Expert witness statement summary


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What's the problem

- Potential chemical hazards to human health and the environment presented by tailings were not adequately assessed
  - Point of contention
- Polyacrylamide flocculants
  - Point of agreement but good example of how risk assessment should work

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Hazard assessment and conceptual site models

"The EES Appendix A006 does not include an adequately detailed conceptual site model, specifically in relation to the assessment of chemical hazards, potential receptors, and pathways between these hazards and receptors, and there is insufficient detail to allow for robust hazard and risk assessment for certain impacts.

Relevant receptors and potential hazards have not been identified in a way that would allow for the potential for harm for the environment to be elucidated."

- J. Jasonsmith, Expert conclave report

Hazard assessment and conceptual site models

- A summary of how the environment functions
- Multiple contexts for CSM & chemical risk assessments
- National Environmental Protection (Assessment of Site Contamination) Measure 1999
    - useful guidance and reference document for both risk assessment and CSMs

Hazard assessment and conceptual site models

- Number of aspects need to be included for CSMs to allow for risk assessment, including (ASC NEPM 1999):
    1. Sources (e.g. fuel tanks, mine spoil)
    2. Affected media (e.g. dust, groundwater, depth & distribution)
    3. Hazards (e.g. Cr^{6+}, median, maximum concentrations, properties, data quality and representativeness)
        - Ambient background concentrations (ABCs), Added Concentration Limits (ACLs)
    4. Receptors (e.g. platypus, grasslands)
    5. Exposure and transport pathways (e.g aerial, groundwater)

Hazard assessment and conceptual site models

Hazard is the potential of a stressor to cause harm whereas risk is a function of the likelihood of exposure occurring and the harm caused by that exposure if it occurs.

Society of Environmental Toxicology and Chemistry. 2018. Technical Issue Paper: Environmental Risk Assessment of Chemicals. Pensacola (FL): SETAC. 5 pp.

Hazard assessment and conceptual site models

- Conceptual site model summarises all this information in one place
- Where are the connections?
- Risk assessment is the probability for harm

Hazard assessment and conceptual site models

Table 8-9: Surface water impact assessment

Replace with

Impact						Affected Water Segment				Initial Risk Assessment			Proposed Management Measures	Residual Risk Assessment		
Project Infrastructure or Activity	Potential Impact	Project Phase			Potentially Affected Environmental Value	Project area ephemeral creeks	Mitchell River	Perry River Providence Ponds Avon River	Gippsland Lakes (Lake King) (Lake Wellington)	Likelihood	Consequence	Unmitigated Impact Risk		Likelihood	Consequence	Residual Impact Risk
		Construction	Operations	Decommissioning & post closure												
Extraction of 3 GL/year of water from Mitchell River under a winter-fill licence (Section 8.4.1 and Section 8.5.1)	Reduced flow rates in the Mitchell River impacting water dependent ecosystems, recreation, aesthetic enjoyment and traditional/spiritual values.	X	X		Water dependent ecosystems Recreation Aesthetic enjoyment Traditional owner, cultural and spiritual		X			Rare	Moderate	Low	009 - Surface water will be extracted from the Mitchell River in line with the licence issued by Southern Rural Water 017 - Implement an adaptive management strategy that includes triggers for surface water quantity and quality for remedial action. 022 – A surface water monitoring program will be implemented to assess impacts during construction and operation. 025 - Water that is retained on site be offset by releasing the same volume of fresh water from the fresh water storage dam.	Rare	Moderate	Low
	Reduced flow rates in the Mitchell River impacting other winter-fill licence holders	X	X		Human consumption Extractive uses [1]		X			Possible	Minor	Low		Possible	Minor	Low
	Reduced flow rates in the Mitchell River impacting EGWI's operation of the Woodglen ASR	X	X		Human consumption Extractive uses [1]		X			Rare	Major	Low		Rare	Major	Low
	Reduced flow rates in the Mitchell River impacting other extractive uses (primarily year-round irrigators).	X	X		Extractive uses [1]		X			Rare	Major	Low		Rare	Major	Low
	Reduced flow rates in Mitchell River altering the salt wedge within Jones Bay, removing upstream migration cues for juvenile fish, or preventing flushing flows.	X	X		Water dependent ecosystems Aesthetic enjoyment Traditional owner, cultural and spiritual				X	Rare	Moderate	Low		Rare	Moderate	Low

