceedance is attributable to Bluewaters I & II, then the AQCS would be developed by Griffin and TWPS to include both reactive and predictive components.

Reactive control
The reactive components of an AQCS strategy would be based upon:

1. continuous sulphur dioxide emissions monitoring;
2. prevailing wind conditions; and
3. ambient sulphur dioxide concentrations recorded in Collie.

These data would be used to by Griffin and TWPS to assess the requirement to reduce the Bluewaters I & II emissions on a real time basis.

Predictive control
The predictive component of an AQCS would be based on regional specific forecasts obtained from the Bureau of Meteorology that would include information on the predicted wind speeds, wind direction and inversion strength. These data would be used by Griffin and TWPS to reduce its sulphur dioxide emissions for periods where adverse dispersion conditions are predicted to occur.

If these approaches were not sufficient to prevent exceedances of the NEPM 1-hour guideline occurring in Collie as a result of the Bluewaters I and II emissions, then Griffin would look to reduce its emissions through the installation of alternative technological controls.

5.2.3 Contingency Plan for Infrequent Exceedance Events

Should the 1-hour average sulphur dioxide concentration recorded at the Collie or new monitoring station (to be located to the north of Collie) approach or exceed the NEPM standard of 571 µ/m^3 and the wind direction is from the north east, then TWPS will immediately reduce the power generation of the Bluewaters Power Station. The reduction required will be determined from the ratio of the measured concentration and the standard but cannot exceed a total turndown of more than 60%. Griffin expects that it would take approximately 10-minutes to achieve a 25% reduction in power generation by Bluewaters Power Station.

In the event that the ambient sulphur dioxide monitoring data records an exceedance of the NEPM 1-hour standard then Griffin and TWPS would:

1. commence a review of the incident to identify the potential source(s) and conditions under which the exceedance occurred;
2. if that review showed that Bluewaters Power Station emissions had caused or significantly contributed to the incidence then Griffin and TWPS would:
    a. clarify the meteorological conditions under which the incident occurred;
    b. develop and implement a strategy aimed to reduce the risk of such an incident occurring again in the future by reducing its sulphur dioxide emissions when those type of adverse conditions are predicted to occur.

Should the above review indicate that Bluewaters Power Station will be required to periodically reduce its sulphur dioxide emission rate, then strategies that would be implemented to achieve this reduction include:

1. retention of a separate low sulphur coal stockpile which could be used for periods where the adverse conditions are forecast to occur; and
2. reduce power generation during the period that adverse conditions are occurring.

5.2.4 Contingency in Unlikely Event of More Frequent Exceedances of the NEPM Standard

Griffin believes that the risk of exceedances of the NEPM 1-hour sulphur dioxide standard occurring frequently in Collie is very low. However, if the NEPM standard is exceeded frequently in Collie then Griffin will investigate additional emissions control technologies.

5.3 QUALITY ASSURANCE/QUALITY CONTROL

The quality assurance/quality control (QA/QC) procedures described in the Australian Standards and USEPA Methods referred to in this SEMAAQMP will be followed across all components of the methods, including equipment preparation and calibration, use of blanks and duplicate samples, sample collection, sample storage, sample retrieval, sample analysis, and reporting.

The stack testing consultant and laboratories selected to collect the stack samples (and sample media preparation if required) and complete the analysis of the samples will be NATA certified and/or experienced in the use of the required analysis methodologies.

Equipment used for the monitoring programs will be operated and maintained in accordance with the manufacturer's specifications, to the extent that compliance to the Australian Standards or USEPA Methods is maintained.

