

Latrobe Valley Coal Fires Carbon Monoxide Response Protocol Department of Health

Objectives of the Carbon Monoxide Response (CMR) Protocol

- To guide the assessment and decision for resulting actions in the event of elevated carbon monoxide in the environment

Sources of technical input

- Protective Action Decision Guide for Emergency Services during Outdoor Hazardous Atmospheres (May 2011);
- Carbon monoxide – Acute Exposure Guideline Levels for Selected Airborne Chemicals: Volume 8 (National Academy of Sciences) Technical support document;
- EPA Data Analysis and Monitoring (DAM) Strategy – Latrobe Valley coal mine fires (February 2014).

Background - general

Smoke from fires in the Latrobe Valley coal mines is impacting on air quality in towns in the area and may affect people's health. As these types of fire often take a long time to put out (i.e. weeks rather than days) it is likely that smoke and poor visibility will be present in varying levels during this time. The progress of fire suppression activity and the wind and weather are all factors which influence which areas will be affected by the smoke.

This protocol is specific to the Latrobe Valley Coal Fires incident. This complex incident involves a large scale brown coal fire which is producing a range of smoke related issues.

Carbon monoxide is a product of incomplete combustion that is produced from the burning of brown coal. Levels influenced by the size of the fires, fire suppression and management activities, wind conditions and meteorology.

Carbon monoxide (CO) is found in smoke from any combustion source. It is therefore present in smoke from summer fires however, in this context it is not considered to be a smoke component of health concern for the general community.

Given the size and intensity of these coal mine fires, levels of CO in the air and radiant heat are two major issues for fire-fighters and other emergency services onsite, situated close to the actual active fires.

Background - Description of carbon monoxide monitoring arrangements

The CFA have set up fixed continuous CO monitors (i.e. Area Ray) covering an area of approximately four kilometres. EPA Victoria has set up mobile, fixed and in situ continuous CO monitors. A map of these locations is available from the EPA upon request.

The CFA can also undertake short-term spot monitoring or area survey work using hand-held portable equipment. Monitoring sweeps are carried out twice daily through predetermined sampling locations in Morwell in conjunction with CFA Hazmat personnel. Ad hoc sampling may also occur in response to requests from the Regional Control Centre (RCC).

EPA Victoria may also request the Hazmat personnel from CFA undertake specific surveys to provide better information about the spatial variation of CO levels in a smoke plume and to verify any CO results from the fixed monitoring data.

Background – Rationale for choice of health protection thresholds

The following describes the ceiling or threshold levels of CO in the Morwell community which require further assessment and, if necessary addition actions and advice to protect public health.

In line with the Protective Action Decision Guide for Emergency Services during Outdoor Hazardous Atmospheres (May 2011) there is a defined hierarchy for the selection of short-term community exposure standards.

Using this approach, the Acute Exposure Guide Level (i.e. AEGL-2) is applied. These are the most protective public health values available and are provided over different averaging times:

Figure 1: Health Protection Air Levels

Health protection air level for CO (ppm)	Averaging period for monitoring against the health protection level for CO
AEGL-2 levels for CO: <ul style="list-style-type: none"> • 420 ppm • 150 ppm • 83 ppm • 33 ppm • 27 ppm 	Averaged over: <ul style="list-style-type: none"> • 10 minutes • 30 minutes • 1 hour • 4 hours • 8 hours

AEGL-2 levels are the 'airborne concentration above which it is predicted that the general population including susceptible individuals could experience irreversible or other serious long-last effects'.

In brief, an AEGL-2 is derived to correspond with a COHb (carboxyhaemoglobin) percentage of 4% which is the 'lowest observed effect level'. At or above this exposure level patients with coronary artery disease may experience a reduced time until the onset of angina during physical exertion.

The full assessment and supporting technical document is: - Carbon monoxide – Acute Exposure Guideline Levels for Selected Airborne Chemicals: Volume 8 (National Academy of Sciences) Technical support document.

Page 141 of this document also summarises the levels of COHb where health effects may be expected to occur in different subgroups in the population.

A further level of conservatism is applied to the AEGL-2 (1 hour average) level of 83 ppm CO in air. This has been reduced to a 70 ppm (1 hour average) to provide further protection.

In addition to the 1 hour averaging of monitoring data, the 4 hour and 8 hour values will also be considered as part of this assessment process.

