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Hazelwood analysis - Database

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Hazelwood Analysis Database

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Important disclaimer

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1 Introduction

The Hazelwood mine fire caused a major air pollution event affecting thousands of residents in nearby towns. A large data set was collected during the Hazelwood mine fire by various parties to assess the impact on air, water and soil. On-going measurements continue at selected locations to assess the air, water and soil quality after the incident.

This report describes the database collating the data that was collected during and after the Hazelwood mine fire.

2 Environmental monitoring

Environmental monitoring was conducted during and after the Hazelwood mine fire. The following sections present the database structure, data sources and processes employed to collate and aggregate the data.

2.1 Database framework

Figure 1 shows the framework of the database.

The database is structured according to the environment that was monitored, e.g. air, ash, soil and water and meteorological data set. Under each environmental compartment there is a list of the various sites where measurements for the given environmental compartment were taken.

There were a total of 38 monitoring sites. Of these, air monitoring was carried out at 16 of the sites, ash measurements at seven sites, soil measurements at nine sites, and water measurements at nine sites.

For each site, the following is provided:

Site ID	Shortened name of the measurement site used to uniquely identify the site in the database tables
Site name	Full name of the air monitoring station, street name or other description to identify measurement site
Latitude/Longitude	Coordinates of measurement site
Pollutants	Pollutants that were measured at the site
Organisation	Organisation that did the measurements
Type	Type of monitoring(Air/Water/Soil/Ash)

The following sections provide more detailed information of the individual parts of the database.