Table 8-8: Groundwater risk assessment

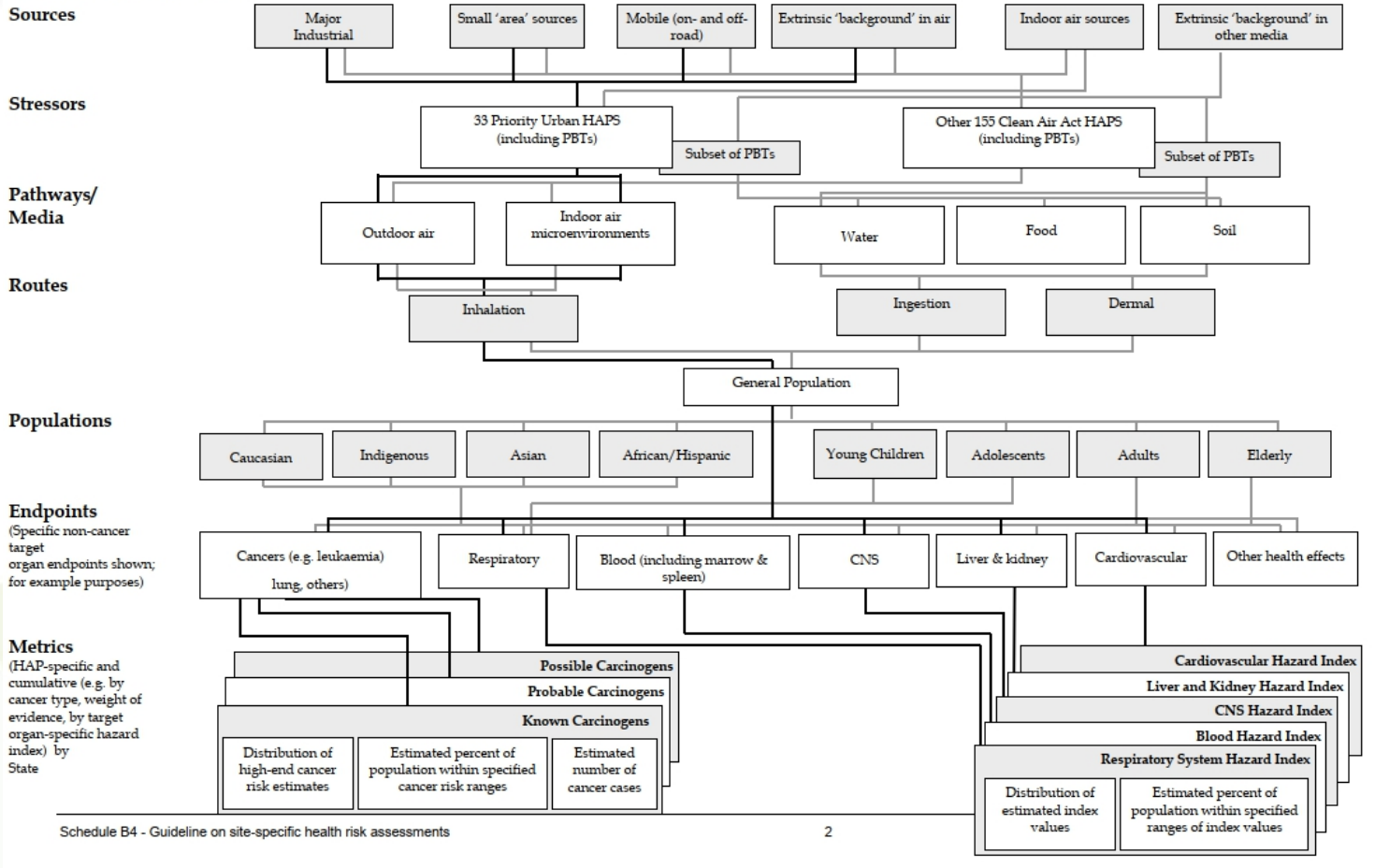
Impact						Initial Impact Risk Assessment			Proposed Management Measures	Residual Impact Risk Assessment		
Project Infrastructure or Activity	Potential Impact	Project Phase			Potentially Affected Environmental Values of Groundwater	Likelihood	Consequence	Unmitigated Impact Risk		Likelihood	Consequence	Residual Impact Risk
		Construction	Operations	Decommissioning & post closure								
Disposal of tailings in the Fine Tailings Storage Facility (TSF) and infiltration of water with elevated concentrations of some dissolved metals to the Coongulmerang Formation (Section 8.3.1)	Altered groundwater flow direction in the Coongulmerang formation leading to changed groundwater availability		X		Extractive uses [1]	Possible	Minor	Low	004 - Runoff and groundwater migrating to the open voids will be collected and reused in the process plant. 006 – A water risk treatment plan will be implemented to minimise discharge from the operational mine areas. 008 – Recovered water will be stored in the process water dam. 013 - Implementation of a groundwater monitoring program. 015 - Recover and reuse water where practicable (such as run-off from ore stockpiles and supernatant water from the TSF and tailings area within the mine void) and optimise operations to maximise water use efficiency. 016 - Seepage water will be monitored so that proactive management of impacts can be implemented. 017 - Implement an adaptive management strategy that includes triggers for groundwater quantity and quality for remedial action. 018 – TSF will be constructed using engineered cells and seepage will be limited by the impermeable nature of the base of the fine tailings cells. Water will be managed using a decant system, sump and drains to capture and reuse seepage.	Unlikely	Minor	Low
	Raised groundwater levels impacting on structures and mine infrastructure.		X		Buildings and structures	Possible	Minor	Low		Unlikely	Minor	Low
	Quality impacts to the beneficial uses of Coongulmerang Formation groundwater.		X	X	Water dependent ecosystems Extractive uses [1] Recreation Traditional owner, cultural and spiritual	Possible	Moderate	Moderate		Unlikely	Moderate	Low
	Quality impacts to the extractive beneficial uses of Mitchell River alluvial aquifer (including potable water supply)		X	X	Extractive uses [1]	Possible	Moderate	Moderate		Unlikely	Moderate	Low