Overview of the approach

If the threshold level of 70 ppm (1 hour) is exceeded a range of immediate actions (i.e. verification or result; repeated level in next hour; further survey CO monitoring to define extent of smoke plume at the concentration) must occur.

If the threshold level of 33 ppm (4 hour) or 27 ppm (8 hours) is possible a further set of actions will occur. For the 4 hour average, this will occur at the 2 hour point. For the 8 hour average, this will occur at the 3-4 hour point.

Once confirmed by the CHO and reported to the Regional IC, the Regional Strategic Emergency Management Team (including deputy RC; RIC, AV, VicPol, Health and EPA) to consider the information and determine the necessary level of health protection action.

Options could include (but not limited to): shelter in place, temporary relocation of a defined area in the smoke plume up wind or evacuation.

Any decision to temporarily relocate or evacuate people is not made by the Chief Health Officer DH but rather the Regional Incident Controller based on the advice of the SEMT.

Minimum dataset for decision-making

- Rolling average one hour environmental carbon monoxide levels;
- Precise location of the measured levels;
- BOM weather forecast for the next 24 hours, including wind direction, speed and predictions.

AEGL-2 Advice Matrix

The following matrix is designed to assist the Department of Health’s assessment team when considering advice to the Incident Controller. It is used in each Scenario outlined below. Note, the CO readings are strictly hourly averages, not spot readings.

Figure 2: AEGL-2 Advice Matrix

CO Readings Matrix									No.	KEY MESSAGING
CO Readings ppm	Predicted Duration of Plume <small>(How long the plume is in the area)</small>								Recommendation to Evacuate	Recommendation to Evacuate
	>12	10-12	8-10	6-8	4-6	2-4	1-2	<1		
150	EW _{EVAC}	EW _{EVAC}	EW _{EVAC}	EW _{EVAC}	EW _{EVAC}	EW _{SIP}	EW _{SIP}	EW _{SIP}	Emergency Warnings	EW _{SIP} - (Emergency Warning Shelter In Place)
83	EW _{EVAC}	EW _{EVAC}	EW _{EVAC}	EW _{EVAC}	EW _{SIP}	EW _{SIP}	EW _{SIP}	EW _{SIP}	Emergency Warnings	EW _{EVAC} - (Emergency Warning Evacuate)
33	EW _{EVAC}	EW _{EVAC}	W _{SIP}	W _{SIP}	W _{SIP}	A	A	A	Upgrade / Update	
27	W _{SIP}	W _{SIP}	W _{SIP}	A	A	A	A	A	Upgrade / Update	
Assumptions <ul style="list-style-type: none"> • Shelter in place provides 6 hours protection before the equalisation with the external atmosphere • CO based on average reading over a 30 to 60 minute period • BoM to provide meteorological forecast of wind speed, direction and duration • BoM prediction to inform the estimated time of exposure 									Watch & Act	
									W _{SIP} - (Watch & Act Shelter In Place)	
									Upgrade / Update	
									Downgrade	
									Advice	
									A - (Advice)	
									Downgrade	
									All Clear	
									Campaign	

Scenario 1 – When a 1 hour average value of 70 ppm CO is reached

A short term trigger level (STTL) has been set for CO levels averaged over one hour. The STTL is based on one hour averaged CO levels (i.e. the 1 hour AEGL-2 value of 83 ppm).

The STTL is set at a lower level of 70 ppm as a trigger point to allow for further assessment of the potential public health risk and broader actions.

The following actions will be taken:

1. The Hazmat technician advises the EPA scientific officer;
2. The EPA scientific officer notifies the EPA EMLO;
3. The EPA EMLO provides this information to the Department of Health (Environmental Health pager 1300 790 733) and to the Regional Deputy Commander;
4. The Department will convene an internal assessment team (including at least the Chief Health Officer, Senior Medical Advisor, Manager Environmental Health, Advisor Health Risk Management) to assess data against the AEGL-2 matrix continuously until the situation is resolved;