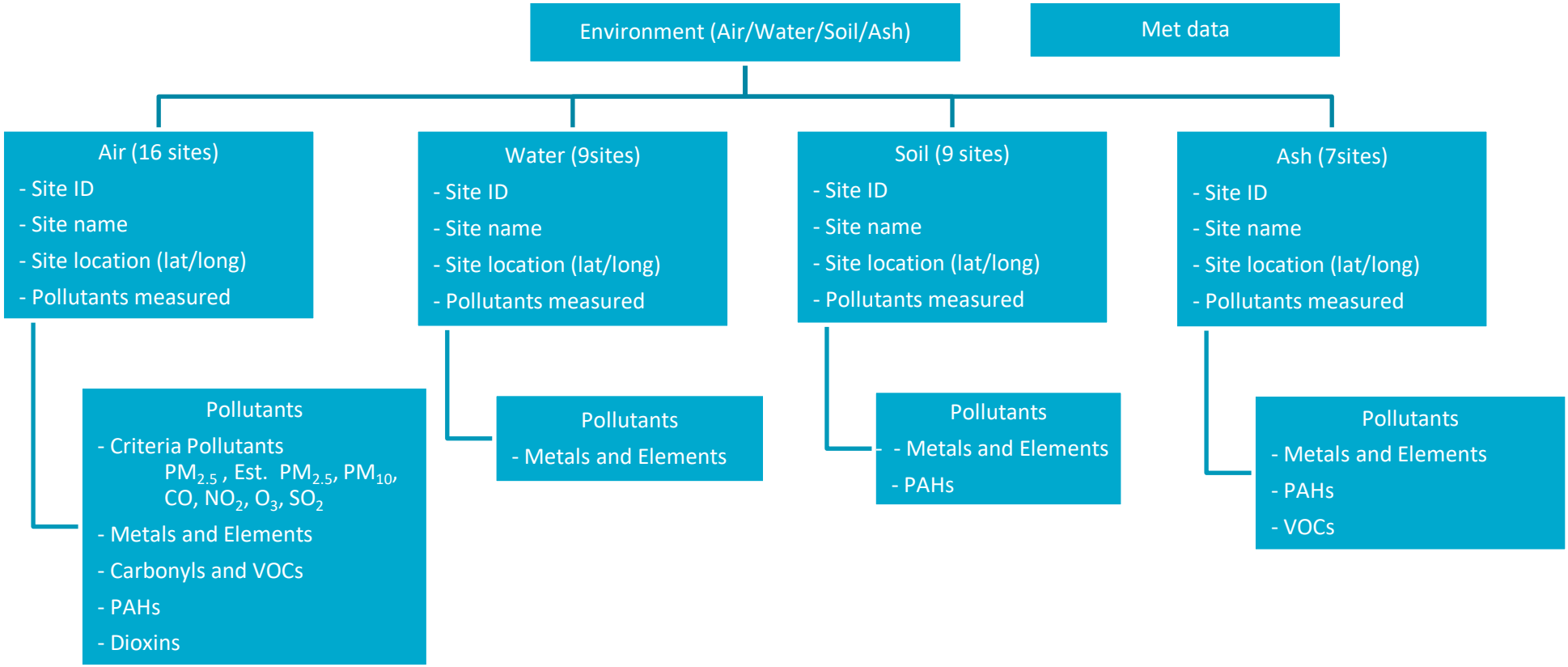

Figure 1 Framework of the Hazelwood mine fire database

2.2 Data sources

During the Hazelwood mine fire, environmental monitoring was conducted by a number of agencies, including EPA Victoria, Country Fire Authority (CFA), Melbourne Fire Brigade, CSIRO and the Bureau of Meteorology (BoM). The data sets were provided to CSIRO to be collated in a database.

2.3 Air quality data sets

A range of air pollutants were measured during and after the Hazelwood mine fire. These include

- Hourly measurements of criteria pollutants ($PM_{2.5}$, estimated[1] $PM_{2.5}$, PM_{10}, carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3) and sulphur dioxide (SO_2)).
- Integrated measurements (i.e. samples collected over a period of time) of metals and elements on $PM_{2.5}$ and PM_{10}
- Integrated measurements of volatile organic compounds (VOCs) and carbonyls
- Integrated measurements of polycyclic aromatic hydrocarbons (PAHs) and dioxins

2.3.1 Criteria pollutants

The criteria pollutants that were measured during the Hazelwood mine fire and recorded in the database were:

- PM (PM_{10}, $PM_{2.5}$ and indicative $PM_{2.5}$) recorded in µg m^{-3} and collected by EPA Victoria and CSIRO. PM_{10} is particulate matter 10 micrometers or less in diameter, $PM_{2.5}$ is particulate matter 2.5 micrometers or less in diameter.
- CO recorded in parts per million (ppm) measured by EPA Victoria and CFA
- SO_2, NO_2 and O_3 recorded in parts per billion (ppb), measured by EPA Victoria

Table 1 displays the instruments that were used to measure PM, CO, SO_2, NO_2 and O_3, the location of the measurement site and organisation that performed the measurements.

Table 1 Information on criteria pollutants collected during the Hazelwood mine fire

Pollutant	Instrument	Location	Organisation
PM_{10}	TEOM	Traralgon AMS	EPA Victoria
$PM_{2.5}$	Beta attenuation monitor	Morwell South AMS, Morwell East AMS	EPA Victoria
$PM_{2.5}$	E-sampler	Morwell South, Traralgon AMS	CSIRO

[1] Indicative PM2.5 is determined from light scattering instruments by applying a mass scattering correction factor to the measurement of light scattering. Since the mass scattering coefficient is dependent on the size and composition of the particles, the PM2.5 is derived using this method is subject to greater uncertainty that directly measuring the mass of the particles. Hence the PM measurement is indicative.

Estimated $PM_{2.5}$	Nephelometer	Traralgon AMS	EPA Victoria
	DustTrak	Morwell South AMS, Kernot hall, St Luke's church	EPA Victoria
	ADR-1500	Helen St, Churchill, Moe	EPA Victoria
CO	Infrared absorption spectrometry	Morwell South AMS, Morwell East AMS, Traralgon AMS	EPA Victoria
	Area RAE[2]	Various sites in Morwell	CFA
SO_2	Pulsed fluorescence spectrometry	Morwell South AMS, Morwell East AMS, Traralgon AMS	EPA Victoria
NO_2	Chemiluminescence	Morwell South AMS, Traralgon AMS	EPA Victoria
O_3	UV absorption photometry	Morwell South AMS, Traralgon AMS	EPA Victoria

Table 2 shows the dates during which hourly measurements of criteria pollutant were made.

Table 2 Hourly data of criteria pollutants included in the database

Sites	$PM_{2.5}$	Estimated $PM_{2.5}$	PM_{10}	CO	NO_2/O_3	SO_2
Morwell South AMS	20/2/14-1/12/14*	13/2/14-20/2/14		19/2/14-22/10/15* 16/2/14-21/2/14	6/3/14-22/10/15*	19/2/14-22/10/15*
Morwell East AMS	13/2/14-1/12/14*			19/2/14-22/10/15*		19/2/14-22/10/15*
Traralgon AMS	20/2/14-28/3/14*	9/2/14-31/3/14	9/2/14-31/3/14*	28/2/14-25/9/15*	9/2/14-22/10/15*	9/2/14-22/10/15*
Morwell South CSIRO	3/3/14-28/3/14					
Kernot Hall		21/2/14-3/3/14				
Helen St.		20/2/14-27/2/14				
St Luke's church		5/3/14-15/3/14				
Churchill		6/3/14-31/3/14*				
Moe		28/2/14-31/3/14*				
Kerrie St.				16/2/14-21/2/14		
Maryvale Crescent Preschool				14/2/14-5/3/14		
Keegan St/Wallace St.				15/2/14-5/3/14		
Morwell Police Station				16/2/14-5/3/14		
Sacred Heart Primary school				12/2/14-4/3/14		