5.4 ANALYSIS AND REPORTING OF MONITORING RESULTS

Griffin and TWPS will be responsible for ensuring that the results of the emissions and ambient monitoring programs will be analysed by qualified personnel as follows:

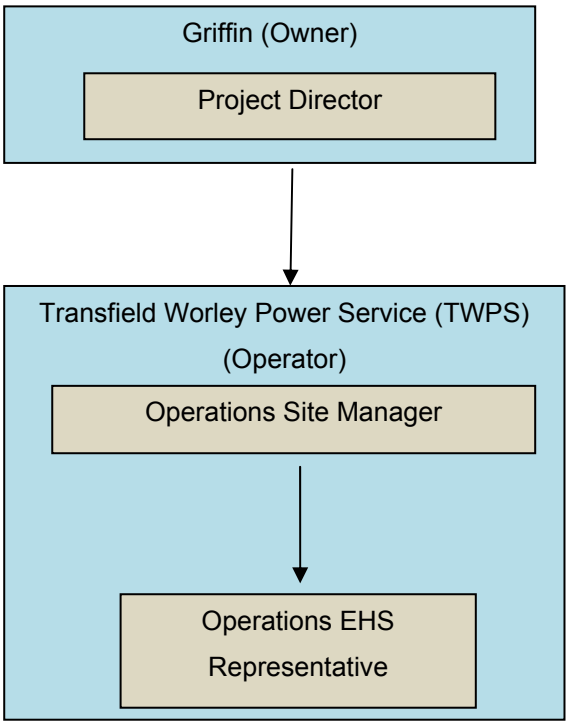
- to verify the accuracy of emission estimates used as the basis for the air quality assessments for the Bluewaters project;
- to confirm the effective operation of pollution control equipment;
- to assist with annual emissions reporting to the NPI;
- to assess compliance within the Collie region (i.e. cumulative impacts) to the Ambient Air NEPM Standards;
- to assess the potential health impacts associated with the measured concentrations;
- to validate the performance of air dispersion modelling tools in predicting ground level concentrations in the Collie region;
- to assess the need to modify elements of the emissions monitoring program or the ambient monitoring program;
- to inform the local community, regulatory agencies and other key stakeholders of the environmental performance of the Bluewaters project; and

- to provide high quality datasets for use in a future Air Quality Management Framework for Collie.

An analysis of the results of the monitoring programs will be reported in the Annual Environmental Report for the Bluewaters project, which will be submitted to the DEC and made available to the public.

6. ROLES AND RESPONSIBILITIES

A conceptual organisational structure, describing the relationship between the owner of Bluewaters Power Station (Griffin) and TWPS is shown below.



TWPS will be responsible for implementation of this EMP.

The Operations EHS Representative is a nominated employee of the operator who has responsibility for coordinating implementation of the operational EMP's and the Environmental Management System (EMS) required under Ministerial Statements 685 and 724.

The Operations Site Manager is an employee of TWPS who is given overall accountability and responsibility for management of operations of Bluewaters Power Station and is therefore responsible for compliance with the operational EMPs and EMS required under Ministerial Statements 685 and 724 as well as overall environmental legal compliance of the site.

7. PUBLIC COMPLAINTS PROCEDURES

A requirement of the Ministerial approval for the Bluewaters project is public reporting of any complaints about air emissions. Griffin and TWPS will establish complaints logging and investigation procedures that include:

- establishment of a dedicated telephone number for the receipt of complaints, with a minimum agreed response time;
- advertisement of the complaint telephone number throughout the Collie community;
- logging of all complaints in an electronic database, with hard copies of complaints produced on a weekly basis and filed in a central area;
- complaint verification procedures including validation against wind direction, recorded ambient data (refer Section 5.2), and investigation of complaints where practicable. The investigation process will also consider prevailing meteorological conditions including wind direction and atmospheric mixing depth where relevant to the event;
- Initial response to the complainant as soon as practicable with initial feedback provided within two working days. Where further investigation into the complaint is warranted, Griffin will endeavour to complete this within two weeks and advise the complainant of the outcome;
- routine internal meetings to discuss complaints and review air quality management procedures. The frequency of such meetings would be dependent upon the number of complaints received and upon recorded ambient air quality monitoring data;
- monthly internal reporting of complaints and corrective actions; and
- annual summary of complaints and corrective actions will be submitted to the DEC for information as part of regulatory reporting requirements (Section 11), and will be made publicly available by contacting Griffin on 08-9261 2800.