SIMULTANEOUSLY

5. The EPA verifies the results by:
 - a. The EPA scientific officer confirms this level by continuous monitoring of CO levels averaged over 15 minute periods;
 - b. The EPA scientific officer initiates a verification test in the field to determine the area of high smoke plume impact using short-term spot monitoring, including:
 - i. deriving the area of the smoke plume with CO levels at the STTL (70 ppm);
 - ii. in addition, this spot monitoring will also define the local 'background' levels of CO for fire operations to plan a safe place for temporary relocation (20 ppm for 1 hour is deemed acceptable).
 - iii. wind direction, wind speed and other meteorology or forecasting tools;
 - c. The EPA scientific officer receives results of the second hour of monitoring;
 - d. The EPA scientific officer communicates this to the Department of Health (EH pager or direct number) and EPA EMLO.
6. If results verify at least one hour of exceedance of 70ppm CO, the Department issues advice to the Regional Incident Controller who will convene a Regional SEMT, including:
 - a. Deploy specialists whose mission it will be to delineate/identify the safest area of potential redeployment of community to limit the social dislocation of vulnerable community members;
7. If results are not verified, the process is stood down.

Scenario 2 – When a 4 hour average value of 33 ppm CO may be reached

A medium term trigger level (MTTL) has been set for CO levels averaged over a two hour period, on a precautionary basis, acknowledging that the 4 hour AEGL-2 value is 33 ppm.

The following actions will be taken when the MTTL has occurred i.e. there has been a two hourly average CO level of 33 ppm:

1. The Hazmat technician advises the EPA scientific officer;
2. The EPA scientific officer verifies in-situ and notifies the EPA EMLO;
3. The EPA EMLO provides this information to the Department of Health (Environmental Health pager 1300 790 733) and to the Regional Deputy Commander;
4. The Department will convene an internal assessment team (including at least the Chief Health Officer, Senior Medical Advisor, Manager Environmental Health, Advisor Health Risk Management) to assess data against the AEGL-2 matrix continuously until the situation is resolved;
5. The EPA verifies the results by:
 - a. The EPA scientific officer confirms this level;
 - b. The EPA scientific officer initiates a verification test in the field to determine the area of high smoke plume impact using short-term spot monitoring, including:
 - i. deriving the area of the smoke plume with CO levels at the STTL;
 - ii. in addition, this spot monitoring will also define the local 'background' levels of CO for fire operations to plan a safe place for temporary relocation (20 ppm for 1 hour is deemed acceptable).
 - iii. assessing wind direction, wind speed and other meteorology or forecasting tools;
 - c. The EPA scientific officer reports all results every hour to the Department of Health (EH pager or direct number) and EPA EMLO.
6. If results verify at least a four hour average CO of 33 ppm, the Department issues advice to the Regional Incident Controller who will convene a Regional SEMT, including:
 - a. Deploy specialists whose mission it will be to delineate/identify the safest area of potential redeployment of community to limit the social dislocation of vulnerable community members;
7. If results are not verified, the process is stood down.