* Date collection is on-going

For each site where criteria pollutants were measured, the following is provided:

Sample Date Date and time when measurements were taken (in hourly intervals)

Site ID Unique identifier for the measurement site

$PM_{2.5}$ Hourly concentrations of $PM_{2.5}$ in µg m^{-3}

[2] Area RAE is a portable device used by CFA to measure exposure of CFA members to gases including CO. It is used to assess occupational exposure so that the CO sensor is less sensitive than the NDIR method employed by EPAV to measure ambient levels of CO.

Est. $PM_{2.5}$	Hourly concentrations of $PM_{2.5}$ in µg m^{-3} using light-scattering devices
PM_{10}	Hourly concentrations of PM_{10} in µg m^{-3}
CO	Hourly concentrations of CO in ppm
NO_2	Hourly concentrations of NO_2 in ppb
O_3	Hourly concentrations of O_3 in ppb
SO_2	Hourly concentrations of SO_2 in ppb
Latitude	Latitude of the monitoring site
Longitude	Longitude of the monitoring site

NB: all geographic coordinates (latitude, longitude) in this database are in the Geocentric Datum of Australia 1994 (GDA94) coordinate system.

2.3.2 VOCs & carbonyls

Different techniques were used to measure ambient concentrations of VOCs and carbonyls. Measurements and analysis of the collected samples are not necessarily both done by the same organisation. Table 3 lists the organisations that collected and analysed the VOC and carbonyl data sets, dates during which samples were collected, locations and sampling techniques. All concentrations are recorded in the database as ppb.

Table 3 Information on VOCs and carbonyls collected during the Hazelwood mine fire

Pollutant	Sampling technique	Location	Dates	Sample collection	Sample analysis
VOCs	Canisters (24-hour sampling)	Morwell South AMS Morwell East AMS Maryvale Crescent Preschool	27/2/14-3/4/14	EPA Victoria	NMI
VOCs	Radiello (7-day passive sampling)	Morwell South AMS Morwell east AMS Maryvale Crescent Preschool	26/2/14-22/4/15	EPA Victoria	SGS Leeder
VOCs	Sorbent tubes (active sampling)	Morwell South CSIRO	3/3/14-19/3/14	CSIRO	CSIRO
Carbonyls	DNPH cartridges (active sampling)	Morwell South CSIRO	3/3/14-19/3/14	CSIRO	CSIRO

For each site where VOCs and carbonyls were measured, the following is provided:

Sample Date	Date when measurements were taken (start of the sampling period)
Sample Info	Specifies sampling technique

Compound	Specifies VOC or carbonyl compound
Concentration	Measured concentration of VOC or carbonyl compound in ppb
Site ID	ID of the monitoring site
Sample Time	
Inequality	
Latitude	Latitude of the monitoring site
Longitude	Longitude of the monitoring site

2.3.3 Metals and Elements

Three different techniques were used to measure ambient concentrations of metals and elements. Table 4 lists the sampling techniques, location and dates of sample collection and the organisations responsible for collecting and analysing the samples. Collection and analysis of a sample are not necessarily done by the same organisation. All concentrations are recorded in µg m^{-3}.

Table 4 Information on metals and elements collected during the Hazelwood mine fire

Pollutant	Sampling technique	Location	Dates	Sample collection	Sample analysis
Metals (PM_{10})	Hi-Volume sampler (24-hour samples)	Morwell South AMS	26/2/14-28/4/15	EPA Victoria	SGS Leeder
Metals (PM_{10})	Partisol sampler (24-hour samples)	Morwell South AMS	28/2/14-26/3/14	EPA Victoria	ANSTO, SGS Leeder
Metals ($PM_{2.5}$)	E-sampler (7-14 days sampling)	Morwell South CSIRO Morwell East AMS Traralgon AMS	28/2/14-21/3/14	CSIRO	ANSTO

Figure 4 provides an example of the database for metals and elements.