Documented procedures for community complaints are provided as Appendix D.

8. ENVIRONMENTAL INSPECTIONS AND AUDITS

Periodic audits for compliance with this plan will be conducted to ensure compliance with all applicable legislation, plans and procedures throughout the operation and maintenance phase. These will be undertaken by Griffin.

In accordance with Section 5 of the Ministerial Statements an annual compliance report will be submitted to the DEC, WA and will address:

- Status of operations;
- Evidence of compliance with the Ministerial Conditions and Proponent Environmental Management Commitments;
- The performance of the environmental management plans and programs;

9. TRAINING AND AWARENESS

TWPS is responsible for ensuring that all employees, contractors and visitors to the site receive inductions that address the relevant Health, Safety and Environment objectives, hazards, risks, controls and behaviours prior to entering the project area.

Employee and contractor training will be conducted to minimise potential impacts arising from a lack of knowledge regarding the environment or inadequate application of site management procedures. Initial environmental training will be provided to all personnel and contractors via the site induction process. Specific training on environmental management issues will be provided to required personnel. Induction and environmental training records will be maintained on-site to allow for management of periodic refresher courses.

General workforce environmental induction and training will include, but is not necessarily limited to:

- Air Quality Management;
- Complaint Management; and
- Incident Reporting.

In addition, power station control room operators and the EHS Representative (and any other relevant personnel) will receive specific training on the requirements of this plan.

10. INCIDENT REPORTING

All employees and contractors will be required to report to the EHS Representative:

- Any incident involving air emissions occurring above requirements in this plan or the Operating Licence for the power station; and
- Any complaint in relation to air emissions (See section 7 above).

Environmental incident reporting and investigation procedures are provided as Appendices E and F respectively. Any incidents will be reported in Griffin's annual compliance report, which will be made publicly available by contacting Griffin on 08-9261 2800.

11. REPORTING

Internal Reporting

The operations contractor (TWPS) is required to report to Griffin agreed environmental performance criteria in accordance with the contract. This will include:

Report immediately to Griffin's Project Director:

1. Any exceedances of the sulphur dioxide emission rate limit; and
2. Any exceedances of the sulphur dioxide ambient air quality guideline at monitoring stations in the Collie region.

Report monthly to Griffin's Project Director:

1. Summation of exceedances of the sulphur dioxide emission rate limit that occurred in the previous month;
2. Summation of exceedances of the sulphur dioxide ambient air quality guideline at monitoring stations in the Collie region that occurred in the previous month;
3. Time-Series data and graph presenting sulphur dioxide emissions for previous month;
4. Time-Series data and graph presenting ambient sulphur dioxide recorded at monitoring stations in the Collie region for previous month;
5. Summation of meteorological data recorded at monitoring stations in the Collie region for previous month; and
6. Report any verifiable complaints that were raised by the public in the previous month.

Prepare and submit an annual review to Griffin's Project Director including the following:

1. Summation of exceedances of the sulphur dioxide emission rate limit that occurred in the previous year;
2. Summation of exceedances of the sulphur dioxide ambient air quality guideline at monitoring stations in the Collie region that occurred in the previous year;
3. Time-Series data and graph presenting sulphur dioxide emissions for previous year;
4. Time-Series data and graph presenting ambient sulphur dioxide recorded at monitoring stations in the Collie region for previous year;
5. Summation of meteorological data recorded at monitoring stations in the Collie region for previous year; and
6. Report any serious verifiable complaints that were raised by the public in the previous month.