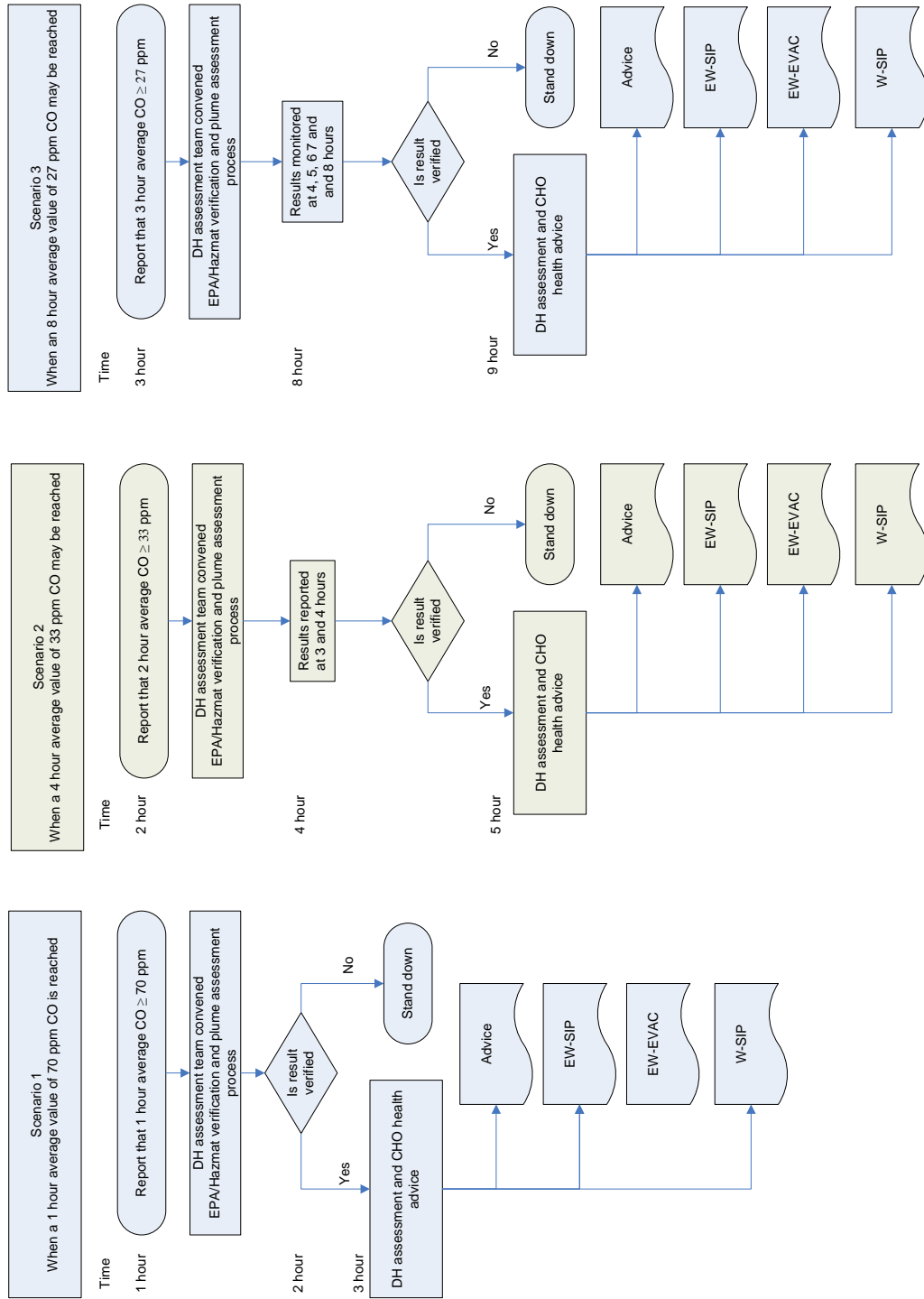
Scenario 3 – When an 8 hour average value of 27 ppm CO may be reached

A long term trigger level (LTTL) has been set for CO levels averaged over a three hour period, on a precautionary basis, acknowledging that the 8 hour AEGL-2 value is 27 ppm.

The following actions will be taken when the LTTL has occurred i.e. there has been a three hourly average CO level of 27 ppm:

1. The Hazmat technician advises the EPA scientific officer;
2. The EPA scientific officer verifies in-situ and notifies the EPA EMLO;
3. The EPA EMLO provides this information to the Department of Health (Environmental Health pager 1300 790 733) and to the Regional Deputy Commander;
4. The Department will convene an internal assessment team (including at least the Chief Health Officer, Senior Medical Advisor, Manager Environmental Health, Advisor Health Risk Management) to assess data against the AEGL-2 matrix continuously until the situation is resolved;
5. The EPA verifies the results by:
 - a. The EPA scientific officer confirms this level;
 - b. The EPA scientific officer initiates a verification test in the field to determine the area of high smoke plume impact using short-term spot monitoring, including:
 - i. deriving the area of the smoke plume with CO levels at the STTL;
 - ii. in addition, this spot monitoring will also define the local 'background' levels of CO for fire operations to plan a safe place for temporary relocation (20 ppm for 1 hour is deemed acceptable).
 - iii. wind direction, wind speed and other meteorology or forecasting tools;
 - c. The EPA scientific officer reports all results every hour to the Department of Health (EH pager or direct number) and EPA EMLO;
 - d. Within the fourth hour, the EPA will assess wind and meteorology data.
6. If results verify at least a eight hour average CO of 27 ppm, the Department issues advice to the Regional Incident Controller who will convene a Regional SEMT, including:
 - a. Deploy specialists whose mission it will be to delineate/identify the safest area of potential redeployment of community to limit the social dislocation of vulnerable community members;
7. If results are not verified, the process is stood down.

Carbon Monoxide response protocol - Flowchart



Appendix 1 – Map Showing Location of Carbon Monoxide Monitors As at 21 February 2014