For each site where metals and elements were measured, the following is provided:

Sample Date	Date when measurements were taken (start of measurement period)
Sample info	Specifies sampling technique
Compound	Specifies metal or element
Concentration	Measured concentration of metal in µg m^{-3}
Latitude	Latitude of the monitoring site
Longitude	Longitude of the monitoring site

Site ID ID of the monitoring site

Sample Time

Inequality

Concentration_ng_m3 Concentration measured in ng/m^3

2.3.4 PAHs and Dioxins

Different techniques were used to measure ambient concentrations of PAHs and dioxins, listed in Table 5, along with location and dates of sampling, and the organisations that collected and analysed the samples (collecting agency is not necessarily the analysing agency). PAH concentrations are recorded in ng m^{-3}; dioxin concentrations are recorded in fg m^{-3}.

Table 5 Information on PAHs and dioxins collected during the Hazelwood mine fire

Pollutant	Sampling technique	Location	Dates	Sample collection	Sample analysis
PAHs (PM_{10})	Hi-Volume sampler	Morwell South AMS	26/2/14-20/3/14 21/5/14-28/4/15	EPA Victoria	SGS Leeder, NMI
PAHs (Filter+PUF)	LSA sampler	Morwell South CSIRO	3/3/14-28/3/14	EPA Victoria	ANSTO, SGS Leeder
Dioxins (PM_{10})	Hi-Volume sampler	Morwell South AMS	26/2/14-20/3/14	EPA Victoria	NMI
Dioxins (Filter+PUF)	LSA sampler	Morwell South CSIRO	3/3/14-28/3/14	CSIRO	Asure Quality

Figure 5 provides an example of the database for PAHs.

For each site where PAHs and dioxins were measured, the following is provided:

Sample Date Date when measurements were taken (start of measurement period)

Sample info Specifies sampling technique

Compound Specifies PAH

Concentration Measured concentration of PAH in ng m^{-3}

Latitude Latitude of the monitoring site

Longitude Longitude of the monitoring site

Site ID ID of the monitoring site

Sample Time

Inequality

2.3.5 COPMOther (Carbon Monoxide, Particles and other gasses)

Sample Date	Date when measurements were taken (start of measurement period)
Site ID	ID of the monitoring site
PMInstrument	
PMCompound	
PMConcentration	
COInstrument	
COCompound	
COConcentration	
OtherInstrument	
OtherCompound	
OtherConcentration	
Latitude	Latitude of the monitoring site
Longitude	Longitude of the monitoring site

2.3.6 Personal (personal monitors)

Site	
Date	
Time	
Compound	
Unit	
Inequality	
Concentration	
Latitude	Latitude of the monitoring site
Longitude	Longitude of the monitoring site

2.3.7 PM (particles)

Sample Date	Date when measurements were taken (start of measurement period)
Site	ID of the monitoring site
PM2.5_ug_m3	
Est_PM2.5_ug_m3	
PM10_ug_m3	
Latitude	Latitude of the monitoring site
Longitude	Longitude of the monitoring site

2.3.8 CO (Carbon Monoxide)

Sample Date	Date when measurements were taken (start of measurement period)
Site	ID of the monitoring site
Instrument	
Compound	
Concentration	
Latitude	Latitude of the monitoring site
Longitude	Longitude of the monitoring site

2.3.9 OtherGases

Sample Date	Date when measurements were taken (start of measurement period)
Site	ID of the monitoring site
Instrument	
Compound	
Concentration	
Latitude	Latitude of the monitoring site

Longitude	Longitude of the monitoring site

2.4 Soil and ash

All samples were collected by EPA Victoria and analysed by ALS for PAHs, metals & elements, halogenated volatiles, mono aromatic hydrocarbons (MAHs) and solvents.

Measurements of halogenated volatiles, MAHs and solvents from soil samples were not included in the database as concentrations remained below the detection limit. For ash samples, measurements of halogenated volatiles were not included in the database.

Sample information of soil and ash samples is provided in Table 6.