CSMs: Finger-boards EES, Appendix A006

Conceptual site models: flow diagrams

E.g. ASC NEPM

Figure 3: Example of scoping a risk assessment for air pollutants, indicating pathways considered (bold lines) and pathways no considered. (Adapted from NRC 2008)



Schedule B4 - Guideline on site-specific health risk assessments 2

Conceptual site models: diagram

E.g. Understanding pollution cycling in the environment (Nam et al. 2008):

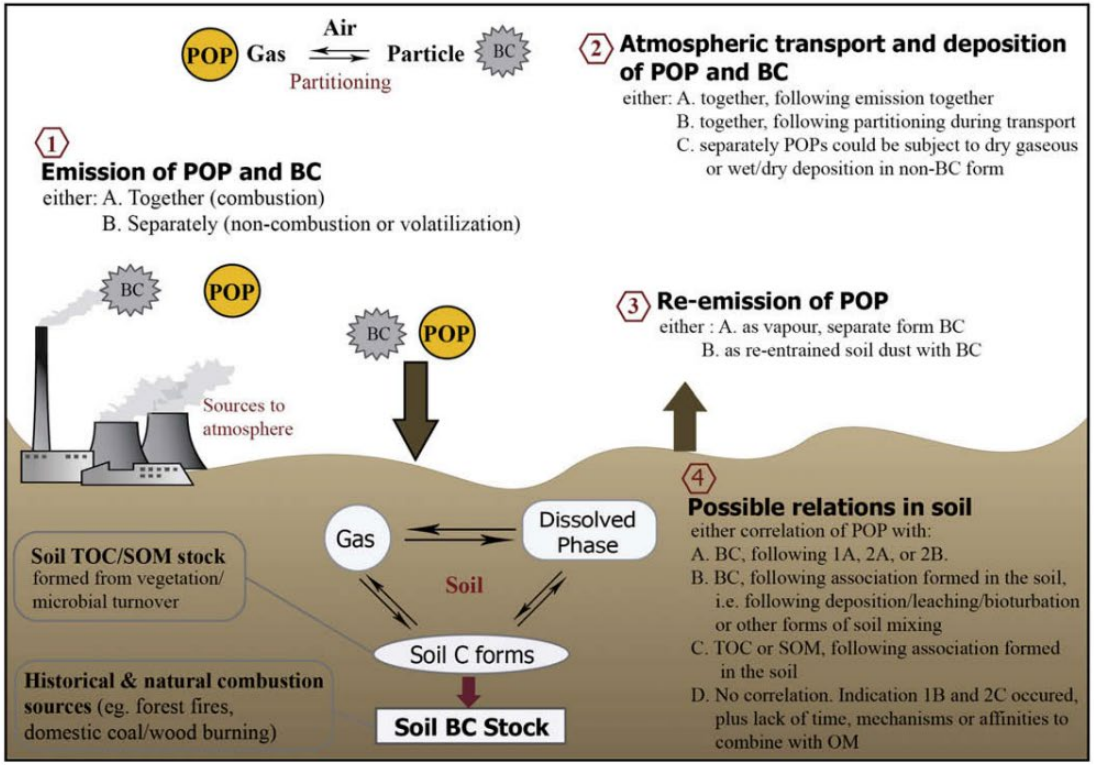


Fig. 1. Possible scenarios for the relationship between POPs and SOM (with a focus on BC) and the inferences which can be made about their sources, fate, and transport.

Nam, J.J., Gustafsson,O., Kurt-Karakus, P., Breivik, K., Steinnes, Eiliv, S., Jones, K.C. (2008). Relationships between organic matter, black carbon and persistent organic pollutants in European background soils: implications for sources and environmental fate. Environmental Pollution 156, 809-817.

Conceptual site models: written

E.g. Understanding how naturally occurring stressors cycle through the environment (Jasonsmith 2010):

Fresh groundwater appears to occur as localised groundwater systems in isolated pockets within Manobalai, with Site Four and Whip Well being good examples of this. Groundwater at Sites One and Three was instead saline and Na-Cl dominated, and arose at specific points on the break of slope on the Narrabeen Group escarpments above the salt scald (Figure 5.16). Hydraulic heads and similar element to Cl ratios indicate that groundwater has a propensity to flow from Sites One and Three down to the salt scald (Table 5.5). South and down gradient of Site Two, this saline groundwater is prevented from flowing into Wybong Creek by smectitic clay at Site Six which acts as a barrier to groundwater flow. Groundwater mounding behind this smectitic clay is likely to be causing the Manobalai salt scald, especially when normal – high rainfall conditions occur in the Wybong Creek catchment. An increase in rainfall in the area is therefore expected to cause a continued rise or sustained high groundwater tables, with scalding at the Manobalai salt scald worsening periodically…

Unknown hazards: Polyacrylamide

- 61 chemicals in ASC NEPM, more than 40,000 used in Australia
- Absence of a chemical in the regulatory hierarchy does not mean absence of hazard
- ASC NEPM provides guidance for process of deriving appropriate criteria — also the job of experts such as ecotoxicologists and environmental chemists
- History of considering chemicals as benign — until discovering that they are not
- Polyacrylamide
    1. Non-toxic in certain environments
    2. Made up of repeating units of toxic acrylamide
    3. Long history of use without adequate understanding of hazards

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Questions