External/Regulatory Reporting

A summary of Air Emissions Management measures undertaken and Monitoring Results will be provided to the DEC in the annual compliance report required by Ministerial Condition 5-1 "the proponent shall prepare an audit and submit annual compliance reports to the Department of Environment which address:

1. Status of Operations,
2. Evidence of compliance with the conditions and commitments,
3. The performance of the Environmental Management Plans and programs.

In addition there are likely to be annual reporting requirements under the Operating Licence issued under Part V of the *Environmental Protection Act (1986)*

The Operator will be responsible for drafting an Annual Environmental Report to meet the above regulatory reporting requirements. This Draft Annual Environmental Report must be provided to Griffin for review no later than 6 weeks prior to its required submission date to the DEC.

In addition, Ministerial Statements 685 and 724 require the submission of a performance review report every five years after the start of operations, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority. Griffin will seek the required information from the operator at such time as this report is required.

All regulatory reports will be treated as public documents and will be made available by contacting Griffin on 08-9261 2800.

12. DOCUMENT REVIEW

This MP will be updated on an ongoing basis (maximum 12 monthly intervals) by the (Construction and Operations) Environmental Representative to reflect changes in operational practices and activities. A component of the document review will be to ensure all relevant environmental factors are being appropriately managed, and to update procedures if required due to changing legislative framework. The review will also evaluate the effectiveness of the ambient air quality monitoring program and need to continue, reduce, or expand the monitoring program.

Feedback from government agencies, or modifications based on environmental monitoring results will be incorporated into, or appended to this document as required.

13. REFERENCES

CSIRO (2005). *Meteorological and Dispersion Modelling Using TAPM for Wagerup Phase 3A: HRA (Health Risk Assessment) Concentration Modelling – Current Emission Scenario Final Report*. Prepared for Alcoa World Alumina Australia by CSIRO Atmospheric Research, Report C/0986, 14 February 2005.

EPA (2003) *Guidance for the Assessment of Environmental Factors. Implementing Best Practice in Proposals Submitted to the Environmental Impact Assessment Process* (No 55). Environmental Protection Authority, December 2003.

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Griffin (2004) *Bluewaters Power Station Public Environmental Review*. Griffin Energy Pty Ltd, May 2004.

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SKM (2002) *Western Power Strategic Planing for Future Power Generation Collie Power Station Expansion Strategic Environmental Review*. Sinclair Knight Merz, June 2002.

NEPC (1998) *National Environmental Protection Council (Ambient Air Quality) Measure*. National Environment Protection Council, 26 June 1998.

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SKM (2005) *Collie Power Station Expansion Air Quality Assessment – Air Quality Modelling and Screening Health Risk Assessment*, Report prepared for Western Power, Griffin Energy, and Collie Power Consortium, and project managed by Sinclair Knight Merz, January 2005.

CSIRO (2004) *A Modelling Assessment of the Air Quality Impact in the Collie Region of 1 x 200 and 2 x 200 MW Power Stations at Bluewaters*. CSIRO, November 2004.

ENVIRON (2006) *Assessment of Air Quality Impacts from the Relocation of Bluewaters Power Station II – Summary Draft Report*. ENVIRON Australia Pty Ltd, 18 April 2006

Ministerial Statement 685 (Bluewaters I), Section 45C application, approved 28 March 2006 (project relocation and clarification of various terms in Schedule 1).

Ministerial Statement 724 (Bluewaters II), Section 45C application, approved 9 October 2006 (project relocation and clarification of various terms in Schedule 1).

Ministerial Statement 685 and 724 (Bluewaters I and II), Section 45c application, approved 18 September 2007 (amendments to Schedule 1).

Figures

Appendix A

Extract of Relevant Ministerial Conditions for Bluewaters

Appendix B

Endorsement from Collie Basin Management Planning Group

Appendix C

Collie Community Reference Group
Meeting Minutes – 14 January 2009

Appendix D

Receiving, Recording & Responding To Community Complaints

Appendix E

Reporting of Environmental Incidents

Appendix F

Environmental Incident Investigation