Table 6 Information on soil and ash samples collected during the Hazelwood mine fire

	LOCATION	SAMPLING PERIOD	COMPOUNDS MEASURED
Soil	Willis Ct.	18/02/14 – 3/03/15	metals, PAHs
	Morwell CFA station	24/02/14 – 4/03/15	metals, PAHs
	Davey St.	24/02/14	metals, PAHs
	Morwell East AMS	24/02/14 – 4/03/15	metals, PAHs
	Tangil East Rd & Latrobe River	25/02/14	metals, PAHs
	Traralgon Golf Club	25/02/14 & 4/03/14	metals, PAHs
	Keegan St. Reserve	10/03/14	metals, PAHs
	Thoms Bridge	10/03/14 – 4/03/15	metals, PAHs
	Lake Narracan	11/03/14 – 7/04/14	metals, PAHs,
Ash	Willis Ct.	18/02/14 (sediment ash) 3/03/14	metals, PAHs, MAHs
	Morwell CFA station	3/03/14	metals, PAHs, MAHs
	Morwell East AMS	3/03/14	metals, PAHs, MAHs
	Wallace St.	12/03/14 13/03/14	metals, PAHs, MAHs
	Morwell Football Club	13/03/14	metals, PAHs, MAHs
	Club Astoria, Maryvale Crescent Ash Floor sweepings Benches	13/03/14	 metals, PAHs, MAHs metals, PAHs, MAHs metals, PAHs
	Morwell Bowling Club	13/03/14	metals, PAHs, MAHs
	Hazelwood Road	18/03/14	metals, PAHs, MAHs
	Dust residue	14/11/14	PAHs

For each site where soil and ash samples were collected, the following is provided:

Sample Date	Date when soil or ash sample was collected
Sample info	Specifies what type of sample was collected (e.g. surface or sub-surface for soil samples; ash, floor sweepings or dust residue for ash samples)
Compound	Specifies metal or PAH
Concentration	Measured concentration of metal or PAH in mg kg^{-1}

2.5 Water

All samples were collected by EPA Victoria and analysed by ALS for PAHs, metals & elements, halogenated volatiles, MAHs and solvents.

Measurements of halogenated volatiles, PAHs, MAHs and solvents were not included in the database as concentrations all remained below the detection limit.

Table 7 lists the locations, sampling periods and compounds measured in the water samples.

Table 7 Information on water samples collected during the Hazelwood mine fire

	LOCATION	SAMPLING PERIOD	COMPOUNDS MEASURED
Water	Waterhole Creek	24/02/14 – 4/03/15	metals, CrVI
	Morwell wetlands	24/02/14	metals
	Main drain to Morwell wetlands	4/03/14 – 3/03/15	metals, CrVI
	Latrobe River, Thoms Bridge	10/03/14 – 4/03/15	metals, CrVI
	Hazelwood Pondage, Eel Hole Creek	4/03/14 – 3/03/15	metals, CrVI
	Morwell River upstream of Eel Hole Creek	4/03/14 – 3/03/15	metals, CrVI
	Morwell River downstream of Eel Hole Creek	4/03/14 – 3/03/15	metals, CrVI
	Residential water tank	24/02/14 – 3/04/14	metals
	Traralgon Golf Course dam	4/03/14	metals
	Lake Narracan	11/03/14 - 7/04/14	metals

For each site where water samples were collected, the following is provided:

Sample Date	Date when water sample was collected
Compound	Specifies metal or element
Concentration	Measured concentration of metal in mg L^{-1}

2.6 Meteorological data

Meteorological data was provided by EPA Victoria and the BoM. Table 8 lists the measurement sites, organisation that recorded the data, meteorological variables recorded and the time period over which the data was collected.

Table 8 Information on meteorological data collected during the Hazelwood mine fire

Site	Organisation	Attributes in database	Dates
Morwell South AMS	EPA Victoria	Temperature (°C) Wind speed (m s^{-1}) Wind direction (degrees)	19/2/14-22/10/15
Morwell East AMS	EPA Victoria	Temperature (°C) Wind speed (m s^{-1}) Wind direction (degrees)	13/2/14-22/10/15
Traralgon AMS	EPA Victoria	Temperature (°C) Wind speed (m s^{-1}) Wind direction (degrees)	9/2/14-22/10/15
LaTrobe Valley Airport **Sale** **Warragul** **Yarrum Airport**	BoM	Temperature (°C) Precipitation (mm) Wind speed (km h^{-1}) Wind direction (degrees)	1/2/14-30/4/15

For each site where meteorological data was collected, the following is provided:

Sample Date Date and time when measurements were taken (in hourly intervals)

Temperature Hourly dry bulb temperature in °C

Wind speed Hourly wind speed in m s^{-1} (EPA sites) and km h^{-1} (BoM sites)

Wind direction Hourly wind direction in degrees

Max wind gust Speed of maximum wind gust in last 10 minutes in km h^{-1}

Precipitation Precipitation since 9am local time in mm

Latitude Latitude of the monitoring site

Longitude Longitude of the monitoring site

Site ID ID of the monitoring site

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